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THE IMPACT OF ISO 9000 ON OPERATING PERFORMANCE AND SENIOR EXECUTIVE COMPENSATION: AN EMPIRICAL ANALYSIS

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CERTIFICATE OF ORIGINALITY

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Chris, Lo Kwan Yu
_____(Name of student)

To My Greatest Lord – Jesus Christ

To My Dearest Parents – Frankie and Shirley

To My Lovely Wife – Angel

ABSTRACT

ISO 9000 is the most popular meta-standard in management. By the end of 2005, the standard had been adopted by 776,608 companies or business divisions in 161 countries. ISO 9000 is now "a passport to the global business" and a basic requirement for many government tenders. Although ISO 9000 has been widely adopted in different industrial sectors, empirical studies disagree about its impact on the adopting firms' operating performance. Amidst the controversies over the actual benefits of ISO 9000 certification, the number of ISO 9000 certified firms has been increasing dramatically since its introduction 20 years ago. Management researchers are increasingly turning to a social perspective, in particular institutional theory, to explain the diffusion of ISO 9000. Institutional theory argues that the diffusion of administrative innovations like ISO 9000 in a certain industry is an institutional process subject to competitive and institutional effects. The institutional process occurs through coercive, mimetic, and normative mechanisms, and structural isomorphism is the consequence. Accordingly, organizations might adopt a popular management technique despite no evidence of obvious technical benefits from its implementation.

In this study we attempt to answer a few research questions related to the institutional and technical benefits of ISO 9000. We seek to find out whether ISO 9000 improves the organizational performance of adopting firms. Based on institutional theory and agency theory, we examine whether the CEOs and top executives of adopting firms are rewarded with higher compensation for ISO 9000 certification. We investigate if the early adopters obtain more technical benefits and senior executives in those firms enjoy higher compensation as a result of ISO 9000 certification. We used event study methodology to examine "abnormal changes" in operational performance, financial performance, and senior executive compensation in ISO 9000 certified firms. We

matched individual ISO 9000 certified firms with a group of control firms based on the industry type (two-digit SIC code), firm size (total asset), and pre-event performance.

Our results show that ISO 9000 certified firms significantly improved their return on asset (ROA) (+15.48%), return on sales (ROS) (+15.92%), labour productivity (+10.30%), operating cycle (+5.01%), relative sales growth (+25.00%) and manufacturing cost efficiency (MCE) (+2.57%) five years after the initial adoption as compared with non-adopters during the same time period. We also found that CEO salaries increased by 3.1% on average, right after ISO 9000 certification. The bonus and stock options of CEOs significantly increased upon the adoption of the meta-standard. We found that the abnormal performance in ROA, labour productivity, Tobin's *q* and operating time efficiency dropped significantly along with the time of adoption (measured in years). The late adopters of ISO 9000 obtained significantly less technical benefits than the early adopters. Nevertheless, the "abnormal increase" in the compensation of senior executives persisted.

Our study contributes to the literature in several ways. We document the impact of ISO 9000 certification on senior executive compensation. We show that, although ISO 9000 has a significant positive impact on the operational and financial performance of the adopting firms, such benefits decrease dramatically among late adopters. Nevertheless, senior executives in both the early and late adopting firms are rewarded for ISO 9000 certification. We provide evidence that further explains the widespread diffusion of ISO 9000 – firms adopt ISO 9000 not just for improving efficiency and gaining organizational legitimacy, but also for personal legitimacy that might lead to direct benefits for the firms' senior executives. We present a paradox in Operations

Management and explain our findings from a social perspective grounded in institutional theory.

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CHAPTER 1 INTRODUCTION

1.1 Background

Market globalization keeps calling for common international standards to be developed so as to foster easier trade by limiting trade barriers linked to national standards and sectorial competitors (Boiral 2003). ISO 9000 has emerged as a key organizational practice for companies worldwide to improve operational efficiency and to establish legitimate management practices (Guler, Guillen and Macpherson 2002). The standard has increasingly come to represent a commercial imperative that is difficult for organizations to avoid without jeopardizing market access and client loyalty (Anderson, Daly and Johnson 1999; Simmons and White 1999; Boiral 2003). By the end of 2002, the ISO 9000 series had been formally adopted by more than 561,000 sites, and the figure had further soared to 776,608 by the end of 2005 – an increase of 38.3% in three years.

Although ISO 9000 was originally advocated by the European countries, it is now widely accepted as the foremost management tool worldwide. Given its popularity, there is an on-going debate in both practitioner-oriented publications and academic journals about the effectiveness of ISO 9000 (Guler, Guillen and Macpherson 2002; Boiral 2003; Corbett, Montes and Kirsch 2004). Some academics and practitioners (Spreha and Helms 1995; Hill 1996) believe that ISO 9000 improves quality and overall efficiency in organizations, and enables them to make uniform products and to have competitive edge, resulting in greater customer satisfaction and market share. Others (e.g., Reedy 1994; Guerin and Rice 1996) explicitly oppose its adoption, warning that knowledgeable organizations are moving in a direction different from ISO 9000. Empirical research has suggested that meta-standards yields little benefit to operational efficiency (Corbett and Kirsch, 2001) and has mixed impacts on the financial

performance of the certified firms (Corbett, Montes-Sancho and Kirsch, 2005; Naveh and Marcus, 2005; Terziovski, Power and Sohal, 2003). These findings are at odds with the global phenomenon of a widespread diffusion of ISO 9000.

Recent research on diffusion of management techniques has found that social factors, rather than economic considerations, are the driving force for the adoption of ISO 9000 (Ketokivi and Schroeder, 2004; Staw and Epstein, 2000). On the other hand, sociologists have pointed out that technical activities and demands for efficiency in organizations are in conflict with organizations' efforts to conform to institutionalized rules (DiMaggio and Powell, 1983; Meyer and Rowan, 1977). The technical merits of business certification in improving operational efficiency become questionable in the process of rapid institutionalization.

The primary goal of developing meta-standards was to apply them in international trade and, as a result, stimulate third-party audits and certification worldwide (Uzumeri 1997). ISO 9000 has rapidly become "a passport for business", a norm for business practices, and a standard requirement in the global supply chain (Christmann and Taylor 2001; Delmas 2002; Guler, Guillen and Macpherson 2002). Although ISO 9000 is described as 'guidelines' for the industry, it has rapidly been institutionalized due to customer pressure, competition or even legislation. Academics have warned that a management standard, once entrenched, is hard to remove, inducing an extremely profound and long-lasting impact on operations management (e.g., Hayes 1994; Uzumeri 1997; Guler, Guillen and Macpherson 2002). They urge management researchers, who have the skill to investigate the implications for management against multiple criteria, to take a serious look at the impact of ISO 9000. In fact, with ISO 9000 widely adopted worldwide, its

organizational impact and the driving forces behind its adoption become one of the most urgent questions for researchers to address.

1.2 Objectives and Significance

In this research, we examined three crucial consequences of ISO 9000 adoption, namely operational performance, financial performance and senior executive compensation – three important implications of organization and management that might in turn be used to explain the widespread diffusion of meta-standards. Based on institutional theory, we will further investigate how the impact of ISO 9000 in company performance was affected by institutional forces in the long run. Specifically, we examined if the early adopters of ISO 9000 obtained more technical benefits than the late adopters, as ISO 9000 has been increasingly institutionalized since its introduction (Anderson, Daly and Johnson, 1999; Guler, Guillen and Macpherson, 2002). We compared the technical benefits of early and late adopters of ISO 9000, in terms of the number and the magnitude of firms' abnormal performance, and how such technical benefits in turn have an impact on the senior executive compensations.

Our results show that ISO 9000 certified firms significantly improved return on asset (ROA) (+15.48%), return on sales (ROS) (+15.92%), labor productivity (+10.30%), operating cycle (+5.01%), relative sales growth (+25.00%) and manufacturing cost efficiency (MCE) (+2.57%) five years after the initial adoption as compared with non-adopters during the same time period. The bonuses and stock options of CEOs significantly increased upon the adoption of the standard. For the impact of institutionalization of ISO 9000, we found that the abnormal performance in ROA, labor productivity, *Tobin's q* and operating time efficiency dropped significantly alone with the time of adoption (measured in years). The late adopters of ISO 9000 obtained

significantly less technical benefits as compared with the early adopters. Nevertheless, the "abnormal increase" in the compensation of senior executives persisted, i.e., there was no sign of dropping for the late adopters.

Our study contributes to the literature in several ways. Firstly, we document the impact of ISO 9000 certification on senior executive compensation. We show that, although ISO 9000 has a significant positive impact on the operational and financial performance of the adopting firms, such benefits decrease dramatically among late adopters. Nevertheless, the senior executives in late adopting firms obtained more rewards for ISO 9000 certification. Our findings provide empirical support for the notion that there is a decoupling between the technical merits and the symbolic value of ISO 9000. We provide evidence that further explains the widespread diffusion of ISO 9000 – firms adopt ISO 9000 not just for improving efficiency and gaining organizational legitimacy, but also for personal legitimacy that might lead to direct benefits for the firms' senior executives.

1.3 Event Study Methodology

To reveal the causal relationship between the adoption of ISO 9000 and its impact on operational performance, financial performance, and senior executive compensation, we adopted event study methodology. Event study was originally proposed by Fama et al. (1969) to test the abnormal performance of stock prices and this method was further improved by Barber and Lyon (1996) to examine long-term impact of an event. In this study, we largely followed the guideline suggested by Barber and Lyon (1996) for detecting abnormal performance of accounting based indicators between sample and control firms during the event period, which is, in our study, the period during which ISO 9000 is implemented. The advantage of event study, as compared to cross-sectional

or time series analysis, is that it enables researchers to concentrate on the event itself, which happens in a specific event window with other factors controlled at the same time. We can also document the specific timing and magnitude of abnormal performance prior and after the event (i.e., the implementation of ISO 9000) happens. Therefore, we can detect any "abnormal changes" of performance (or compensation) as a result of the event, which implies some causal relationships.

However, as the financial information is affected by many other factors in the same period of time, the impact of the event must trigger a reaction that is significant enough to be seen amidst the impacts of other factors. This problem could have exaggerated when using a long event windows period (i.e. event windows length in terms of year). To overcome this limitation, we carefully matched sample and control pairs based on the industry (2 digits SIC code), similar firm size (33 to 300% of total asset), and, most importantly, the pre-event performance (90 to 110% pre-event performance). To make our results more reliable, we matched each sample firm with a portfolio of control firms that meet the above criteria. Abnormal performance of sample firms was calculated and then tested by parametric and non-parametric tests. The details of event study and our data collection procedure will be discussed in Chapter 3.

1.4 Outline of the Dissertation

In Chapter 2, we will discuss the literature of ISO 9000 and the institutional theory. We will develop the theoretical foundation for the institutional explanation on the global diffusion of ISO 9000. In this study, we have three independent but related studies, which will be reported in Chapter 4, 5 and 6. These three studies relied on the same methodology of event study. We will also discuss the event study methodology and data collection procedures in details in Chapter 3. We then present our research hypotheses

and corresponding results our Research Part One (Chapter 4), Research Part Two (Chapter 5) and Research Part Three (Chapter 6).

We will focus on the relationships between ISO 9000, operational and financial performance in Chapter 4. We will reveal the timing and magnitude of "abnormal changes" in performance as a result of ISO 9000 adoption. This was conducted by investigating a large number of ISO 9000 adopters from 1990 to 2005 and comparing each of them to a group of control firms.

In Chapter 5, we will investigate the relationships between ISO 9000 and senior executive compensation, including base salary, bonuses, and stock options. We adopted both agency theory and institutional theory perspectives to explain the relationship between the ISO 9000 adoption and compensation changes. We attempted to ascertain if ISO 9000 would lead to direct benefits the senior management of an organization, which might in turn explain for the global popularity of the standard.

Chapter 6 investigates the possible decoupling between operating performance and the symbolic value of ISO 9000 during its institutionalization since the mid 1990s. We will compare and contrast the timing and magnitude of "abnormal changes" in operating performance, market valuation, sales and senior executive compensation between early and late adopters of ISO 9000. Specifically, we attempted to investigate if technical benefits of ISO 9000 decrease as time goes by and the standard is increasingly institutionalized. We would also investigate the abnormal changes of senior executive compensation corresponding to the time of adoption and the technical merits of ISO 9000 obtained by the firm.

Finally, Chapter 7 provides a summary of this research and concludes the major findings.

CHAPTER 2 THE LITERATURE REVIEW OF ISO 9000 AND INSTITUTIONAL THEORY

2.1 ISO 9000 – The Most Popular Meta-Standard in Quality Management

The term “meta-standard” refers to a set of design rules for management processes, which creates classes of management systems (Uzumeri, 1997). Quality-oriented meta-standards focus on the quality management of firms for various industries in which they are required and adopted. For example: QS 9000 and ISO/TS 19646 are mainly for the automobile industry, while ISO 13485 and TL 9000 are mainly for medical equipment and telecommunication industries. ISO 9000 was the first and the most popular quality-oriented meta-standard, which applies to different industries. In its early development, ISO 9000 was more commonly adopted in the manufacturing industries.

With the characteristics of meta-standard, ISO 9000 consists of 20 generic rules of management processes, including quality planning, goal setting, and clear assignment of task authority and responsibility, which focuses on quality management systems. It has now become the passport for global business, (Uzumeri, 1997) a basic requirement of government tenders in many countries and the supplier prerequisite for multinational corporations. Therefore, ISO 9000 has become diffused into different business networks and supply chains. Although much research has been conducted into the organizational impacts of ISO 9000, there have been few conclusive results (Terziovski, Samson and Dow, 1997).

2.1.1 The background of ISO 9000

ISO 9000 was developed by International Standard Organization (ISO) in 1987 and the number of ISO 9000 registered sites has increased dramatically since its introduction. These reached 776,608 at the end of 2005, representing a growth of 17.6% from the previous year. ISO 9000 underwent a major revision in 2000, with the new version emphasizing continuous improvement of quality control. The number of ISO 9000 certified sites dropped during the transition period while the old 1994 standard was being faded out, but increased dramatically after the introduction of the new version (Table 2.1 and Figure 2.1).

Fig. 2.1 The number of ISO 9000 registered site world wide

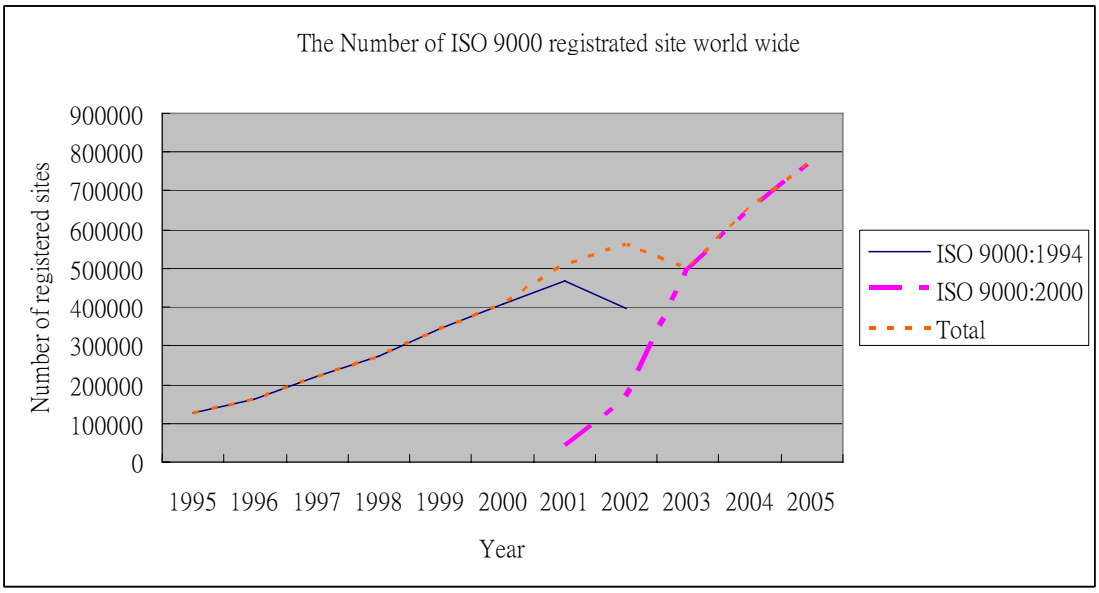


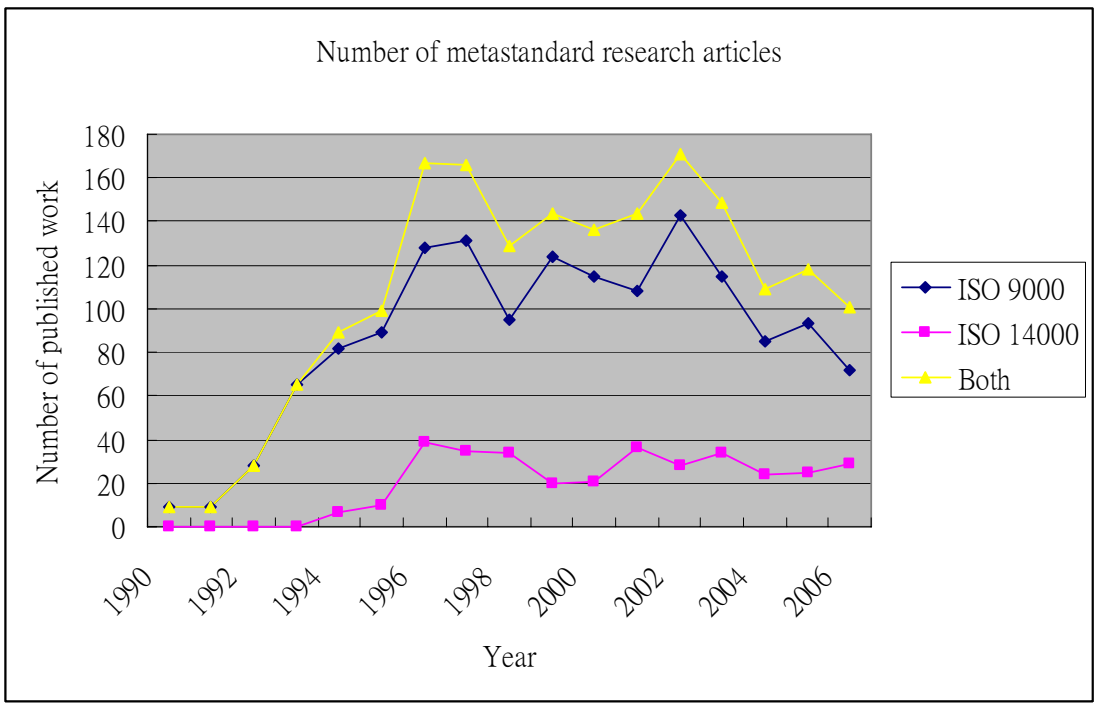
Table 2.1 The number of ISO 9000 registered sites worldwide; Source: (ISO, 2003, 2005, 2006)

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
ISO 9000:1994	127349	162701	223299	271847	343643	408631	466228	394623			
ISO 9000:2000							44388	167124	497919	660132	776608
Total	127349	162701	223299	271847	343643	408631	510616	561747	497919	660132	776608

Since its introduction in 1987, ISO 9000 has received much attention from practitioners as well as academics. The number of ISO 9000 related scholarly publications has grown along with the growing number of certifications issued. However, there are no conclusive results from the academics and the actual benefits of this standard are still unclear (Corbett et al., 2005). According to ABI/Inform database, the number of scholarly works on ISO 9000 published between 1990 and 2006 is about 1491 (Figure 2.2). According to previous studies on ISO 9000, one school of thought maintained that the implementation of ISO 9000 can yield competitive advantages, while another predicted that ISO 9000 would turn out to be another management fad (Abrahamson and Fairchild, 1999; Wayhan, Kirche and Khumawala, 2002).

Despite the controversy over its actual benefits, the number of new ISO 9000 registrations is still increasing nearly 20 years since its introduction. The number of certified companies keeps rising and still maintains a growth rate of about 20% in 2005.

Fig. 2.2 The number of meta-standard scholarly research articles (scholarly works) published since 1990



2.1.2 ISO 9000 and quality management theories

Quality management is defined as an integrated approach to achieving and sustaining high quality output, focusing on the maintenance and continuous improvement of processes and defect prevention at all levels and in all functions of the organization, in order to meet or exceed customer expectation (Flynn, Schroeder and Sakakibara, 1994). The conceptual and empirical foundations for the link between improved quality and business performance are well established (Simmons and White, 1999). In quality management literature, the major assumption is that producing quality goods and services is less costly to a company than poor workmanship (Deming, 1986; Hackman and Wageman, 1995; Juran, 1974). Therefore, companies whose strategy is to produce quality goods should eventually do better on profitability than companies whose low cost strategy by compromises quality (Hackman and Wageman, 1995).

To respond to the call to implement proper quality management in various industries, in 1987, International Organization for Standardization developed ISO 9000 as the generic quality management standards for worldwide application. The ISO 9000 standards consists of 20 quality system elements which focus on process control through quality planning, goal setting, and clear assignment of task authority and responsibility (Anderson et al., 1999). The aim of ISO 9000 is to improve operations, so as to produce quality products and services. Therefore since its introduction in 1987, there has been much academic research studying the link between ISO 9000 adoption and business performance.

2.1.3 Previous studies on ISO 9000

Many of the early studies on ISO 9000 focused on the perceived benefits, such as marketing benefits (Anderson et al., 1999; Poksinska, Dahlgaard and Antoni, 2002; Walgenbach, 2001; Wiele, Iwaarden and Williams, 2005), operational improvement (Quazi and Padibjo, 1998; Rao, Ragu-Nathan and Solis, 1997; Terziovski et al., 1997), and financial performance (Dimara, Skuras, Tsekouras and Goutsos, 2002), by surveying the perceptions of practitioners. Previous research findings are contradictory and thus provide no conclusive explanation of the world wide diffusion of ISO 9000.

In recent years, some empirical studies had been conducted to investigate the possible casual relationship between ISO 9000 and business performance using objective data (e.g., Corbett et al., 2005; Naveh and Marcus, 2005), however, there are issues related to the methodology employed in these studies. Corbett's (2005) study only used data from 1990 to 1997. Naveh and Marcus (2005) investigated a sample of ISO 9000 certified companies from 1990 to 2000. However, less than 50% of their 313 sample companies had sufficient post-event performance data. Moreover, these event studies only focused on financial measures of profitability in the ISO 9000 certified firms. The impact on the operational performance, such as labor productivity and operating cycle time, remains unclear in the literature.

Recent research has suggested that ISO 9000 does not lead to higher operational efficiency (Corbett and Kirsch, 2001; Kollman and Prakash, 2002). Terziovski, Samson and Dow (1997) concluded that, despite its overwhelming popularity, ISO 9000 has little or no power to explain operational performance, such as process quality and customer satisfaction. Kollman and Prakash (2002) maintained that the perceived operational benefits of meta-standards are largely shaped by how they are promoted by stakeholders.

Meanwhile, empirical research comparing the financial performance of ISO 9000 certified and non-ISO 9000 certified companies has also yielded mixed results (Corbett et al., 2005; Haversjo, 2000; Heras, Casadesus and Dick, 2002; Wayhan et al., 2002). As the standard does not lead to improved operational performance (Terziovski et al., 1997), most researchers have concluded that the higher financial performance of ISO 9000 companies found in some studies is due to "reverse causality" – more profitable organizations tend to adopt ISO 9000, rather than the adoption of ISO 9000 leading them to become more profitable (Simmons and White, 1999). In short, previous research has concluded that ISO 9000 alone does not guarantee any technical benefits and that an economic explanation for business efficiency does not fully account for the global popularity of business certification (Anderson et al., 1999).

Management researchers are increasingly turning to a social perspective on institutional theory to account for various types of organizational behavior (Scott, 1995). Sociologists have argued that the survival and success of an organization depends not only on its economic efficiency, but also on institutional approval (Hannan and Freeman, 1984). They uphold that the organizational performance of a firm largely depends on its ability to establish cognitive and socio-political legitimacy (Shane and Foo, 1999). Organizational legitimacy is valuable because it enhances organizational status and corporate reputation, reducing perceived uncertainty, the cost of attracting consumers, and the difficulty of measuring intangible capabilities (Staw and Epstein, 2000).

Institutional perspectives emphasize the role of social factors, rather than factors related to economics or efficiency, in driving the actions of organizations (Scott, 1995; Westphal, Gulati and Shortell, 1997). Management practices spread from one organization to another following a process of institutionalization, which is driven by

dependence on resources, social comparisons, or network ties linking potential adopters (Guler et al., 2002). Accordingly, recent studies have focused on how globalization (Guler et al., 2002) and self-regulation (Christmann and Taylor, 2001) have led to the widespread use of ISO 9000. Guler, Guillen and Macpherson (2002) highlight how the diffusion of ISO 9000 in the global economy is shaped by the activities of such large organizations as multinational enterprises, and how cross-national isomorphism follows trade relationships, particularly cohesive ones. Even though stakeholders and trading partners do not pressure companies into becoming certified, organizations obtain ISO 9000 to safeguard their own reputation and legitimacy (Christmann and Taylor, 2001). We will discuss how institutional forces might have driven the world wide ISO 9000 adoption in detail in the following section.

2.2 Institutional Theory

2.2.1 Definition of institutional theory

Scholars in social sciences believe that organizations are becoming more alike, not just because of economic reasons, but also because of social forces. Organizations need to obtain legitimacy from related stakeholders for survival and prospects (Suchman, 1995). Stakeholders may value a particular management practice or organizational structure and therefore expect the organization to adopt that practice. Such expectation eventually creates pressure toward those organizations or firms, known as institutional pressure. This pressure drives the diffusion of a certain management practice or organizational structure. Such a phenomenon is known as the Institutional Theory (DiMaggio and Powell, 1983; Meyer and Rowan, 1977; Scott, 1995; Scott, 1987; Zucker, 1987)

Although institutional theory originates in social sciences, it is widely adopted in many disciplines, such as business, economics and political science (Scott, 1995). Institutional theory describes how organizations become more similar to each other through a process of “Institutionalization” or “Institutional Isomorphism”. Once a management practice is institutionalized, it obtains a rule-like status, becomes deeply entrenched in the social norms and is hard to remove (Zeitz, Mittal and McAulay, 1999). Organizations will adopt the management practice despite a lack of clear technical benefits from its implementation.

2.2.2 Three major isomorphisms in institutionalization

DiMaggio and Powell (1983) suggested that organizations become more alike, not just because of competition or efficiency considerations, but also due to isomorphisms. There are three major types of institutional forces, namely, coercive, normative, and mimetic (DiMaggio and Powell, 1983). Organizations are constantly under the three isomorphism pressures to make them more “alike”:

1. *Coercive isomorphism*

This isomorphism is largely derived from a resource-dependency perspective (DiMaggio and Powell, 1983), which ensures the governing bodies or actors who control a scarce resource will demand dependent organizations adopt the same organizational structure that suit their interest. The dependent organizations would have to comply with this demand, regardless of the actual technical benefits of such a management practice. Therefore, regulatory bodies, government, and multinational firms are major sources of coercive pressure (Guler et al., 2002).

2. *Normative isomorphism*

This isomorphic organizational change stems primarily from professionalization (DiMaggio and Powell, 1983). Professional associations and educational institutes (e.g., universities) initiate this isomorphic change. For example, the growth of a professional association contributes to value consensus and shapes norms. Consequently, the values, norms, and beliefs in a business community are influenced by the professional association (Galaskiewicz, 1985).

3. Mimetic isomorphism

Mimetic isomorphism is rooted in the response to environmental uncertainty (DiMaggio and Powell, 1983). When the benefits of management practices are unclear, the goals are ambiguous, or when the environment creates symbolic uncertainty, organizations may model themselves on other organizations. As a results, organizations borrow the "innovation" of management practices from similar organizations in the field that they perceive to be more legitimate or successful (DiMaggio and Powell, 1983).

2.2.3 Institutional theory and management practice diffusion

These three mechanisms had been widely applied in different research contexts, including the adoption of TQM, new accounting standards, civil service reforms, and executive compensation (Table 2.2). A number of studies have shown that the adoption of a management practice may not be entirely due to economic or technical benefits, but also for social legitimacy reasons. For example, Westphal and Zajac (1994) found that the adoption of a long term incentive plan (LTIP) in CEO compensation contracts is driven by institutional forces; while the early adopters actually implemented the LTIP, the late adopters adopted it only for symbolic value. Westphal et al. (1997) also revealed that early adopters of TQM gained more technical benefits from its implementation,

while late adopters only pursued the symbolic value of TQM. However, prior research examining the decoupling of the technical and institutional benefits of a new management practice has been largely based on qualitative methods and/or case studies (Westphal and Zajac, 2001).

Table 2.2 Previous studies applying institutional theory in explaining the diffusion of a management practice

Management practices	**Reference**
Education practice	(Meyer and Rowan, 1977)
Accounting standard and reporting	(Mezias, 1990)
Charity contribution	(Galaskiewicz and Wasserman, 1989)
Venture capital industry	(Bruton and Ahlstrom, 2003)
Human resources management	(Baron, Dobbin and Jennings, 1986; Edelman, 1992; Westphal and Zajac, 1994; Westphal and Zajac, 2001)
Total Quality Management (TQM)	(Bates and Hollingworth, 2004; Westphal et al., 1997; Yeung, Cheng and Lai, 2006)
Civil service reform	(Tolbert and Zucker, 1983)
Environmental management system (EMS)	(Bansal and Roth, 2000; Delmas and Toffel, 2004; Delmas, 2002; Jennings and Zandbergen, 1995)

2.2.4 Institutional theory and ISO 9000

It is reasonable to suspect that ISO 9000 might also follow a similar pattern of institutionalization. However, there is no study which investigates the conflict between the institutional expectations of ISO 9000 and its operational efficiency. Guler et al. (2002) suggested that the diffusion of ISO 9000 is due to institutional pressure, and they urged that future researchers focus on the decoupling effect in the later stage of diffusion.

This study will be the first study to investigate this decoupling process of ISO 9000 using objective data and to examine whether the diffusion of ISO 9000 can be explained by institutional theory. In the following sections, we will discuss how ISO 9000 adopters might obtain legitimacy from related stakeholders.

a) Government and MNE regulations on ISO 9000

Delmas (2002) and Christmann and Taylor (2001) suggested that institutional pressure for the adoption of ISO certification is coercive pressure from the government or a few major customers in the supply chain. They pointed out that ISO 9000 certified firms tend to request their suppliers adopt the standard. ISO 9000 has also been used as a basic requirement of many state-level purchases or government tenders. This basic requirement could be explicit or implicit, but in either case, firms which have obtained the ISO 9000 have a higher chance of winning the contract (Buttle, 1997). A similar phenomenon was documented in the supply chains of automotive and computer equipment (Darnall, 2006).

b) Professional organizations on ISO 9000

Previous research has found the existence of normative pressures among organizations to adopt similar practices resulting from professionalization and knowledge transfer (Galaskiewicz, 1985; Galaskiewicz and Wasserman, 1989; Guler et al., 2002). A number of organizations have been instrumental in promoting ISO 9000, such as Association of Quality Engineers and German Standards Institute (DIN) in Germany (Beck and Walgenbach, 2005), European Organization for Quality (EOQ) in Europe and American Society for Quality (ASQ) in the US, as well as business press and business schools (Beck and Walgenbach, 2005; Dedhia, 2001). These professional organizations and associations acted as the source of normative pressure for the adoption of ISO 9000.

c) Market pressure on ISO 9000

As ISO 9000 evolved as a "passport" for international business (Christmann and Taylor, 2001; Delmas, 2002), non-certified firms faced the danger of being screened out from the customers' potential supplier lists. Despite the lack of conclusive evidence on the technical benefits of ISO 9000 (Terziovski et al., 1997), decision makers may not be willing to risk the potential loss of sales due to the lack of ISO 9000 certification. Their response to this uncertainty is to follow the norm and have the firm ISO 9000 certified.

Moreover, end users and middle-tier manufacturers have rising concerns on quality and environmental performance which come from their stakeholders or supply chain partners. Following this, there have been increasing numbers of lawsuits related to poor quality or environmental issues (Kollman and Prakash, 2002; Lally, 1998; Potoski and Prakash, 2005). The potential economic and legitimacy loss could be very costly. In response to this risk, many organizations make use of the ISO 9000 a clear signal that they have well-managed processes to take care of product and service quality.

2.2.5 Institutional benefits of ISO 9000

According to institutional theory, organizations adopt institutionalized management practices but decouple these practices from the actual functioning of the organizations. Their purpose in adopting institutionalized management practices is partly or largely symbolic (Westphal and Zajac, 1994). Organizations can acquire symbolic benefit by signaling their compliance with the institutional expectation. In other words, organizations enhance their legitimacy by following the norm of related stakeholders' expectations of ISO 9000. Considerable evidence suggests that both organizations,

(Anderson et al., 1999; Westphal et al., 1997) and their CEOs, (Staw and Epstein, 2000; Westphal and Zajac, 1994) can reap financial benefit from such symbolic management of stakeholders' perceptions.

a) Organizational legitimacy

Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within a socially constructed system of norms, values, beliefs, and definitions (Suchman, 1995). An organization will be conferred organizational legitimacy when adopting ISO 9000 is perceived as a desirable, proper and appropriate action from a social perspective. The literature suggests that there is a strong relationship between organizational legitimacy and financial performance (McGuire, Sundgren and Schneeweis, 1988; Orlitzky and Benjamin, 2001). If the adoption of ISO 9000 helps the organization obtain legitimacy, it may reap tangible financial benefits. The following indicators may reflect part of the impact from stakeholders' perception of legitimated organizations.

Sales – direct customers

Large corporations and some government tenders require their suppliers to adopt ISO 9000. Companies adopting ISO 9000 will gain additional recognition or legitimacy from potential customers over the non-certified competitors (Curkovic and Handfield, 1996; Darnall, 2006). This could lead to improved sales performance in the long run. The percentage of relative change in sales performance may reflect the impact of organizational legitimacy (Corbett et al., 2005).

Market value – shareholders

The adoption of meta-standards could lead to improved corporate image (Bansal and Clelland, 2004; Walgenbach, 2001). This improved image and lower perceived risk can be reflected in the intangible asset valuation or market value (Bansal and Clelland, 2004; Dowell, Hart and Yeung, 2000; Feldman, Soyka and Ameer, 1996; Klassen and McLaughlin, 1996; Konar and Cohen, 2001). *Tobin's q* is the most commonly used indicator to reflect market valuation in the literature.

b) Personal legitimacy – board of directors

Personal legitimacy is the moral legitimacies which rest on the charisma of individual organizational leaders (Suchman, 1995). People manage their personal legitimacy by actively taking on roles and displaying social affiliations (Elsbach, 1994; Leary and Kowalaski, 1990). If senior management actually improves organizational performance by pursuing ISO 9000, then one would expect these executives to be held in high regard within their firm (Staw and Epstein, 2000). According to institutional theory, even if ISO 9000 does not improve organizational efficiency, senior managers will probably be rewarded for bringing the organization a number of accreditations, leading to higher corporate esteem. In addition, by successfully obtaining certificates, the professionalism and accountability of senior management is demonstrated to the stakeholders, the public and the board of directors (Staw and Epstein, 2000). From a human resource (HR) perspective, which regards human resources as a critical element in enhancing a firm's long-term competitiveness, organizations are willing to provide more competitive salaries for socially legitimate leaders in presumption of their management capability (Zajac and Westphal, 1995).

Improvement in firm performance leads to increases in senior executive compensation. However, previous studies documented that there is a stronger relationship between legitimacy and compensation (Stanwick and Stanwick, 2001; Tosi, Werner, Katz and Gomez-Mejia, 2000; Westphal and Zajac, 1994). Tosi et al. (2000) carried out a meta-analysis of CEO compensation and concluded that firm size is the major factor in CEO compensation (over 40%), while firm performance accounts for less than 5% of the variance. The rationale is that the size of the firm affects the prestige or reputation of a leader, as they manage larger and more complex organizations. Apart from firm size and firm performance, there are a number of factors affecting the CEO compensation, which include level of diversification, industry, organizational structure, and human capital (Tosi et al., 2000). We argue that personal legitimacy, via the adoption of a well-recognized management practice, will also be one of the factors affecting CEO and senior executive compensation.

2.2.6 The decoupling of technical efficiency and institutional approval

ISO 9000 was developed based on the basic principles of quality management. Through standardization and continuous improvement in processes and procedures, ISO 9000 is assumed to improve operational efficiency throughout the organization (Rao et al., 1997). The conceptual and empirical foundations for the link between improved quality and business performance are well established according to various theories (Deming, 1986; Reed, Lemak and Mero, 2002). Most academics (e.g., Hill, 1996; Spreha and Helms, 1995) believe that ISO 9000 improves quality and overall efficiency in organizations enabling them to make uniform products and conferring a competitive edge, resulting in greater customer satisfaction and market share.

On the other hand, the rapid diffusion of ISO 9000 has made it an institutionalization process in the global business environment, and it has becoming an example of institutionalized rules (Guler et al., 2002). From an institutional perspective, it is quite feasible that organizations could invoke the socially legitimate goal of ISO 9000 certification without being dedicated to its principles (Westphal et al., 1997). Institutional theory describes a process whereby the symbolic value of an administrative innovation ultimately supplants, or even distorts, its technical efficiency (DiMaggio and Powell, 1983; Zbaracki, 1998). Academics have even warned of potential conflicts between institutional demands and efficiency considerations (Meyer and Rowan, 1977; Walgenbach, 2001; Westphal and Zajac, 1998, 2001). They have speculated that there is 'loose decoupling' between management practices for internal efficiency and those institutional requirements stipulated by ISO 9000 (Fligstein, 1985; Tolbert and Zucker, 1983). Accordingly, the adoption of institutionalized rules does not necessarily improve operational efficiency (DiMaggio and Powell, 1983).

The time of adopting ISO 9000 is an important moderating factor in the decoupling process. According to institutional theory, early adopters are driven by the technical merits of a management practice while the late adopters are driven by legitimacy (Meyer and Rowan, 1977; Scott, 1995; Westphal et al., 1997). The early adopters could possibly obtain greater technical merit, because they actively recognize the improvement opportunities themselves, instead of passively responding to isomorphic pressures from stakeholders. Therefore, the technical merit will diminish when a management practice becomes institutionalized; the late adopters merely obtain symbolic value or legitimacy instead.

There are a number of studies which are trying to address this issue (e.g., Beck and Walgenbach, 2005; Naveh, Marcus and Moon, 2004; Westphal et al., 1997; Yeung et al., 2006; Zbaracki, 1998). Westphal, Gulati and Shortell (1997) reveal that Total Quality Management (TQM) has undergone an institutionalization in hospitals, and they concluded that the diminishing effect of technical benefits is the result of institutionalization. Zbaracki (1998) conducted five case studies to examine the relationship between the technical and institutional elements of TQM. He argued that TQM gains institutional value through inflated claims of its technical benefits by the managers who introduced it, and these managers are understandably keen to maintain the myth of TQM. Yeung et al. (2006), on the other hand, found no evidence that late TQM adopters could obtain benefits from organizational legitimacy by their claim to use TQM. They suggested that the institutional value of TQM interventions is limited due to the popularity of quality-oriented meta-standards, such as ISO 9000, QS 9000, TL 9000, etc., which involve concrete system requirements, similar to hard TQM elements. Naveh et al. (2004) similarly compared performance between early and late adopters of ISO 9000, and they found no evidence that early adopters obtain more technical benefits.

In conclusion, the diminishing effect of technical benefits could be due to the fact that adopters changed their focus to institutional benefit (Westphal et al., 1997). The symbolic value of a management practice eventually supplants its technical value. However, there is limited empirical evidence to show whether ISO 9000 also experiences diminishing technical benefits and decoupling between adoption and actual implementation.

CHAPTER 3 METHODOLOGY

Research design choices imply trade-offs between (1) generalizability (external validity), (2) precision in measurement and control of the behavioral variable (i.e. internal validity and construct validity), and (3) realism of context (McGrath and Martin, 1982). Any research method chosen will have inherent flaws, and the choice of that method will limit the conclusions that can be drawn (Scandura and Williams, 2000). According to Scandura and Williams (2000), there are nine types of research strategy, which are (1) literature reviews, (2) sample survey, (3) laboratory experiment, (4) experimental simulation, (5) field study: primary data, (6) field study: secondary data, (7) field experiment, (8) judgment task, and (9) computer simulation. Among the empirical studies in quality management literature, three main types of research strategy are commonly used, which are sample survey, field study: primary data, and field study: secondary data.

In the stream of survey type studies, academics have developed a clear framework for quality management and an associated measurement instrument to measure the management practices and quality performance of organizations (Flynn et al., 1994; Hart, 1992). However, the biggest limitation of this type of research is the difficulty of collecting longitudinal data. In the quality management literature, we found very few longitudinal survey studies of ISO 9000 (Terziovski et al., 2003). In most of the studies, the changes in performance prior to, and after the adoption of quality management practices were assessed by subjective evaluation by survey respondents. Relying on questionnaires and perceptual data, the results of previous research in ISO 9000 were questionable.

Attempting to compensate for the limitations in survey type studies, some researchers have conducted cross-sectional field studies based on primary and secondary data of quality, operational and financial performance (e.g., Heras et al., 2002; Simmons and White, 1999). However, cross-sectional field studies usually encounter the problem of internal validity (Scandura and Williams, 2000). To avoid the problem of "reverse causality" – more profitable organizations tend to adopt ISO 9000 – researchers started to use longitudinal data and event study methodology to investigate the causal relationship between ISO 9000 adoption and business performance (e.g., Corbett et al., 2005; Naveh and Marcus, 2005; Sharma, 2005). We believe that to reveal the casual relationship between the adoption of ISO 9000 and its benefits, and to investigate the possible decoupling of operational efficiency and institutional benefit over time, longitudinal research based on event study methodology is the most appropriate research methodology. The methodology we used in this study is largely based on the foundation of Corbett et al.'s (2005) and Naveh and Marcus's (2005) work, which follow the event study guidelines suggested by Barber and Lyon (1996).

3.1 Sample Selection and Data Collection

We selected manufacturing companies (SIC code 2000-3999) that are listed in the stock markets in the North America, as ISO 9000 is most commonly adopted in this industry. The stock markets in the U.S. and Canada are well-established, with adequate archived financial information. The companies' financial information is available in Standard and Poor's COMPUSTAT database. There are 3,642 active manufacturing companies in the database. We discarded those companies which are either out of business now or have been acquired by another firm, to avoid data contamination.

3.1.1 ISO 9000 information

To identify ISO 9000 certified firms and their year of certification, we collected ISO 9000 registration data from two online databases, which are www.qualitydigest.com and www.whosregistered.com. From these two databases, we searched by company name to find out the date of each certification and the plants/sites that were certified. Since each company could have multiple plants/sites certified we following the practice of previous research (Corbett et al., 2005; Naveh and Marcus, 2005; Simmons and White, 1999), only focusing on the first ISO 9000 certification.

As many listed manufacturing firms have subsidiaries, we obtained the subsidiaries' names from their corporate website. If the subsidiaries' names appeared in either one of the meta-standards online database, and the certified process was closely related to the parent company's business, we also considered it a valid observation. If we could not find any meta-standard record of a particular company or their subsidiaries, we considered that this company had not adopted ISO 9000, and it was used as a control firm. Appendix A lists the detailed procedures of data collection from these two databases. After compiling the data from the online databases, we found that 1,104 out of 3,642 (30.31%) listed manufacturing firms in North America were ISO 9000 certified. The distribution of the year of certification is shown in Table 3.1.

Table 3.1 Distribution of the year of certification

	ISO 9000	
Year	**No. of firms**	**% of Firms**
1990	4	0.36
1991	8	0.72
1992	42	3.80
1993	82	7.43
1994	112	10.14
1995	101	9.15
1996	120	10.87
1997	102	9.24
1998	85	7.70
1999	71	6.43
2000	72	6.52
2001	50	4.53
2002	79	7.16
2003	112	10.14
2004	35	3.17
2005	29	2.63
	1104	**100.00**

3.1.2 Financial information

Operational and financial information were obtained from Standard and Poor's COMPUSTAT North America database. The COMPUSTAT database is considered to be a very reliable source of archival financial information for studying business and corporate strategies (Simmons and White, 1999). The database of our version covers financial data of each firm from 1988 to 2005. Since the first ISO 9000 in our sample is 1990, the database covers all the early and late adopters of meta-standards.

3.1.3 Senior executive compensation

To investigate the potential institutional benefits to the senior executive, we used both short-term and long-term compensation data in this study. Short-term compensation refers to base salary and bonuses, while the long-term compensation is the value of stock options. The compensation of CEO and other top 4 highest paid executives of each firms were collected from Standard and Poor's Execomp database. However, the number of manufacturing companies covered in this database is just 756. To improve the data coverage, we collected additional compensation data from other sources.

In 1992, the Securities and Exchange Commission (SEC) began requiring companies to disclose detailed executive compensation information in their proxy statements. Listed companies have to disclose the CEO's and other top executives' salary, bonuses, stock options, restricted stock, and long-term incentive plan in their DEF14A proxy statement. We randomly selected 1200 firms (about 1/3 of total manufacturing firms in our sample) among the 3642 manufacturing firms and collected the salary and bonus compensation from the DEF 14A proxy statement. As a result, we are able to check the accuracy of the Execomp database and expand the overall coverage of sample and control firms.

3.2 Event Study Methodology

In order to reveal any causal relationship between the adoption of ISO 9000 and operational performance, we adopted event study methodology in this study. We followed the guidelines suggested by Barber and Lyon (1996) for detecting abnormal performance between sample and control firms. The event period studied in this study was the period during which ISO 9000 was implemented. To pass the ISO 9000 audit, the average preparation time is 6-18 months prior to registration (Corbett et al., 2005).

Since the preparation and auditing periods typically take at least half a year, we used "year" as the time unit in our event windows. The year of registration was used as the focal point time *t*. The year before registration date was *t-1*. Therefore, the time before ISO 9000 implementation was taken as *t-2*. We were also interested in the long-term impact of ISO 9000, so we looked into the financial data for the next three years after ISO 9000 certification (i.e., *t+1*, *t+2* and *t+3*). Table 3.2 shows a summary of the length of event windows in other operation management research.

Table 3.2 Summary of event windows period of event studies.

Event	Event windows	Indicators	Reference
Quality Award	t-5 to t+5	ROA	(Hendricks and Singhal, 1996)
ISO 9000	t-2 to t+3	ROA, ROS, Sales, TobinQ	(Corbett et al., 2005; Naveh and Marcus, 2005)
ERP, CRM	t-2 to t+3	ROA	(Hendricks, Singhal and Stratman, 2007)
Top management dismissal	t-3 to t+3	Operating income	(Denis and Denis, 1995)

t = the event year

3.2.1 Matching sample and control firms

We adopted the event study methodology and eliminated confounding factors other than the event of ISO 9000 certification. We carefully matched sample and control pairs based on specific matching criteria. The sample groups included companies that experienced the event (i.e., obtaining the first ISO 9000 registration), while control group companies are free from the impact of that event. Sample and control group companies have to be in the same industry with similar firm size and pre-event performance, so as to minimize the confounding factors in a particular industry or due to the overall state of the economy. Moreover, we matched each sample firm with a portfolio of control firms that fit the matching criteria, so as to minimize performance fluctuations that might happen in a particular control firm. The average sample to control firms matching ratio is 1 : 2.49.

In this study, we matched the sample firms' and control firms' industry type by SIC code. In general, matching the same first two digits of SIC code ensures that highly similar industries are selected. The purpose of having this matching criterion is to control any industry specific effects during the event period. Firm size was also controlled as large corporations may have more resources available for quality improvements (Hendricks and Singhal, 1997). Following Hendricks and Singhal's (1997) event study on TQM implementation, we used 33-300% of total assets, a factor of three, as our firm size matching criterion.

Barber and Lyon (1996) suggested that matching pre-event performance is the most critical factor for event studies. They found that matching industry type (two digit SIC code) and 90-110% pre-event performance created the most appropriate matching groups

between sample and control firms. Accordingly, we matched the sample and control firms with two digit SIC code, 33-300% firm size (total asset), and 90-110% pre-event performance. In cases where some sample firms did not match any control firms based their on two digit SIC code, firm size and pre-event performance, we loosened the matching criteria to increase the sample size (Hendricks and Singhal, 1996, 1997, 2001; Naveh and Marcus, 2005). In short, the matching steps were as follows:

Step 1 – Two digit SIC code + 33-300% Total Asset + 90-110% abnormal performance

Step 2 – One digit SIC code + 33-300% Total Asset + 90-110% abnormal performance

Step 3 – 33-300% Total Asset + 90-110% abnormal performance

In Corbett et al.'s (2005) event study of ISO 9000 and financial performance, they controlled industry (SIC code), firm size (Total asset) and ROA (financial performance), to match the sample and control pairs. However, they also carried out statistical tests on other indicators, such as sales growth, cost efficiency and operating income, etc. We attempted to scrutinize the actual performance of those indicators after controlling for pre-event performance. Therefore, in this study, strictly following Baber and Lyon's methodology – each test of indicators was conducted by matching the corresponding pre-event performance of that particular indicator so as to provide more accurate results.

3.2.2 The calculation of abnormal performance

Abnormal performance was calculated by the sample post-event performance (i.e. the actual performance) minus the expected performance. Expected performance was

calculated by sample pre-event performance plus the change of control firms' performance. The formulas are the following:

$$AP_{(t+j)} = PS_{(t+j)} - EP_{(t+j)},$$

$$EP_{(t+j)} = PS_{(t+i)} + Avg(PC_{k(t+j)} - PC_{k(t+i)}),$$

where

AP = Abnormal performance,
EP = Expected performance,
PS = Performance of sample firms,
PC = Performance of control firms,
t = Year of ISO 9000 certification,
i = Starting year of the comparison (i = -3, -2…+2),
j = Ending year of the comparison (j = -2, -1…+3),
k = Number of control firms.

The average performance of the control firms was used to calculate the abnormal performance of the sample firm. The average performance from a group of control firms, rather than relying on a single control firm, can provide more reliable results. The null hypothesis in our study is that the average abnormal performance of an ISO 9000 certified firm equals zero.

3.3 Data Analysis Procedures

The statistical tests commonly used in event studies are the paired-sample t-test (parametric), and the non-parametric Wilcoxon Signed Ranks (WSR) test and Sign test (e.g., Corbett et al., 2005). If the abnormal performance follows a normal distribution, the parametric paired sample t-test is generally valid. We examined the data for normality by using the Kolmogorov-Smimov test and the Shapiro-Wilk test. If the abnormal performance of the sample firms was not normally distributed, the non-parametric WSR test and Sign test would be used. We trimmed out the top and bottom one percentile records to avoid outliners. These data analysis procedures are used in

Chapter 4 and Chapter 6. Simple regression analysis is used (Chapter 6) to test the decoupling between institutional approval and technical benefits from ISO 9000. The Mann-Whitney test is be used in Chapter 6 to test the median difference between early and late adopters of ISO 9000.

CHAPTER 4 RESEARCH PART ONE - ISO 9000 AND OPERATING PERFORMANCE

The conceptual and empirical foundations for the link between improved quality and business performance are well established, according to various grounded theories (Deming, 1986; Reed et al., 2002). However, some important operational dimensions have received little attention in previous ISO 9000 empirical studies. In this section, we will develop hypotheses for the relationship between ISO 9000 implementation and operational and financial performance. We will also introduce two operational indicators, labor productivity and the operating cycle time, which are critical but have seldom been used for analysis of the technical merits of ISO 9000 adoption. Table 4.1 provides a summary of the different measures of operational performance used in this research.

4.1 The Benefits of the ISO 9000

ISO 9000 is a quality management system that requires organizations to have detailed documentation of their management and production procedures. Compliance with ISO 9000 indicates the consistent use of documented, standardized procedures in operations (Anderson et al., 1999) which helps reduce mistakes, defects and rework. Moreover, implementing ISO 9000 requires the adopting firms to document all relevant management procedures. This leads to less dependence on tacit knowledge from particular employees (Mukherjee, Lapre and Wassenhove, 1998). Accordingly, the productivity of the firm will experience much less negative impact from employee turnover.

In Schmenner's (1991) case study of a automobile manufacturer with 561 plants, he found that strong quality control functions were positively associated with labor

productivity. Elmuti and Kathawala (1997) also found that the adoption of ISO 9000 improves employee productivity through the improvement of employee morale. Labor productivity depicts the average output of employee and can be measured by the operating income divided by number of employee. However, Elmuti and Kathawala's (1997) study was cross-sectional and thus provided no empirical evidence of the causal relationship. In contrast, we examine the impact of ISO 9000 on productivity based on longitudinal data. We hypothesize that:

H1: The adoption of a quality-oriented meta-standard leads to improved labor productivity

In the manufacturing industry, another important dimension of operational efficiency is time-based efficiency. For a manufacturing firm, time-based efficiency embraces the timeliness of delivery, manufacturing lead time, etc. (Yeung, Cheng and Chan, 2004; Yeung, Cheng and Lai, 2005). To measure these indicators objectively, we use an accounting-based indicator – operating cycle time. Operating cycle time is defined as the time required to convert raw materials into customer payment (Eskew and Jensen, 1996). Operating cycle time is the summation of the number of inventory days and the number of account receivable days.

ISO 9000 requires the firm to design procedures for ensuring that quality is constantly measured and appropriate corrective actions are taken whenever defects occur. Consequently, defects should be detected and corrected early, the defect rate should decrease (Corbett et al., 2005), and less scrap and rework should be produced in the manufacturing processes (Naveh and Marcus, 2005). As a result, the overall operating cycle time required to fulfill a customer order in certified firms should be shorter than

that in firms without similar QM systems. Moreover, during the implementation of the QM system, all manufacturing procedures would have been reviewed and non-value added processes eliminated. As a result, the time required to turn the raw materials into finished products, the inventory days, should be shortened (Flynn, Sakakibara and Schroeder, 1995).

The perceived benefits of ISO 9000 are not confined to improving product quality, but also include enhancing customer service (Buttle, 1997). If the implementation of ISO 9000 improves product quality and customer service, the time required to fulfill customer orders should be shorter. If there is any quality problem with the products, payment might be postponed as non-conforming products are returned. Customers may not pay for the products until the quality problem has been resolved. In other words, the time between product delivery and customer payment, the account receivable days, should be shorter for companies with higher product and service quality.

The total time incurred in the above processes is known as operating cycle or "cash-to-cash cycle" (Eskew and Jensen, 1996). Therefore, we hypothesize that the operating cycle time should be shorter after the implementation of ISO 9000.

H2: The adoption of a quality-oriented meta-standard leads to a shorter operating cycle.

In the OM literature, operational performance usually refers to time efficiency and cost efficiency (Yeung et al., 2006). The implementation of quality-oriented meta-standard aims at improving operating procedures, ensuring that quality is constantly monitored and corrective actions are taken in a timely manner. Accordingly, ISO 9000 should certificates decrease the number of non-conforming products and minimize the cost due

to defects or rework. We argue, therefore, that implementing ISO 9000 leads to a positive impact on cost efficiency in adopting firms (Campanella, 1990; Corbett et al., 2005). To measure cost efficiency, the most commonly used indicator is the cost of goods sold divided by sales. Therefore, we develop the following hypothesis.

H3: The adoption of a quality-oriented meta-standard leads to improved cost efficiency

Table 4.1 Summary of operational performance indicators

Indicators	Formula	Implication	Reference
Labor productivity (*LP*)	$LP = \frac{OI}{E}$	Improvement in process management	(Schmenner, 1991)
Inventory days (*I*)	$I = \frac{365}{IT}$	Number of days required to convert raw materials into products	(Eskew and Jensen, 1996)
Account receivable days (*AR*)	$AR = \frac{365}{ART}$	Number of days required for customer payment fulfillment	(Eskew and Jensen, 1996)
Operating cycle (*OC*)*	$OC = I + AR$	Time based efficiency of operation	(Eskew and Jensen, 1996; Stewart, 1997)
Manufacturing Cost efficiency (*MCE*)	$MCE = \frac{COGS}{S}$	Efficiency in cost control	(Corbett et al., 2005)

I = Number of inventory days
IT = Inventory turnover ratio
S = Sales
COGS = Costs of good sold
E = Number of employee
OI = Operating income
AR = Number of account receivable days
ART = Account receivable turnover ratio
OC = Operating cycle
** For detailed calculation, please refer to Appendix B.*

4.2 The Financial Benefit of the ISO 9000

An improvement in operational performance may eventually be reflected in measures of financial performance. The most common financial performance indicators are Return on Asset (ROA) and Return on Sales (ROS). Both ROA and ROS reflect a company's profitability. Some studies revealed a significant positive impact of ISO 9000 certificate on ROA and ROS (Chow-Chua, Goh and Wan, 2002; Corbett et al., 2005; Simmons and White, 1999), but others found no evidence to support such a relationship (Heras, Dick and Casadesus, 2002).

Simmons and White's (1999) study is one of the first that used data from COMPUSTAT to study the benefits of ISO 9000 certificate. From their cross-sectional analysis, Simmons and White (1999) found that ISO 9000 certified companies had a higher level of ROA. Similarly, Mokhtar, Karbhari and Naser (2005) found that ISO 9000 certification was strongly correlated to ROA. However, neither study implies a causal effect, since both use cross-sectional analysis.

To reveal the causal effects of the adoption of a quality-oriented meta-standard, some researchers have resorted to the use of longitudinal data. Heras, Casadesus and Dick (2002; 2002) published two related research works, reporting that, after controlling for pre-certification performance (ROA) between certified and non-certified firms, there was no difference in post-certification performance.

Naveh and Marcus (2005) also applied event study methodology to investigate the positive impact of ISO 9000 on ROA and ROS. However, their study was limited because of insufficient data coverage. More than 50% of their 313 sample companies did

not have enough post-certification performance data, such that the long term financial performance may be have been biased towards the early adopters of ISO 9000. Therefore, the results they presented have higher explanatory power for the early adopters than the late adopters of ISO 9000.

Corbett, Montes-Sancho and Kirsch (2005) carried out an event study of ISO 9000 which revealed that the ISO 9000 certified manufacturing firms performed significantly better than non-certified firms in terms of ROA and ROS. However, their data covered only the years 1990 to 1997, which mainly include early adopters of ISO 9000. Therefore, according to institutional theory, it is questionable whether the same technical and financial impact still exists today.

H4: The adoption of a quality-oriented meta-standard leads to improved ROA and ROS.

Haversjo (2000) found that ISO 9000 certified firms in Denmark performed 35% better in ROA than non-certified firms, but the positive impact disappeared in 4 to 5 years time. However, Haversjo (2000) also found that the positive impact mainly relied the improvement in sales, rather than internal efficiency. As one of the motivations behind adopting ISO 9000 is to improve sales and market share, it is worthwhile investigating ISO 9000's impact on sales growth.

Sharma (2005) examined the relationship between ISO 9000, sales growth, profit margin and earnings per share. Sharma controlled pre-event performance between sample and control firms, such that the improved performance actually due to ISO 9000 could be measured. The data was collected from the Singapore stock exchange, but the sample size was comparatively small, containing only 35 certified companies. In Corbett,

Montes-Sancho and Kirsch's (2005) event study on ISO 9000, which consisted of 554 sample and control matched pairs, they also found significant increase in sales growth occurring one year before the company was certified. Based on the above literature, we develop Hypothesis 5.

H5: The adoption of a quality-oriented meta-standard leads to improved sales growth

Apart from ROA and sales growth, researchers are also interested in studying the market reaction towards the adoption of ISO 9000. Market valuation of the company is reflected its stock price. Apart from stock price fluctuations, *Tobin's q* is commonly used to reflect the market valuation of companies' intangible assets. This is commonly used as a proxy for stock price movements (Adams, 1999; Corbett et al., 2005; Dowell et al., 2000; Konar and Cohen, 2001). *Tobin's q* is defined as firm market value per dollar of replacement cost of tangible assets (Chung and Pruitt, 1994).

H6: The adoption of a quality-oriented meta-standard leads to improved market valuation.

Table 4.2 Summary of the financial indicators

Indicator	Formula	Implication	Reference
Return on Asset (*ROA*)	$ROA = \frac{OI}{TA}$	Profitability of company assets	(Corbett et al., 2005; Simmons and White, 1999)
Return on Sales (*ROS*)	$ROS = \frac{OI}{S}$	Profitability of sales volume	(Corbett et al., 2005; Naveh and Marcus, 2005)
Relative sales growth (ΔS)	$\Delta S = \frac{S_y - S_{y-1}}{S_{y-1}}$	The yearly sales growth percentage	(Corbett et al., 2005; Heras et al., 2002; Simmons and White, 1999)
Tobin's q(Q)	$Q = \frac{MVE + PS + DEBT}{TA}$	Market valuation – as a proxy of stock price movement	(Adams, 1999; Corbett et al., 2005; Konar and Cohen, 2001)

OI = Operating income
S = Sales
y = year
MVE = Market valuation of equity
PS = Market value of preferred stock
DEBT = Long term debt
TA = Total assets

4.3 Data Collection and Methodology

Based on financial data from COMPUTSTAT and ISO 9000 registration year information from two online databases, www.qualitydigest.com and www.whosregistered.com, we matched ISO 9000 certified companies with a portfolio of non-certified companies based on industry code, company size, and pre-certification performance of each of the indicators. Table 4.3 is the summary of the pre-certification performance (t-2) of the sample and control companies. All the *p*-values show that there was no significant difference in pre-certification performance between the sample and control groups. Both sample and control companies enjoyed similar performance right before ISO 9000 adoption (i.e., two year before formal certification).

Table 4.3 Descriptive statistics for pre-certification performance (year t-2) of sample and control firms for each indicator

Indicator	N	Mean	Median	St.dev	Min	Max
ISO 9000 certified firms						
Total assets*	597	2195.10	324.95	5178.98	1.25	42344.35
Sales*	703	1684.82	242.65	4450.38	0.29	49732.10
Labor productivity[a]	583	29.18	20.19	27.82	1.70	212.29
Operating cycle[b]	695	169.49	150.50	98.36	34.64	1216.73
Manufacturing cost efficiency[c]	705	66.06	65.84	39.12	15.98	745.96
ROA[c]	594	15.83	14.82	7.79	0.73	59.99
ROS[c]	590	14.76	13.39	7.96	0.58	53.06
Relative Sales growth[c]	461	27.78	17.37	30.43	0.15	209.02
Tobin's q[d]	627	1.60	0.98	1.86	0.01	17.17
Control firms						
Total assets*	597	1877.04	318.13	4142.87	1.00	31043.00
Sales*	703	1677.99	242.00	4414.46	0.28	48317.32
Labor productivity[a]	583	29.09	20.20	27.644	1.56	221.16
Operating cycle[b]	695	168.27	151.19	96.12	33.43	1121.60
Manufacturing cost efficiency[c]	705	65.59	66.00	36.87	15.00	687.69
ROA[c]	594	15.66	14.54	7.56	0.77	55.29
ROS[c]	590	14.66	13.42	7.90	0.54	53.75
Relative sales growth[c]	461	27.50	17.09	30.01	0.15	206.06
Tobin's q[d]	627	1.60	1.00	1.88	0.01	18.86

*Total asset and Sales – Million US$
[a]Labor productivity – Thousand US$ per employee
[b]Operating cycle – Days
[c]Manufacturing cost efficiency , ROA, ROS and relative sales growth - Percentage
[d]*Tobin's q* is a dimensionless measure

4.4 Results

We examined if ISO 9000 certification leads to "abnormal performance" in terms of operational performance, financial performance and senior executive compensation. The

statistical test results of the corresponding indicators are shown in Table 4.4 to Table 4.10, respectively. The column “From year” depicts the event window under test, while *t* is the year when the sample firms obtained their first ISO 9000 certification. The column “N” is the sample size and “AP Mean” and “AP Median” show the mean and median of abnormal performance (AP). Although we matched the sample with control firms based on their performance in *t*-2 year, we also reported the change from *t*-3 to *t*-2 (in the first row) to examine whether there was any systematic bias prior to the sample firms’ decision to implement ISO 9000. The second row “*t*-2 to *t*-1” shows the abnormal performance of the sample firms immediately after implementing ISO 9000.

Table 4.4 Abnormal performance of labor productivity – for event years between 1990 and 2005

Labor Productivity in thousand US$ per employee (1990–2005)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	567	-0.7956	0.0000	0.1770	0.4925	0.5000
t-2 to t-1	583	1.6906	0.5683	0.0735*	0.0125**	0.0255**
t-1 to t	569	-0.4238	0.3113	0.3195	0.4950	0.2925
t to t+1	543	0.1065	-0.3163	0.4600	0.2570	0.1615
t+1 to t+2	524	-0.2632	-0.2363	0.4055	0.1270	0.3965
t+2 to t+3	465	0.8650	0.3866	0.2825	0.4230	0.2890
t-2 to t	572	2.7844	0.7335	0.0100***	0.0100***	0.0060***
t-2 to t+1	543	2.1107	1.1831	0.0605**	0.0365**	0.0325**
t-2 to t+2	530	3.0136	0.5179	0.0325**	0.1525	0.1695
t-2 to t+3	464	3.5443	-0.1419	0.0325	0.1890	0.4445
t-1 to t+1	542	0.1426	-0.2807	0.4545	0.3310	0.3980
t-1 to t+2	529	0.9159	-0.6442	0.3165	0.2450	0.1805
t-1 to t+3	464	1.1795	-0.5721	0.2785	0.2600	0.1890

p<0.1*; p<0.05<**; p<0.01***

Labor productivity improved right after the company started preparation of ISO 9000 registration in t-2 to t-1 period (Table 4.4). In this period, each employee in the certified firms, on average, generated an additional US$ 1,696 operating income compared with control firms. This change may be due to a decrease in either the number of employees or an improvement in operating income with the same number of employees. But, in either case, the results provide solid evidence that employees in ISO 9000 certified firms are more productive than those in non-certified firms.

The abnormal improvement is long-term and gradual after obtaining the ISO 9000 certification. From t-2 to t, t-2 to t+1, t-2 to t+2 and t-2 to t+3 periods, the abnormal performance has a upward trend and this leads to a positive change of US$3,013.6 per employee from t-2 to t+3 period. That is a 10.3% improvement in labor productivity

compared to non-certified firms, when we look at labor productivity in t-2 year (US$29,181.5 per employee). Based on the evidence shown in Table 4.4, Hypothesis 1 is supported.

Table 4.5 Abnormal performance of operating cycle – for event years between 1990 and 2005

Operating Cycle (days) 1990-2005						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	650	-0.4690	1.2042	0.4135	0.1430	0.1635
t-2 to t-1	695	-5.2861	-5.4915	0.0900*	0.0000***	0.0000***
t-1 to t	682	-0.3780	-1.4538	0.4665	0.0540	0.1690
t to t+1	648	0.9717	0.0485	0.3735	0.3725	0.5000
t+1 to t+2	614	0.7230	-0.7903	0.3785	0.1480	0.2465
t+2 to t+3	534	-1.7128	-0.5529	0.2415	0.1900	0.2870
t-2 to t	683	-6.9016	-7.2576	0.0270**	0.0000***	0.0000***
t-2 to t+1	657	-7.7608	-6.9308	0.0245**	0.0000***	0.0000***
t-2 to t+2	623	-8.0671	-8.1449	0.0020***	0.0000***	0.0000***
t-2 to t+3	537	-8.4999	-8.7295	0.0025***	0.0000***	0.0005***
t-1 to t+1	648	-2.2890	-0.5930	0.2420	0.3180	0.3325
t-1 to t+2	622	-5.0027	-2.3325	0.1425	0.0915*	0.1395
t-1 to t+3	536	-6.7931	-3.5919	0.0725*	0.0110**	0.1050

p<0.1*; p<0.05<**; p<0.01***

A similar pattern to that of labor productivity is shown in the results for operating cycle time. The abnormal performance for operating cycle significantly improved by 5.2861 (5.2861 days shorter), after the start of preparation for ISO 9000 certification (from *t*-2 to *t*-1). This demonstrates that the certified firms spent less time converting raw materials into products, and received payment from customers earlier than non-certified firms. The trend of yearly improvements can also be observed in operating cycle time. In the *t*-2 to *t*+3 period, the ISO 9000 certified firms shortened their operating cycle by 8.4999 days on average compared to non-certified firms. This is solid evidence that ISO 9000

certification improved the time-based efficiency of manufacturing firms. Therefore, Hypothesis 2 is supported.

Table 4.6 Abnormal performance of manufacturing cost efficiency – for event years between 1990 and 2005

Manufacturing Cost Efficiency (1990 – 2005)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	699	1.14	0.03	0.0065***	0.1030	0.4400
t-2 to t-1	705	-3.59	-0.08	0.0175**	0.1145	0.2735
t-1 to t	691	2.11	0.13	0.1105	0.1150	0.2970
t to t+1	658	-1.33	-0.09	0.0550*	0.1415	0.3925
t+1 to t+2	623	-0.06	-0.37	0.4405	0.4745	0.3745
t+2 to t+3	546	-0.42	-0.06	0.2500	0.4755	0.1845
t-2 to t	691	-0.07	-0.34	0.1910	0.0200**	0.0340**
t-2 to t+1	665	-5.11	-0.14	0.0050***	0.1225	0.3210
t-2 to t+2	628	-2.57	-0.51	0.0100***	0.0220**	0.0510*
t-2 to t+3	546	-1.33	-0.76	0.0090***	0.0350**	0.0145**
t-1 to t+1	659	-1.01	0.19	0.1810	0.1450	0.2665
t-1 to t+2	625	0.18	-0.43	0.4330	0.1880	0.0550*
t-1 to t+3	545	-0.43	-0.45	0.3145	0.1150	0.0850

p<0.1*; p<0.05<**; p<0.01***

The pattern for manufacturing cost efficiency (MCE) is slightly different from that for labor productivity and operating cycle time. It does not show a significant improvement in the *t*-2 to *t*-1 period based on the results from the WSR and Sign tests (Table 4.6). The size of the abnormal changes in MCE ranges from 0.7% (t-2 to t) to 2.57% (t-2 to t+2). Most of the periods after t-2 year show statistically significant improvement in MCE, with the exception of the t-2 to t+1 period, for which the WSR and Sign tests do not show evidence of a statistically significant abnormal change in MCE. Despite this, the general trend of decrease in MCE is obvious in many periods.

Table 4.7 Abnormal performance of ROA – for event years between 1990 and 2005

ROA (1990-2005)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	595	0.29	-0.20	0.2000	0.4720	0.3715
t-2 to t-1	594	0.95	0.67	0.0010***	0.0000***	0.0000***
t-1 to t	585	0.11	0.36	0.3650	0.1615	0.1235
t to t+1	563	0.29	0.30	0.1900	0.0700*	0.0320**
t+1 to t+2	543	-0.29	0.11	0.2245	0.2120	0.4320
t+2 to t+3	480	0.81	0.48	0.0405**	0.0130**	0.1090
t-2 to t	588	1.27	0.84	0.0060***	0.0005***	0.0010***
t-2 to t+1	563	1.46	0.95	0.0005***	0.0000***	0.0025***
t-2 to t+2	543	1.17	0.96	0.0075***	0.0010***	0.0100***
t-2 to t+3	480	2.45	1.57	0.0000***	0.0000***	0.0000***
t-1 to t+1	562	0.47	0.38	0.1295	0.0705*	0.0955*
t-1 to t+2	542	0.46	0.88	0.1645	0.0565*	0.0055***
t-1 to t+3	479	1.33	1.06	0.0120**	0.0035***	0.0180**

p<0.1*; p<0.05<**; p<0.01***

ISO 9000 certified firms experienced significant abnormal improvements in financial performance as well. The abnormal improvement of ROA is shown from the period *t*-2 to *t*-1, while no significant change was found from t-1 to t (Table 4.7). After certification, in the period t to t+1, certified firms also showed continuous improvement in ROA, but it was less significant (p = 0.032). However, the cumulative improvements appear to be very strong and consistent, based on a longer period (e.g., from *t*-2 to *t*+3). The p-values for most of the periods are less than 0.01. The magnitude of the long term change in ROA is also significant. From the starting period of *t*-2 (before ISO 9000 certification), the ROA increased 15.83%.

Table 4.8 Abnormal performance of ROS – for event years between 1990 and 2005

ROS (1990-2005)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	593	0.23	-0.04	0.2260	0.3985	0.4350
t-2 to t-1	590	0.89	0.55	0.0015***	0.0000***	0.0000***
t-1 to t	582	0.65	0.34	0.0250**	0.0095***	0.1145
t to t+1	560	0.03	0.11	0.4680	0.2495	0.3210
t+1 to t+2	538	0.07	-0.01	0.4375	0.2820	0.5000
t+2 to t+3	470	0.02	0.08	0.4870	0.1080	0.3060
t-2 to t	584	1.52	0.95	0.0000***	0.0000***	0.0000***
t-2 to t+1	560	1.19	1.07	0.0110**	0.0000***	0.0000***
t-2 to t+2	538	1.50	0.85	0.0015***	0.0005***	0.0000***
t-2 to t+3	471	2.35	1.50	0.0000***	0.0000***	0.0000***
t-1 to t+1	559	0.63	0.10	0.0865*	0.0640**	0.2495
t-1 to t+2	537	0.92	0.43	0.0720*	0.0660*	0.0235**
t-1 to t+3	470	1.29	1.02	0.0135**	0.0025***	0.0150**

p<0.1*; p<0.05<**; p<0.01***

The results of abnormal ROS (Table 4.8) show similar patterns to that of ROA. For the majority of the periods, the results show significant improvements in ROS (p<0.01). The cumulative improvement in long term performance is significant, although not in the period from t to t+1 (while ROA improved in the same period). The magnitude of abnormal change in ROS is similar to that of ROA, improving 2.35% from t-2 to t+3 (15.92% growth compared to that of non-certified firms). The results in Table 4.7 and 4.8 demonstrate that Hypothesis 4 is supported.

Table 4.9 Abnormal performance of sales growth – for event years between 1990 and 2005

Relative sales growth (1990-2005)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	427	2.79	0.99	0.1400	0.3450	0.2805
t-2 to t-1	461	2.69	0.59	0.0860*	0.1275	0.2125
t-1 to t	453	0.12	0.00	0.4790	0.3965	0.5000
t to t+1	434	-1.76	0.51	0.1965	0.3025	0.1115
t+1 to t+2	419	1.24	0.00	0.2615	0.2695	0.4395
t+2 to t+3	389	3.93	0.00	0.0310**	0.1425	0.3150
t-2 to t	453	2.97	-0.04	0.0245	0.1930	0.4625
t-2 to t+1	437	1.05	0.05	0.2825	0.2875	0.5000
t-2 to t+2	421	1.75	2.89	0.1460	0.0160**	0.0040***
t-2 to t+3	389	7.03	2.80	0.0000***	0.0010***	0.0215**
t-1 to t+1	434	-1.93	1.57	0.2575	0.3185	0.2070
t-1 to t+2	418	1.27	2.58	0.3185	0.0955*	0.0350**
t-1 to t+3	388	5.35	2.99	0.0400**	0.0495**	0.0240**

p<0.1*; p<0.05<**; p<0.01***

Table 4.9 shows the yearly change in sales growth of ISO 9000 certified firms relative to those of non-certified firms. It shows a different pattern from that of ROA and ROS results. The results for yearly sales growth shows that there was no significant difference in sales growth rate prior to obtaining certification and the companies did not experience immediate improvement that was similar to what occurred for ROA and ROS. However, there is a cumulative improvement in yearly sales growth in the long run. In the period t-2 to t+2 and t+3, the abnormal change in yearly sales growth reached 7.03%, which is a 25% growth from t-2 (the year right before implementation). The results suggest that the improvement in sales growth is insignificant after implementation, but becomes very significant one to two years after formal certification. Overall, hypothesis 5 was also supported.

Table 4.10 Abnormal performance of *Tobin's q* – for event years between 1990 and 2005

***Tobin's q* (1990-2005)**						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	574	0.0272	0.0201	0.3775	0.1725	0.2390
t-2 to t-1	627	-0.0523	-0.0170	0.2105	0.2555	0.2360
t-1 to t	606	-0.0413	-0.0181	0.2780	0.2520	0.3575
t to t+1	577	-0.0299	-0.0300	0.3440	0.2280	0.0570*
t+1 to t+2	534	-0.0158	0.0256	0.3875	0.4815	0.2580
t+2 to t+3	450	0.0129	0.0205	0.3910	0.3590	0.4070
t-2 to t	604	-0.5300	-0.0196	0.2000	0.3705	0.2195
t-2 to t+1	577	-0.0271	-0.0378	0.3425	0.1630	0.1395
t-2 to t+2	538	0.0293	-0.0058	0.3235	0.3090	0.4830
t-2 to t+3	465	-0.0502	-0.0533	0.2440	0.1785	0.2290
t-1 to t+1	567	0.0136	-0.0178	0.4225	0.3370	0.2510
t-1 to t+2	532	-0.0306	0.0023	0.3345	0.4045	0.5000
t-1 to t+3	460	-0.0297	0.0477	0.3570	0.4300	0.2420

p<0.1*; p<0.05<**; p<0.01***

The results for *Tobin's q* show no significant difference between ISO 9000 certified and control firms (Table 4.10). None of the other periods have shown improvement in *Tobin's q*. Moreover, there was a weakly significant negative result for the Sign test from *t* to *t*+1. Therefore Hypothesis 6 was rejected.

4.5 Discussion

This study investigates the impact of ISO 9000, a quality-oriented meta-standard, on operational and financial performance. Supporting the findings from similar event studies (Corbett et al., 2005; Naveh and Marcus, 2005), our results provide solid evidence of the relationship between the implementation of ISO 9000 and operating performance. The objective of this part of the research was to investigate the magnitude and timing of each operational and financial improvement. Our findings in this part show significant improvement in both time-based (operating cycle) and cost-based (labor

productivity and manufacturing cost efficiency) indicators. However, the improvement in financial performance such as sales growth, could also be due to the legitimacy acquired from the certification (instead of improvements in efficiency) according to institutional theory. Institutional theory suggests that late adopters receive fewer operational benefits from the institutionalized rules than the early adopters. Therefore, we should further investigate whether the institutionalization related to ISO 9000 adoption could have affected these relationships. We will further our investigation into this issue in Research Part Three.

Across all measures of performance, the performance improvement in certified firms usually started in t-2, which we believe is the period during which they implemented ISO 9000 and prepared for the third-party audit (Corbett et al., 2005). For all indicators, there was no statistically significant difference in performance from *t*-3 to *t*-2, which shows that there was no improvement before ISO 9000 implementation. In other words, we have ruled out the possibility that more efficient companies tend to adopt ISO 9000. This provides evidence which contradicts the prior assertion of reverse causality.

One of the major contributions of the current study is its demonstration of abnormal performance in labor productivity and operating cycles after ISO 9000 implementation, as such results were not reported in the previous research. We documented the timing and the magnitude of the impact of ISO 9000 certification on these operational indicators. The ISO 9000 certified firms obtained an additional operating income of 1.69 thousand US dollars (each employee per year) and a 5.28 day reduction in operating cycle right after they started the implementation of the standard. This improvement appeared to be very consistent and has important implications for both QM practitioners and researchers. We provided concrete evidence of the benefits of implementing a quality meta-standard.

Our results are generally consistent with the findings of Corbett et al.'s(2005) and Naveh and Marcus's (2005) study, except in the case of *Tobin's q*. Corbett et al. (2005) found that *Tobin's q* significantly improved after the adoption of ISO 9000, while we found no evidence of this. One possible explanation is that while early adopters (1990-1997) experienced abnormal performance in *Tobin's q*, the late adopters did not (1998-2005). This is possible, as ISO 9000 certification might follow the pattern of institutionalization and experience diminishing technical benefits. We will also further investigate this possibility in Research Part Three.

4.6 Conclusion of Research Part One

There is solid evidence that a causal relationship exists between ISO 9000 certification and the operating performance of the companies. Time-based efficiency, cost-based efficiency, sales growth rate and profitability are improved following certification. However, the implementation of ISO 9000 does not lead to increases in market valuation. Based these findings, we believe that the CEO and top executives might have been rewarded for the improved operating performance and the additional organizational legitimacy from ISO 9000 certification. We are going to investigate this issue in Research Part Two.

CHAPTER 5 RESEARCH PART TWO - ISO 9000 CERTIFICATION AND SENIOR EXECUTIVE COMPENSATION

5.1 CEO and Executive Compensation

In the compensation literature, the theoretical framework for the relationship between financial performance and executive compensation has mainly been developed following agency theory (Fernandez-Alles, Cuevas-Rodriguez and Valle-Cabrera, 2006). There has been spirited debate in the compensation literature about the question of whether top executives are worth their pay (Tosi et al., 2000). A number of studies investigated the relationship between CEO compensation and financial performance and found only a weak relationship between them (e.g., Ittner, Larcker and Rajan, 1997; Jensen and Murphy, 1990; Tosi and Gomez-Mejia, 1994). The landmark study by Jensen and Murphy (1990) revealed that the relationship between pay and performance is small, as there is only a $3.25 increase in CEO pay per $1000 change in shareholder wealth.

Apart from financial performance, there are many factors affecting senior executive compensation, such as firm size (Tosi et al., 2000), board control (Gomez-Mejia, Tosi and Hinkin, 1987; Tosi and Gomez-Mejia, 1989), industry type (McCann, Hinkin and GomezMejia 1992), social similarity between the CEO and the board of directors (Belliveau, III and Wade, 1996) and adoption of popular management practices (Staw and Epstein, 2000). Staw and Epstein (2000) suggested that the adoption of popular management techniques such as TQM enhances an executive's reputation, and the board of directors will reward senior executives regardless of the actual technical benefits of the management techniques. However, they focused on the correlation between the adoption of popular management techniques and short-term compensation, obtaining only two years' financial and compensation data.

In this section, we will investigate whether the adoption of ISO 9000 is one of the factors which affects the CEO's and other senior executives' compensation. If so, at what stage will the CEO and other top executives be rewarded? How much will they be rewarded and what forms (e.g., salary increase or bonuses) will the rewards take?

5.2 Agency Theory and Compensation

The theoretical framework between financial performance and executive compensation is mainly based on agency theory (Fernandez-Alles et al., 2006). Agency theory is directed at the ubiquitous agency relationship, in which the principal (shareholders or board of directors) delegates work to the agent (CEO and top executive) (Eisenhardt, 1989). Such a relationship is bounded by a contract (or agreement) between the principal and the agent that specifies the rights of the parties, ways of judging performance, and their payoffs (Fama and Jensen, 1983). There are two problems which will possibly occur in this relationship. First, the desires or goals of the principal and agent might be in conflict. Second, it is difficult or expensive for the principal to monitor what the agent is actually doing, as agents have better control over the company resources, and this issue is called information asymmetry (Eisenhardt, 1989). Therefore, it is important to set up the compensation policy as a reward mechanism or governance that aligns the interests of the agent with those of the principal (Fama and Jensen, 1983). As a result, according to agency theory, an agent's compensation will be dependent on organizational performance, and the level of information asymmetry.

However, there is no conclusive evidence of this relationship in empirical research (Tosi et al., 2000). In contrast, some empirical evidence shows that the compensation of a CEO is highly dependent on other factors, such as firm size, industry type and the

adoption of popular management practices (e.g., TQM) (Staw and Epstein, 2000). These factors are based on institutional needs, rather than economic considerations. Eisenhardt (1989) recommends using agency theory alongside complementary theories when explaining executive compensation. Accordingly, researchers approach this problem by integrating agency theory and institutional theory (e.g., Fernandez-Alles et al., 2006; Westphal and Zajac, 1994; Zajac and Westphal, 1995).

5.3 Institutional Theory and Compensation

Recently, researchers have turned to an institutional perspective on senior executive compensation. According to institutional theory, senior executives might be rewarded for the simple adoption of popular management techniques to enhance corporate reputation or personal management reputation, regardless of their actual operating performance (Staw and Epstein, 2000). CEOs and senior executives who implement ISO 9000 may be held in greater esteem by the board of directors and its compensation committee. Institutional theorists believe that this could be a rational move because, in some cases, institutional compliance with the business environment is more important than simply maximizing financial benefits (Scott, 1995). Securing more external legitimacy could materially benefit the companies, as this may facilitate access to certain valuable resources (Elsbach and Sutton, 1992). As a result, senior executives will be compensated for the increased legitimacy of their organization, as well as in recognition of their personal reputation.

In summary, agency theory and institutional theory consider two very different factors when determining executive compensation. Agency theory explains how such compensation is contingent on organizational performance, while institutional theory

accounts for how the compensation is contingent on the social context of the company (Eisenhardt, 1988).

5.4 Types of Compensation and Hypotheses

Before we develop our research hypotheses, we will first discuss the differences among different types of compensation. In most of the executive compensation studies, there are two classifications of compensation, namely, short-term versus long-term compensation (Balkin, Markman and Gomez-Mejia, 2000) and behavioral-based versus performance-based (Perry and Zenner, 2001; Stroh, Brett, Baumann and Reilly, 1996). Short-term compensation is also referred to cash compensation and includes the base salary and bonuses. Long-term compensation refers to stock options and other long-term incentive pay. Behavior-based compensation refers to base salary, while performance-based compensation refers to bonuses, stock options and other long-term incentives (Eisenhardt, 1989; Perry and Zenner, 2001; Stroh et al., 1996). In either classification, bonuses and stock options mainly serve as incentive alignments, and are highly related to organizational performance according to agency theory (Jensen and Murphy, 1990). If the adoption of ISO 9000 improves the operating performance of the company, performance-based compensation should be improved accordingly. Salary, on the other hand, is usually classified as behavior-based compensation (Stroh et al., 1996), and may be dependent on the board of directors' valuation of the top executives' management capabilities.

5.4.1 Base salary

Regarding the prediction and explanation of CEO salary, both agency theory and institutional theory could constitute the theoretical foundation of the relationship

between the adoption of ISO 9000 and senior executive compensation. According to the agency theory perspective, if principals (shareholder or board of directors) value the adoption of ISO 9000 positively, they will encourage senior executives to adopt it. Moreover, if the adoption of ISO 9000 actually improves the companies' performance during the implementation, the senior executives will be rewarded for the behavior that followed principals' interest (Eisenhardt, 1989).

Strictly speaking, following agency theory framework, CEOs and senior executives should be rewarded for their behavior in implementing ISO 9000, instead of the "certification" of ISO 9000. Meanwhile, according to institutional theory, even if there is no operational benefit derived from the adopting ISO 9000, senior executives could still be rewarded, as the certification has high legitimacy value for the organization. Since ISO 9000 is an institutionalized management practice that brings recognition from stakeholders, the adoption of ISO 9000 could secure some of the institutional resources that are critical for companies' survival, and thus improves the organizational legitimacy of the firm. The CEO and other top executives, who are responsible for the implementation of ISO 9000, are likely to be perceived as more capable and forward-looking leaders, and thus deserving of higher salaries (Staw and Epstein, 2000).

Apart from the agency and institutional theory framework, we may also use human resource capital theory to account for the salary increase. Higher job-related skills and management capabilities help executives to earn a salary premium (O'Reilly, Main and Crystal, 1988). Salary level is determined by human capital variables such as education, work experience, tenure in the company, and the term in the job (Hogan and McPheters, 1980). Passing an ISO 9000 audit is the recognition of the top executives' ability to have a proper quality system in place. The successful implementation of a popular

management practice might be highlighted in annual appraisals by the compensation committee. For these reasons, we argue that the adoption of ISO 9000 leads to higher base salaries for senior executives.

The implementation of ISO 9000 is not an individual effort by the CEO, but the collective effort of the senior management team. Accordingly, it would be expected that other senior executives are involved in the process. Therefore, the bonuses of top executives other than the CEO might also be increased as a result of ISO 9000 implementation. Thus, we propose the following hypotheses.

H1a: The adoption of a quality-oriented meta-standard leads to higher CEO's salaries.

H1b: The adoption of a quality-oriented meta-standard leads to higher salaries among senior executives (excluding CEO)

5.4.2 Bonuses

According to agency theory, given the difficulty in monitoring the performance of senior executives, shareholders tend to use financial motivation that aligns the interests of the agent (maximizing compensation) with the principal (maximizing company profit) (Jensen and Meckling, 1976). Based on compensation data in the 1970s, Jensen and Murphy (1990) found that CEOs receive $3.25 for every $1000 increase in shareholder wealth. Bonuses are defined as cash awards to senior executives during a specific short-term period, usually annually. Bonuses would be expected to account for much of the relationship between company performance and executive compensation; increases in financial performance should be associated with higher bonuses (Gerhart and Milkovich,

1990). If the adoption of ISO 9000 leads to higher operational and financial performance as we have shown, senior executives will accordingly be given a higher bonus. However, the actual relationship between ISO 9000 adoption and organizational performance is difficult for outsiders to assess. As a result, even if the adoption of ISO 9000 does not improve operational and financial performance substantially, senior executives will still be awarded with higher bonuses as long as the implementation of ISO 9000 is perceived as legitimate.

The conflict of interest between principals and agents is caused by the information asymmetry issue. As senior executives control company resources and are likely to know more about the operations than the principal, an information asymmetry exists, which allows agents to secure more personal benefits (Pratt and Zeckhauser, 1985). Thus, the principal would endeavor to counter this asymmetry and seek ways to prevent agents from the undue use of principals' resources (Tosi and Gomez-Mejia, 1989). Through internal and external audits, ISO 9000 certification assures that an appropriate quality management system is in place, providing additional monitoring of management, which should be welcomed by the board of directors. Therefore, based on the agency theory perspective, we argue that the performance based bonuses will increase after ISO 9000 certification.

H2a: The adoption of a quality-oriented meta-standard leads to a higher CEO's bonuses.

H2b: The adoption of a quality-oriented meta-standard leads to higher top executives' (excluding CEO) bonuses.

5.4.3 Stock options

The use of stock-based compensation for CEOs increased significantly throughout the 1990s (Bryan, Hwang and Lilien, 2000). Stock-based compensation includes stock options, stock appreciation rights, stock purchase plans, stock awards, performance share plans, phantom stock plans and other related long-term incentive programs (Tosi and Gomez-Mejia, 1989). Among all these stock-based compensations, stock options have emerged as a primary component of compensation for executives in U.S. listed companies (Murphy, 2003). Complementary to short-term compensation such as bonuses, stock options are tied to longer organizational goals over a period of three to five years (Balkin et al., 2000).

Many companies characterize stock options as devices for aligning the long-term interests of shareholders to those of executives, as well as rewarding executives for long-term success (Aboody and Kasznik, 2000; Bryan et al., 2000; DeFusco, Johnson and Zorn, 1990; Perry and Zenner, 2001; Westphal and Zajac, 1994; Yermack, 1997). The success of ISO 9000 requires long-term vision to quality improvement (Yeung, Lee and Chan, 2003). Quality management is not a short-term fix, but a long-term goal for an organization (Flynn et al., 1995). As a result, it is possible that boards do not only award senior executives with short-term bonuses for achievement in ISO 9000 implementation, but also attempt to align senior executives' interests with a long-term goal in quality management. Therefore, there is a possible link between the stock option granted to senior executives and the implementation of ISO 9000.

H3a: The adoption of a quality-oriented meta-standard leads to a higher value of the CEO's stock options.

H3b: The adoption of a quality-oriented meta-standard leads to a higher value of top executives' (excluding CEO) stock options.

5.5 Methodology

Since 1992, the Securities and Exchange Commission (SEC) has required companies to report detailed information on senior executives' compensation in their proxy statements. Publicly listed companies have to disclose the CEO's and another top 4 executives' salaries, bonuses, stock options, restricted stock, and long-term incentive plans in their DEF14A proxy statement. This proxy statement is publicly available through the Exchange Commission Electronic Data Gathering, Analysis and Retrieval (SEC EDGAR) system. It is also consolidated by Standard and Poor's in its "ExecuComp" database. ExecuComp is a reliable source of compensation data, and is commonly used in the executive compensation literature (e.g., Bryan et al., 2000; Murphy, 2003). The ExecuComp includes compensation data for companies from the S&P 500, S&P 400 mid-cap, and S&P 600 small-cap indices (Bryan et al., 2000; Murphy, 2003).

By combining the Compustat database and ExecuComp database, we found 756 manufacturing firms (SIC code 2000 to 3999). We collected three types of compensation data, (1) base salary, (2) bonuses, and (3) stock options. We selected stock options instead of other long-term compensation because the use of stock options has emerged as the primary component of compensation for executives in the U.S. listed companies (Murphy, 2003). Following previous studies in the executive compensation literature (Cheng, 2004; Sloan, 1993), we used a natural logarithmic transformation to control for skewness in bonuses and stock options granted, which is calculated based on Black-Scholes' formula (Black and Scholes, 1973). Black-Scholes' pricing model is commonly

used in the compensation literature as the proxy for the value of stock options (Black and Scholes, 1973; Merton, 1973), which serve as the determination of a stock option's estimated value at grant. Standard &Poor's modified the Black-Scholes' formula by using an "expected life" equal to 70% of the actual term, and setting the range of volatilities and dividend yields between the 5^{th} and the 95^{th} percentile (Standard and Poor's, 2007). The modified Black-Scholes formula has been used in number of recent studies (Murphy, 2003; Perry and Zenner, 2001). For CEOs' and top executives' salaries, we used the actual amount (in thousand US$) without any transformation.

Based on the similar event study methodology discussed in Chapter 3, we matched the sample and control firms based on two digit SIC code, total assets (33-300%), and 90-110% range of pre-certification CEO or senior executive salary (95-105% for bonuses and stock options). If we could not match a portfolio of control firms using two digit SIC codes, we then tried to match the sample firms using their one digit SIC code while other criteria remained unchanged. If we still could not find any matching control firms, we discarded the SIC code criteria, and simply tried to match the control firms based on total asset and pre-certification compensation criterion. For any sample firms for which we could not find any control firms, we discarded these observations. For the matching of bonuses and stock option compensation, we adopted 95-105% range limits because the differences between the actual values were reduced as we performed the natural logarithmic transformation. The transformation helped generate a larger number of well matched firms than our number sample firms (Table 5.1). There was no significant statistical difference in all the pre-certification compensation indicators between sample and control firms. Table 5.1 presents the descriptive statistics of the compensation data for sample and control firms.

Table 5.1 Descriptive statistics in pre-certification compensation (year t-2) of sample and control firms for each type of compensation

Type of compensation	N	Mean	Median	St. dev	Min	Max
ISO 9000 certified firms						
CEO salary[a]	186	514.598	465.289	231.177	0.000	1112.500
Top executive salary[a]	237	254.986	233.043	100.691	66.157	698.336
CEO bonuses[a]	143	570.660	435.250	469.586	33.000	3446.000
Top executive bonuses[a]	202	171.528	138.352	130.924	14.422	976.671
CEO Stock options[b]	145	2099.121	850.593	4086.499	38.074	33643.669
Top executive stock options[b]	196	632.851	264.360	1320.825	14.174	13153.507
Control firms						
CEO salary[a]	186	544.175	494.214	283.037	132.185	2851.503
Top executive salary[a]	237	254.283	231.740	100.535	59.543	686.516
CEO bonuses[a]	143	573.038	443.719	530.677	30.500	5000.000
Top executive bonuses[a]	202	165.152	134.539	122.547	13.867	995.647
CEO Stock options[b]	145	2092.846	850.119	4034.448	31.740	34400.793
Top executive stock options[b]	196	664.381	262.130	1499.159	15.887	14480.302

[a] In thousand US$

[b] Valued by S&P's Execucomp modified Black-Scholes formula

The descriptive statistics show that CEO's salary, on average, is about double that of the other four senior executives, while the CEO's bonuses is about three times their bonuses. The value of CEO stock options (calculated based on Black-Scholes' formula) is also about five times higher than the average of other top 4 executives. This data is consistent with findings in the literature demonstrating that a CEO receives much higher compensation than other top executives (Lazear and Rosen, 1981; O'Reilly et al., 1988).

5.6 Results

We tested the hypotheses and investigated whether the CEO's and senior executives' salaries, bonuses, and stock options significantly increased as a results of ISO 9000 adoption. The corresponding statistical results are shown in Tables 5.2 to 5.7. The column "From year" depicts the event periods for the change in compensation, while *t* is the year that the sample firms obtained the first ISO 9000 certification. "N" is the sample size for that event period, and "AP Mean" and "AP Median" show the abnormal changes in compensation. Although we matched the sample and control firms based on the performance in *t*-2 year, we also reported the *t*-3 to *t*-2 year data in the first row, to see if there was any systematic bias in the compensation level prior to the sample firms' decision to implement ISO 9000. The second row "*t*-2 to *t*-1" shows the abnormal changes in compensation of the sample firms immediately after implementing ISO 9000 (*t*-2 is assumed the year of ISO 9000 implementation, as mentioned before).

Table 5.2 Abnormal changes in CEO salary for event years between 1990 and 2005

CEO Salary in thousand US$						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	144	-8.0121	4.4063	0.1900	0.2485	0.3080
t-2 to t-1	186	-0.9314	0.7400	0.4535	0.3700	0.4125
t-1 to t	180	6.1532	3.4757	0.1505	0.1940	0.2750
t to t+1	171	16.4001	5.4858	0.0115**	0.0810*	0.1995
t+1 to t+2	172	20.1217	3.9698	0.0255**	0.0240**	0.0455**
t+2 to t+3	142	13.1819	2.5712	0.0730*	0.1225	0.1010
t-2 to t	183	11.4639	7.2105	0.1175	0.2605	0.1875
t-2 to t+1	176	20.4584	14.5720	0.0335**	0.0690*	0.2035
t-2 to t+2	170	35.2151	30.3122	0.0040***	0.0035***	0.0535*
t-2 to t+3	142	44.8045	18.3305	0.0015***	0.0035***	0.1375
t-1 to t+1	178	15.6143	12.3895	0.0590*	0.0390**	0.0770*
t-1 to t+2	170	34.1395	28.1259	0.0045***	0.0015***	0.0045***
t-1 to t+3	143	32.6863	30.2860	0.0115**	0.0045**	0.0035***
t to t+2	171	23.5287	11.5320	0.0330**	0.0335**	0.2450
t to t+3	144	26.9854	18.4765	0.0320**	0.0325**	0.0185**

p<0.1*; p<0.05<**; p<0.01***

In Table 5.2 the abnormal performance of CEO salary significantly improved right after the company officially obtained ISO 9000 registration in year “t”. This finding might imply that salary is not linked with performance, but rather to the perceived value of the management skills for becoming successfully accredited with ISO 9000. From the t to t+1, t to t+2 and t to t+3 periods, we can see that the abnormal salary gradually increases from US$16,400.1 (+3.1%) to US$26,985.4 (+5.3%). In the t-2 to t+3 period, the abnormal changes in salary is US$44,804.5, which represented an additional 8.7% salary increment compared with their non-certified competitors. These results provide solid evidence that CEOs are rewarded for the adoption of ISO 9000.

Table 5.3 Abnormal changes in top executive salary for event years between 1990 and 2005

Top Executive Salary in thousand US$ (Except CEO)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	197	2.7282	1.6224	0.1910	0.1885	0.1965
t-2 to t-1	236	0.8692	-0.4015	0.3810	0.4135	0.5000
t-1 to t	235	-3.8345	-2.7100	0.9175	0.9200	0.7430
t to t+1	227	7.6808	2.7256	0.0050***	0.0435**	0.0920*
t+1 to t+2	222	-0.5375	-2.7980	0.4320	0.4120	0.2300
t+2 to t+3	193	3.2844	-1.9553	0.2140	0.4470	0.3330
t-2 to t	235	-2.7104	-4.2109	0.2210	0.1885	0.1805
t-2 to t+1	232	1.7716	-1.8861	0.3255	0.3660	0.4740
t-2 to t+2	223	2.9397	-2.8825	0.2705	0.4770	0.2110
t-2 to t+3	193	3.7647	-5.0737	0.2530	0.3825	0.2825
t-1 to t+1	232	0.8124	-0.7748	0.4055	0.4180	0.4220
t-1 to t+2	223	2.7794	2.1959	0.2705	0.2810	0.3440
t-1 to t+3	193	3.0769	2.0907	0.2810	0.2705	0.3330
t to t+2	223	7.1451	2.6872	0.0540*	0.1315	0.2515
t to t+3	193	8.4145	6.7313	0.0560 *	0.1210	0.4430

p<0.1*; p<0.05<**; p<0.01***

Table 5.3 shows the results of abnormal changes in top executives' salary. There is significant difference between top executives' salary and CEO salary, in terms of both timing and magnitude. The results for top executives only show an abnormal salary increment in the t to t+1 period and, as a whole, it appears to be less significant in most periods. This pattern is not surprising, as top executives might include executives who are not responsible for ISO implementation (e.g., financial controller). The chief operating officer or some other related executives might be rewarded for the implementation effort but not others. Therefore the impact of some salary increases might have been diluted by the insignificant salary changes of other executives. Regarding the magnitude of abnormal salary, top executives received much less reward than the CEO, as expected. The salary differential between CEO and next level

executives is well documented in executive compensation literature by the tournament theory (Lazear and Rosen, 1981); the premium in CEO salary is the prize of the tournament of individual's ranking in an organization. After all testing, hypotheses 1a and 1b were supported.

Table 5.4 Abnormal changes in CEO Bonuses with event year in between 1990 to 2005

CEO Bonuses (ln)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	109	0.0845	-0.1016	0.6955	0.9455	0.9725
t-2 to t-1	139	0.1758	0.1598	0.1840	0.0025 ***	0.0005***
t-1 to t	140	0.1143	-0.0691	0.3290	0.3210	0.1545
t to t+1	135	-0.1711	0.0455	0.2140	0.2905	0.3655
t+1 to t+2	132	0.2280	0.0428	0.1730	0.1690	0.3315
t+2 to t+3	111	0.4599	-0.0003	0.0340 **	0.1250	0.5000
t-2 to t	134	0.3429	0.2399	0.0420 **	0.0015 ***	0.0100***
t-2 to t+1	135	0.1606	0.3402	0.2355	0.0060 ***	0.0010***
t-2 to t+2	127	0.3563	0.4372	0.0300 **	0.0000 ***	0.0005***
t-2 to t+3	111	0.6155	0.2896	0.0005 ***	0.0005 ***	0.0010***
t-1 to t+1	135	-0.1525	-0.0965	0.2800	0.2720	0.4315
t-1 to t+2	131	0.2038	0.1936	0.2255	0.2285	0.3635
t-1 to t+3	112	0.3311	0.2021	0.1095	0.1140	0.0780 *
t to t+2	126	0.0349	0.0402	0.4385	0.3725	0.4645
t to t+3	115	0.1261	0.0035	0.3470	0.4720	0.5000

p<0.1*; p<0.05<**; p<0.01***

According to Table 5.4, the abnormal CEO bonuses significantly increased in the t-2 to t-1 period, which means the CEO received additional bonuses right after firms started to implement ISO 9000. In Research Part One, we have found that ROA, ROS, labor productivity, operating cycle, manufacturing cost efficiency significantly improved in t-2 to t-1 period. This might explain why the bonuses, the performance-based compensation, also increased in the same period. The increase in abnormal CEO bonuses does not just

happen in a single year; the abnormal changes persist from t-2 to t+3 years, following similar patterns of change as the other abnormal operating performance measure (refer to the results of Chapter 4). Table 5.5 shows the results of top executives' (excluding CEO) abnormal change in bonuses, and the abnormal change also started from the t-2 to t-1 period. The changes in the other periods persisted from t-2 to t+3 year. Therefore, hypothesis 2a and 2b were supported.

Table 5.5 Abnormal changes in top executive bonuses for event years between 1990 and 2005

Top Executive Bonuses (ln)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	166	-0.0293	-0.1057	0.3825	0.1350	0.1965
t-2 to t-1	200	0.0799	0.0946	0.1965	0.0135**	0.0200**
t-1 to t	200	0.0254	0.0297	0.4090	0.3440	0.4435
t to t+1	199	-0.0905	0.0200	0.2170	0.4450	0.2855
t+1 to t+2	191	0.1333	0.0400	0.1655	0.2915	0.3860
t+2 to t+3	167	0.0786	-0.0286	0.3105	0.4380	0.3785
t-2 to t	197	0.5543	0.1512	0.2710	0.0150**	0.0165**
t-2 to t+1	194	-0.0084	0.1348	0.4685	0.0490**	0.0090***
t-2 to t+2	191	0.0586	0.1450	0.3215	0.0580*	0.0410*
t-2 to t+3	167	0.1347	0.1815	0.1545	0.0255**	0.0315**
t-1 to t+1	197	-0.0486	-0.0198	0.3490	0.4890	0.4435
t-1 to t+2	191	0.0367	0.0449	0.3990	0.2200	0.3320
t-1 to t+3	167	0.7493	0.0809	0.3095	0.0985*	0.1765
t to t+2	191	0.0603	-0.0508	0.3345	0.4545	0.3860
t to t+3	167	0.1040	-0.0004	0.2590	0.2895	0.5000

p<0.1*; p<0.05<**; p<0.01***

Table 5.6 Abnormal changes in CEO stock options for event years between 1990 and 2005

CEO Stock Options (natural logarithm of Black-Scholes value)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	117	-0.4649	-0.2854	0.0775	0.0200	0.0080
t-2 to t-1	141	0.5000	0.2619	0.0490 **	0.0140 **	0.0890 *
t-1 to t	141	-0.3257	-0.0344	0.1655	0.2570	0.4000
t to t+1	136	0.0001	-0.1093	0.5000	0.4685	0.2455
t+1 to t+2	128	-0.0180	0.0244	0.4775	0.4850	0.3945
t+2 to t+3	110	0.4594	0.3356	0.0965 *	0.0640 *	0.1955
t-2 to t	141	0.1382	0.4094	0.3000	0.0110 **	0.0020 ***
t-2 to t+1	137	-0.0981	0.2594	0.3640	0.2565	0.0860 *
t-2 to t+2	130	0.1568	0.2902	0.2800	0.0825 *	0.0480 **
t-2 to t+3	110	0.2438	0.3942	0.2120	0.0285 **	0.0030 ***
t-1 to t+1	137	-0.3304	0.1018	0.1980	0.2435	0.2740
t-1 to t+2	132	-0.4547	0.0049	0.1165	0.2035	0.5000
t-1 to t+3	109	0.0039	0.4127	0.4960	0.3320	0.0625 *
t to t+2	132	0.0644	-0.0243	0.4330	0.4605	0.5000
t to t+3	110	0.2591	-0.1163	0.2480	0.4040	0.2525

p<0.1*; p<0.05<**; p<0.01***

From Table 5.6, we also found that the abnormal changes in CEO stock options appeared in the t-2 to t-1 period. The abnormal changes are persistent with the CEOs continuously being rewarded with more stock options after the adoption of ISO 9000. The abnormal increment in stock option award did not appear in the t-3 to t-2 period, which means it was not because more stock option awarding firms tended to obtain ISO 9000 certification. As the result of abnormal stock options showing a similar pattern to that of abnormal bonuses, it implies that both long-term and short-term performance based compensation react in the same way towards the adoption of ISO 9000. For the results of the abnormal changes of top executive stock options, the pattern was similar to the CEOs' results. From table 5.7, the significant abnormal changes in top executives' stock

options started to appear in the t-2 to t-1 period. Therefore, hypothesis 3a and hypothesis 3b were supported.

Table 5.7 Abnormal changes in top executive stock options for event years between 1990 and 2005

Top Executives Stock Options (natural logarithm of Black-Scholes value)						
From year	N	AP mean	AP Median	p-value (t-test)	p-value (WSR test)	p-value (Sign test)
t-3 to t-2	155	0.1076	-0.1397	0.3040	0.2585	0.1305
t-2 to t-1	192	0.2192	0.1577	0.0765 *	0.0165 **	0.0180 **
t-1 to t	195	0.0420	0.0416	0.4150	0.4020	0.2370
t to t+1	191	-0.1239	-0.0817	0.2860	0.2610	0.2345
t+1 to t+2	181	0.0644	-0.0162	0.3675	0.4705	0.3830
t+2 to t+3	151	0.3159	0.1894	0.0335 **	0.0540 *	0.0520 *
t-2 to t	192	0.1887	0.3187	0.0835 *	0.0015 ***	0.0000 ***
t-2 to t+1	191	-0.0085	0.2404	0.4810	0.2260	0.0965
t-2 to t+2	180	0.0777	0.2256	0.3165	0.0595 *	0.0070 ***
t-2 to t+3	151	0.2438	0.2818	0.0380 **	0.0235 **	0.0520 *
t-1 to t+1	191	-0.0687	-0.0033	0.3785	0.4770	0.5000
t-1 to t+2	181	-0.0459	-0.0658	0.4160	0.3775	0.4410
t-1 to t+3	153	0.0184	0.0285	0.4665	0.3990	0.4360
t to t+2	181	-0.0895	0.0116	0.3385	0.4445	0.4410
t to t+3	153	0.0879	-0.0997	0.3355	0.4055	0.2590

p<0.1*; p<0.05<**; p<0.01***

5.7 Discussion

This is the first study that reveals the relationship between the adoption of a meta-standard and senior executive compensation. We documented solid evidence of the relationship between the adoption of ISO 9000 and all three types of major executive compensation. The abnormal changes in salary appeared right after they obtained the ISO 9000 certification (passing the third party audit), and the abnormal changes in bonuses and stock options clearly followed the patterns of abnormal operating performance in Research Part One.

The abnormal changes in salary occured right after ISO 9000 certification, instead of ISO 9000 implementation. Since salary is adjusted only after formal certification, instead of before certification when operational performance is significantly improved, it is likely that the adjustment is based on institutional considerations. By bringing the organization to ISO 9000 certification, senior management of the firm is likely to enhance their credibility. Whether or not business certification really leads to improvements in organizational efficiency, senior managers are probably being rewarded for bringing the organization an accreditation, leading to higher corporate esteem. In addition, by successfully attaining ISO 9000 certification, the professionalism and accountability of senior management is demonstrated to the stakeholders, the public and the board of directors (Staw and Epstein, 2000).

From a human capital perspective, organizations are willing to provide more competitive salaries for both socially legitimate leaders and for their management capability (Zajac and Westphal, 1995). Senior executives are awarded for their managerial skills in bringing accreditation to the organization. From either an institutional or human resource perspective, the successful implementation of ISO 9000 produces internal and external legitimacy for the executives. The CEO and other top executives, who are responsible for the implementation of ISO 9000, are likely to be perceived as more capable and forward-looking leaders, and thus deserving of higher salaries (Staw and Epstein, 2000). However, such legitimacy can only obtained after successfully passing the third party audit – the formal accreditation.

Although salary is adjusted only after formal ISO 9000 certification, additional bonuses and stock options are given right after ISO 9000 implementation (pre-certification

period). One of the possible explanations is that bonuses and stock options, which are known as performance-based compensation, are given as a result of improved operational and financial performance. As shown in the previous chapter, ISO 9000 implementation (taken as the t-2 to t period), but not certification (taken as year t), is significant related to operational and financial performance. Even if organizations have not yet been formally accredited with ISO 9000, the operational and financial measures improve and, thus, the performance-based compensation of senior executives is also enhanced.

These findings suggest that various types of compensation react differently towards the same management event. Our study showed that, with the same management event, the timing and magnitude could be very different between salary and bonuses, and we strongly suggested that future research should examine these two indicators independently.

The above results imply that the adoption of ISO 9000 could lead to higher personal benefits for senior executives. Consistent with the predictions of institutional theory and agency theory, both behavioral- and performance-based compensation were increased during the implementation and after the accreditation of ISO 9000. These findings provide an additional explanation for the widespread dissemination of ISO 9000 around the world, as the adoption of ISO 9000 could become a means for senior executives to obtain higher compensation. Subject to further research, it is possible that the adoption of other management practices, such as ISO 14000, could also bring additional personal benefits to senior executives. However, the relationship among the adoption of management practice, actual operational performance, and senior executive compensation are rarely investigated in the literature. In Research Part Three, we will

further investigate whether the institutionalization of ISO 9000 would moderate these relationships.

5.7 Conclusion of Research Part Two

All three hypotheses proposed in this section were supported. ISO 9000 adoption leads to increases in salary, bonuses and stock options, although their timing is different. Notably, salary is adjusted right after certification, while bonuses and stock options are increased before certification (but after implementation). We argue that salary is increased because of the legitimacy of ISO 9000 accreditation. Accordingly, senior executives are held in higher regard by their firm. Nevertheless, ISO 9000 implementation also leads to higher operational and financial performance. As a result, senior executives are also rewarded for their efforts in improving the efficiency of their organization.

However, based on institutional theory, early adopters of ISO 9000 might experienced more technical benefits then the late adopters, while the late adopters might gain higher symbolic value of ISO 9000 than early adopters. Therefore, it is important to further investigate whether the time of adoption would have moderated the relationships between ISO 9000 adoption, operating performance and senior executive compensation.

CHAPTER 6 RESEARCH PART THREE – THE DECOUPLING OF TECHNICAL EFFICIENCY AND INSTITUTIONAL BENEFITS

In research Part One and Part Two, we investigated the impact of ISO 9000 on company performance and senior executive compensation. Both parts provided concrete evidence that the adoption of ISO 9000 leads to "abnormal improvement" in operational performance, financial performance and senior executive compensation. In this chapter, we attempt to investigate how institutionalization of ISO 9000 would have affected the pattern of changes in abnormal operating performance and executive compensation in different time periods. We investigate the possible decoupling of the technical benefits and the legitimacy value of ISO 9000 and study how this problem might become more serious over time. Will late adopters obtain fewer technical benefits as ISO 9000 is increasingly institutionalized? At the same time, is it also possible that late adopters actually enjoy better sales performance, due to the institutionalization of ISO 9000 (even if they do not have higher operational efficiency). More importantly, if late adopters obtain fewer technical benefits, as predicted by institutional theory, will the adoption of the standard still lead to higher CEO compensation?

6.1 Institutional Decoupling

The rapid diffusion of the ISO 9000 transformed it into an institutionalization process in the global business environment, and it has become an example of institutionalized rules (Guler et al., 2002). According to institutional theory, it is feasible that organizations can invoke the socially legitimate goals of ISO 9000 without being dedicated to its principles (Westphal et al., 1997). Institutional theory describes a process whereby the

symbolic value of an administrative innovation ultimately distorts, or even supplants, its technical efficiency (DiMaggio and Powell, 1983; Zbaracki, 1998). In order to survive, companies conform to what is socially defined as appropriate and efficient, largely disregarding the actual technical benefits on organizational performance (Tolbert and Zucker, 1983). Academics have warned of potential conflict between institutional demands and efficiency considerations (Meyer and Rowan, 1977; Walgenbach, 2001; Westphal and Zajac, 1998, 2001). They speculate that there is 'loose decoupling' between management practices for internal efficiency and those institutional requirements stipulated by ISO 9000 (Fligstein, 1985; Guler et al., 2002; Tolbert and Zucker, 1983). We define this phenomenon as "institutional decoupling" – the potential conflict between institutional demands and efficiency considerations.

The potential conflict between the demands of institutional environment and efficiency of a management practice have been investigated theoretically and empirically in the literature (Beck and Walgenbach, 2005). In the literature of institutional theory, earlier studies investigating institutional decoupling have been primarily qualitative (Edelman, 1992; Meyer and Rowan, 1977). Meyer and Rowan's (1977) research education institutions, which described the decoupling between the adoption of government standards and efficient procedures in daily operations, have provided valuable insights in theorizing institutional decoupling. However, these earlier works did not investigate the timing and magnitude of an institutional decoupling, and thus had only limited implications for predicting and explaining the decoupling process (Westphal and Zajac, 2001).

To reveal the timing and magnitude of the decoupling process for institutionalized management practices, some researchers have carried out longitudinal analyses based

on objective financial data (Tolbert and Zucker, 1983; Westphal et al., 1997; Westphal and Zajac, 1998, 2001; Zajac and Westphal, 2004). Zajac and Westphal published several related empirical works on the institutional decoupling of various management practices, including TQM (Westphal et al., 1997), long-term incentive plans (Westphal and Zajac, 1994), and stock option repurchase plans (Westphal and Zajac, 2001; Zajac and Westphal, 2004). In their most recent study, Zajac and Westphal (2004) documented the institutional decoupling between the adoption and actual implementation of stock repurchase programs. They found that the financial market reaction towards stock repurchase plans changes over time. Late adopters can obtain abnormal stock returns simply by declaring the adoption of stock repurchase plan, without actually exercising it. As more firms have adopted stock repurchase programs, such programs are perceived as legitimate management practice and become institutionalized over time. Nevertheless, there is growing evidence of a decoupling between adoption and actual implementation (Zajac and Westphal, 2004).

The biggest difference between ISO certification and other popular management practices, such as TQM and stock repurchase plans, is the high level of documentation required. ISO 9000 requires many organizational records of operational processes for auditing, in order to make sure that the intended level of quality is being delivered to the customers (Terziovski et al., 2003). The certification of ISO 9000 is subjected to satisfactory results from the auditing process. A certification issued by a certifiying body, an independent third party, shows that the quality system of the certified firm is in line with the requirements of the standards. This should serve as a verification of a company's ability to produce quality goods (Walgenbach, 2001). The aim of this auditing mechanism is to avoid a decoupling between adoption and actual implementation. However, ISO auditors might pay more attention to whether the

client's quality system is effectively documented and less to the technical outcomes of the system (Williamson, Rogerson and Vella, 1996). Therefore, a decoupling between adoption and effective implementation may still occur.

In fact, some studies reveal that there is large gap between adoption and actual implementation of ISO 9000. Boiral (2003) found that the top management of ISO 9000 certified companies are usually "ceremonial integrators", whose goal is to project rational and institutionally approved images associated with the adoption of ISO 9000. Boiral (2003) also found that the majority of front-line staff members were dissident, believing that ISO 9000 implementation created an iron cage, and were unwilling to implement it. Such conflict between top management and front-line staff makes the actual implementation of ISO 9000 difficult. We believe that such a phenomenon constitutes an institutional decoupling, whereby companies symbolically demonstrate commitment to a quality management system by obtaining ISO 9000 certification without actually implementing it. In this section, we will investigate whether ISO 9000 certified companies and their top executives reap financial benefits (in terms of sales and executive compensation) from its symbolic value, regardless of their companies' operating performance.

6.2 Time of Adoption

The process of institutionalization of a certain management practice leads to a positive image and accompanying symbolic value of the practice (DiMaggio and Powell, 1983). The symbolic value can accumulate over time, given the decoupling between "ceremonial adoption" and "actual implementation" (Westphal and Zajac, 2001; Zajac and Westphal, 2004). In the U.S., the Department of Defense and Energy, the Food and Drug Administration, the Federal Aviation Administration, and NASA have required

their suppliers to adopt ISO 9000 since the mid 1990s (Anderson et al., 1999; Guler et al., 2002). As ISO 9000 adoption shifted from a voluntary practice to compulsory compliance in the mid-1990s, it has become a taken-for-granted management practice (Guler et al., 2002). Since the symbolic value of ISO 9000 appears to be becoming increasingly important, a decoupling between superficial adoption and actual implementation might occur.

The time of adoption of ISO 9000 might be positively related to the decoupling process. According to institutional theory, early adopters are driven by the technical merits of a management practice, while the late adopters are driven by legitimacy or symbolic value (Meyer and Rowan, 1977; Scott, 1995; Westphal et al., 1997). The early adopters can therefore obtain more technical merit than the late adopters. This is because they actively recognize the improvement opportunities themselves, instead of passively responding to isomorphic pressures from stakeholders. Therefore, the improvement in early adopters' operational performance should be stronger than that of late adopters. According to institutional theory, the implementation of ISO 9000 for late adopters is driven by the symbolic value instead of its technical benefits for quality management and efficiency. The shift in focus in the adoption of the ISO 9000 results in extra documentation work and the promotion of bureaucracy (Beck and Walgenbach, 2003). Accordingly, we propose our first hypothesis.

H1: Early adopters of ISO 9000 obtain higher operational performance than late adopters.

From an economic perspective, operational performance is generally linked with financial performance. The impact of ISO 9000 on financial measures, such as ROA

and ROS, should follow similar patterns to operational performance. The improvement in operational efficiency will reduce waste and lead to more effective use of fixed assets (such as machinery and production lines). Accordingly, we hypothesize that early adopters of ISO 9000 will also experience higher ROA and ROS than late adopters.

H2: Early adopters of ISO 9000 will obtain higher ROA and ROS than those of late adopters.

Following the argumentss in Research Part One of this study, and based on institutional theory, the financial market should respond positively to ISO 9000 certification. If true, ISO 9000 certified companies should have a higher valuation, whether or not there are technical benefits attached to these practices. ISO 9000 certified companies will be perceived as having better management systems, compared with non-certified firms. The symbolic value of ISO 9000 will be higher, as the standard becomes more institutionalized. Therefore, the market valuation of the firm should be higher in the long-run.

H3: Late adopters of ISO 9000 will have a higher Tobin's q than early adopters.

To test whether technical benefits are decoupled from marketing benefits, we also investigate the abnormal sales performance of early and late adopters of ISO 9000. According to institutional theory, late adopters can reap benefits by simply declaring the adoption of a management practice without actually implementing it (Zajac and Westphal, 2004). Therefore, we are also interested in the institutional benefits that ISO 9000 certified companies can gain once they start to adopt the standard (which we defined as two years before formal certification). It is easier for top executives to

announce their intention to adopt ISO 9000 than to actually implement it effectively (Zbaracki, 1998). By annoucing the future adoption of ISO 9000, companies may gain certain institutional approval from their customers. Institutional approval results in abnormal sales performance (even if the firms have not yet obtained the ISO 9000 certification), regardless of the actual effectiveness of the implementation. As ISO 9000 is increasingly institutionalized and more and more customers require the adoption of this certificate, late adopters could gain more sales by fulfilling certification requirement than the early adopters. In other words, the certified companies might gain more sales not because of higher operational efficiency, but because of their compliance with the ISO 9000 standard.

H4: Late adopters of ISO 9000 will obtain higher abnormal sales performance than early adopters.

Senior executives are not only rewarded for better company performance as a result of their efforts, but thy are also rewarded for the legitimacy they seek (Staw and Epstein, 2000; Zajac and Westphal, 1995). Staw and Epstein (2000) found that higher pay was given to CEOs when their companies were associated with popular management techniques, regardless of the actual effectiveness of those techniques. According to institutional theory, these management techniques are popular because they are perceived as an indicator of management's professionalism. The CEOs who adopted popular management practices may be held in higher regard and considered more advanced or forward-looking leaders by the board of directors or compensation committee. They are thus worth more than those still using yesterday's solutions (Staw and Epstein, 2000).

If the majority of the companies in an industry adopt similar reward practices, companies will follow the fashion of social convention when rewarding their senior executives for the adoption of ISO 9000 (Fernandez-Alles et al., 2006). The social network among companies promotes the diffusion of such practices from one to another (Uzzi, 1997). The adoption of ISO 9000 will then be perceived as a valuable vehicle for the executive to request (or for the board of director to justify) an increase in the CEOs' salary, bonuses, and stock options. As the symbolic value of ISO 9000 accumulates over time through the process of institutionalization, the decoupling between operational performance and executive compensation becomes significant for late adopters.

H5: Late adopters' CEOs receive higher compensation than early adopters' CEOs.

6.3 Methodology

To test whether the time of adoption affects the abnormal performance achieved by ISO 9000 certified firms, we adopted simple regression analysis, with the year of certification as an independent variable. To further compare the abnormal performance of early and late adopters, we classified the firms as early and late adopters, using the median, Year 1997, as the cut off point. Companies which adopted ISO 9000 between 1990 and 1997 (8 years) were defined as early adopters, while companies adopting ISO 9000 between 1998 and 2005 (8 years) were classified as late adopters. Both parametric and non-parametric tests were used to analyze the difference in abnormal performance between early and late adopters. This is because some indicators follow a normal distribution, regarding CEO bonuses and CEO stock options, while others indicators do not.

As discussed in the Chapter 5, there are three main types of compensation for senior executives, namely, base salary, bonuses, and stock options. According to the results from the Research Part Two of this study, the timing of abnormal changes in CEOs' base salaries is different from that of bonuses and stock options – the performance-based indicators. Abnormal CEO base salary appears right after ISO 9000 certification, while abnormal bonuses and stock options appear prior to certification. Therefore, our analyses of executive compensations are based on the time periods in which abnormal changes in compensation appear to be more significant (i.e., t to t+2 for base salary, t-2 to t for bonuses and stock options). For other operational indicators, we focus on three different event window periods, which are t-2 to t (pre-certification period), t to t+2 (post-certification period) and t-2 to t+2 (overall period).

6.4 Results

Table 6.2 shows the results of the regression analysis of the abnormal performance of each indicator in the three different event windows, namely the pre-certification period (t-2 to t), the post-certification period (t to t+2), and the overall period (t-2 to t+2). Firstly, regarding the operational performance indicators (labor productivity, operating cycle and manufacturing cost efficiency), we notice that abnormal labor productivity (p = 0.033) and operating cycle (p = 0.0045) drops significantly during the post-certification period. The result shows that the abnormal performance of labor productivity is decreased by US$223 per employee every year. This means that early adopters of ISO 9000 experienced significantly higher abnormal labor productivity than late adopters. Turning to the operating cycle, the results are consistent with labor productivity. The abnormal operating cycle increases by 2.339 days every year on average, implying that late adopters require more time to complete the operating cycle. Since the regression analysis of manufacturing cost efficiency does not show a similar

downward trend compared with the other two operational performance indicators, further statistical tests were carried out on the difference in abnormal performance between early adopters (1990 to 1997) and late adopters (1998 to 2005).

Independent sample t-tests were used to analyze whether the means of the abnormal performance were different between early and late adopters, while the non-parametric Mann-Whitney U test was used to analyze the equality of the medians. The Mann-Whitney U test was used because it does not impose the assumption of normal distribution. The Mann-Whitney U test provided more reliable results for this study as our data does not meet the assumption of normal distribution in many periods.

Table 6.3a shows the results for the pre-certification period and post-certification period, while Table 6.3b shows the results for the overall period. We noticed that, in the post-certification period, early adopters' labor productivity, operating cycle, and manufacturing cost efficiency performed significantly better than those of the late adopters. As for labor productivity, the late adopters experienced negative abnormal performance, which means that the operating income delivered by each employee was on average US$4,632.5 less than non-certified competitors in the post-certification period (Table 6.3a). Compared to non-certified companies, the late adopters also had 11.87 days longer operating cycle, and have 0.61 percent decrease in manufacturing cost efficiency (i.e. the cost of manufacturing is higher). These results show that the abnormal performances of the late adopters are actually negative, demonstrating they are not only less efficient than the early adopters but actually less efficient than non-certified firms.

Manufacturing cost efficiency in the pre-certification (t-2 to t) period, showed a significant positive improvement among the late adopters (Table 6.3a). This finding contradicts our prediction that late adopters would obtain less technical benefit. One of the possible reasons is that such companies enjoy greater economies of scale, as they have significantly improved their sales volume. In fact, we found that the pre-certification period's abnormal sales performance was significantly higher among late adopters. These findings provide solid evidence that early adopters of ISO 9000 have higher abnormal operational efficiency than late adopters, except for pre-certification period manufacturing cost efficiency. Therefore, Hypothesis 1, that early adopters of ISO 9000 would obtain higher operational performance than late adopters, was only partially supported. We will discuss this further in the next section.

Regarding the regression analysis for ROA results, the significant drop in abnormal ROA over time appeared in both the post-certification period (p = 0.0995) and the overall period (p = 0.005). The post-certification period's and overall period's abnormal ROA dropped by 0.2% and 0.4% each year, respectively (Table 6.2). From the independent samples t-tests, we also found a significant difference in abnormal ROA between early and late adopters in the post-certification period (p = 0.0505) and the overall period (p = 0.0015). In the post-certification period, the mean abnormal ROA of early adopters was +0.0049 which is significantly different from the mean abnormal ROA of late adopters (-0.0091). This difference was more significant in the overall period, as the mean of early adopters' abnormal ROA was +0.0243, while the mean of late adopters' abnormal ROA was -0.0042.

The results for ROS follow a similar pattern to those for manufacturing cost efficiency. In the regression analysis, we found that ROS did not drop over time in the pre-

certification, the post-certification, nor the overall period. However, the results of the independent samples t-tests showed that the post-certification early adopters' abnormal performance of ROS is significantly better than that of late adopters, which might imply that the late adopters lose the momentum of improvement immediately after having obtained the certification. Compared with the results for manufacturing cost efficiency, ROS also shows significant improvement for late adopters in the pre-certification period (Mann-Whitney U test: $p = 0.0330$). This contradictory finding might also be due to the abnormal improvement in sales in the pre-certification period. Based on the results for ROA and ROS, Hypothesis 2 was partially supported – early adopters of ISO 9000 obtained higher ROA and but not ROS.

Turning to the results of regression analysis for *Tobin's q*, we found significant drops in *Tobin's q* over time in the post-certification period ($p = 0.0115$) and the overall period ($p = 0.0940$), and the same result was obtained from the independent samples t-tests. This finding is contradictory to our hypothesis. For the post-certification period, the mean abnormal *Tobin's q* of early adopters' was +0.0944, while that of the late adopters' was -0.2940 ($p = 0.004$). For the overall period, the mean abnormal *Tobin's q* of early adopters is +0.117, while that of the late adopters was -0.062 ($p = 0.0895$). Therefore Hypothesis 3 is rejected. Actually, the early adopters of ISO 9000 had a higher abnormal market valuation than that of the late adopters. In fact, the change in *Tobin's q* was consistent with that of ROA – early adopters perform significantly better.

From an economic perspective, the deteriorating abnormal operational performance should lead to lower sales and market share. Therefore, it is logical to predict that "abnormal sales growth" decreases with operating performance. However, in contrast to deteriorating ROA and operational measures for the late adopters, we do not find

deteriorating abnormal sales growth for the late adopters of ISO 9000. As shown in Table 6.2, we find that the abnormal sales shows a significant positive trend in the post-certification period (p = 0.0910). This finding can be explained by institutional theory. By obtaining ISO 9000 certification, the adopters are complying with the institutional expectations of the market and gaining market access to domestic and international trades, regardless of the technical benefits derived from its implementation. Abnormal sales performance was observed only in the post-certification periods. Overall, such findings are consistent with our argument – as ISO 9000 is increasingly institutionalized over time, and late adopters actually have higher abnormal sales performance compared with the early adopters.

The independent samples t-test for abnormal sales shows that late adopters enjoy higher abnormal sales performance not only in the post-certification period, but also in the pre-certification period. We found that the mean abnormal sales for early adopters was US$-13.5 million, while that of the late adopters was US$+114.7 million. Both the independent samples t-tests and Mann-Whitney U test (Table 6.3a) show that the difference in the post-certification period is highly significant. This finding also helps explain why manufacturing cost efficiency and ROS are significantly higher in late adopters – sales is the denominator for both indicators. The abnormal sales increase over time when the company is informationally linked with the adoption of ISO 9000 (either in the implementation stage or after formal certification). Thus, Hypothesis 4 is supported - late adopters of ISO 9000 will obtain higher abnormal sales benefit than early adopters.

As regards CEO compensation, our regression analysis shows that all three types of compensations significantly increase over time. From the results of Research Part Two

of this study, we found that the abnormal change in CEO salary appears after the companies have been certified (the post-certification period). The increase in abnormal CEO salary is consistent with previous results, as the increase in abnormal CEO salary also appeared in the post-certification period (Table 6.2). The later the companies received the certification, the higher the increase in the abnormal CEO salary. The results in Table 6.2 show that the abnormal CEO salary grows by $8,223 annually, on average.

Despite the decline in abnormal operational and financial performances, abnormal CEO bonuses and stock options increased every year. The regression analysis in Table 6.2 (the actual values are transformed by natural logarithm in our statistical analysis), indicates that the abnormal CEO bonuses in the pre-certification period ($p = 0.0720$) significantly increases over time. Meanwhile, the results of the independent samples t-tests of the pre-certification period also show that the late adopters' CEOs receive much higher bonuses ($p = 0.0405$) and stock options (0.0500) as a result of ISO 9000 implementation. The mean abnormal CEO bonuses of early adopters are US$ 58,625, while the value of that of late adopters is US$200,440, which is 342% higher. Additionally, the mean abnormal value of CEO stock options is US$ 151,785.4 and US$ 445,018.6 for early and late adopters respectively, representing a difference of 293%. These findings support Hypothesis 5 that the CEOs of late adopters of ISO 9000 gain higher abnormal compensation, compared with early adopters.

Table 6.2 The results of regression analysis of the abnormal performance of each indicator over time (in terms of year)

	Pre-certification period (t-2 to t period)				Post-certification period (t to t+2 period)				Overall period (t-2 to t+2 period)			
Abnormal performance	**N**	**P value**	**b**	**R^2**	**N**	**P**	**b**	**R^2**	**N**	**p**	**b**	**R^2**
Labor productivity	572	0.1320	-0.3690	0.0020	523	0.0330 **	-0.2230	0.0060	530	0.0445 **	-0.8330	0.0050
Operating Cycle	683	0.2240	-0.7350	0.0010	615	0.0045 ***	2.3390	0.0110	618	0.1185	0.9140	0.0020
Manufacturing Cost Efficiency	654	0.1365	-0.0030	0.0020	594	0.2490	0.0020	0.0020	601	0.4795	-0.0020	0.0000
ROA	588	0.3615	0.0000	0.0000	539	0.0995 *	-0.0020	0.0030	543	0.0050 ***	-0.0040	0.0120
ROS	584	0.4755	0.0000	0.0000	531	0.5620	-0.0010	0.0010	538	0.2710	-0.0010	0.0000
Tobin's Q	604	0.3450	0.0070	0.0000	537	0.0115 **	-0.0500	0.0100	538	0.0940 *	-0.0250	0.0030
Sales	683	0.3075	6.4170	0.0000	615	0.0910 *	20.0750	0.0030	622	0.3095	9.7040	0.0000
CEO salary	183	0.3310	-1.3250	0.0010	161	0.0880 *	8.2230	0.0130	169	0.2210	3.3400	0.0040
CEO bonuses[a]	134	0.0720 *	0.0940	0.0160	126	0.2080	0.0970	0.0130	127	0.1070	0.1040	0.0210
CEO stock options[a]	141	0.0445 **	0.1420	0.0210	132	0.2465	-0.0880	0.0040	130	0.3480	0.0350	0.0010

p<0.1*; p<0.05<**; p<0.01***

[a]The value of CEO bonuses and CEO stock option were transformed with natural logarithm

Table 6.3a The independent samples t-tests and Mann-Whitney U test for differences between early and late adopters of ISO 9000

	Pre-certification period (t-2 to t period)						**Post-certification period (t to t+2 period)**					
	Early adopters		Late adopters		Independent sample t-test [#]	Mann-Whitney U test	Early adopters		Late adopters		Independent sample t-test [#]	Mann-Whitney U test
Abnormal performance	**N**	**mean**	**N**	**mean**	**P value. (1-tiled)**	**P value. (1-tiled)**	**N**	**mean**	**N**	**mean**	**P value. (1-tailed)**	**P value. (1-tailed)**
Labor productivity	295	3.0343	277	2.5182	0.4155	0.3720	291	2.4840	232	-4.6325	0.0060 ***	0.0025 ***
Operating Cycle	324	-4.2328	359	-9.3101	0.2315	0.1545	322	-4.9614	293	11.8701	0.0030 ***	0.0065 ***
Manufacturing Cost Efficiency	325	-0.0130	329	-0.0217	0.2525	0.0080 ***	318	-0.0120	277	0.0061	0.0745 *	0.0030 ***
ROA	306	0.0165	282	0.0086	0.2135	0.2470	301	0.0049	238	-0.0091	0.0505 *	0.0235 **
ROS	303	0.0109	281	0.0198	0.1565	0.0330 **	298	0.0057	234	-0.0116	0.0380 **	0.0080 ***
Tobin's Q	286	-0.0774	318	0.0265	0.1965	0.3885	282	0.0944	255	-0.2940	0.0040 ***	0.0010 ***
Sales	323	-13.5232	360	114.7145	0.0915 *	0.0085 ***	320	19.0813	295	138.7198	0.1190	0.2665
CEO salary	86	10.6553	97	12.1809	0.4685	0.4615	82	-3.7610	80	41.6129	0.0125 **	0.0110 **
CEO bonuses[a]	74	-0.1141	60	200.4400	0.0405 **	0.0825 *	72	0.0261	54	0.7338	0.2375	0.1595
CEO stock options[a]	61	0.2627	80	445.0186	0.0500 *	0.0580 *	61	-0.3566	71	0.5155	0.3155	0.3500

p<0.1*; p<0.05<**; p<0.01***

[#] If the two samples do not have equal variance, the non-equal variance tests results were used

[a] The value of CEO bonuses and CEO stock options were transformed with natural logarithm

Table 6.3b The independent samples t-tests and Mann-Whitney U test for differences between early and late adopters of ISO 9000

Overall period (t-2 to t+2 period)						
	Early adopters		Late adopters		Independent sample t-test [#]	Mann-Whitney U test
Abnormal performance	**N**	**mean**	**N**	**mean**	**P value. (1-tailed)**	**P value. (1-tailed)**
Labor productivity	294	6.5021	236	-1.3320	0.0100 **	0.0265 **
Operating Cycle	322	-10.0985	297	-3.5622	0.1050	0.2920
Manufacturing Cost Efficiency	319	-0.0243	282	-0.2107	0.4055	0.3935
ROA	304	0.0243	239	-0.0042	0.0015 ***	0.0025 ***
ROS	299	0.0133	238	0.0152	0.4280	0.1075
Tobin's Q	280	0.1117	258	-0.0602	0.0895 *	0.0045 ***
Sales	326	82.3472	296	135.1566	0.3420	0.0375 **
CEO salary	85	13.1462	84	50.4469	0.0705 *	0.0800 *
CEO bonuses [a]	73	0.1197	54	0.6762	0.0855	0.0435 **
CEO stock options [a]	60	0.0556	70	0.2433	0.3605	0.2015

p<0.1*; p<0.05<**; p<0.01***

[#] If the two samples do not have equal variance, the non-equal variance tests results were used

[a] The value of CEO bonuses and CEO stock options were transformed with natural logarithm

6.5 Discussion

Most of the hypotheses in this study were supported, except for the hypothesis on *Tobin's q* and manufacturing cost efficiency. In general, we found that abnormal operational and financial performance significantly decreased along with the year of adoption, supporting an institutional perspective of the adoption of ISO 9000. The early adopters gain more technical benefits from the implementation of ISO 9000 compared with the late adopters. However, Hypothesis 3 for *Tobin's q*, developed based on institutional theory, was not supported. Specifically, our results for *Tobin's* q performance of early adopters (1990-1997) were consistent with Corbett et al.'s (2005) findings, which concluded that the adoption of ISO 9000 leads to an improvement in market valuation (measured by *Tobin's q*). However, we found that such abnormal positive *Tobin's q* performance disappeared along with the decrease in ROA.

The drops in *Tobin's q* among the late adopters might be related to the assumption of market efficiency, which states that market stock prices fully reflect the actual performance of the companies. In an efficient capital market, stock markets are very efficient at reflecting information about individual stock and about the stock market as a whole (Fama, 1970, 1998). *Tobin's q* reflects firms' market value of the replacement value of their assets (Bharadwaj, Bharadwaj and Konsynski, 1999; Fama, 1970). Although adopting ISO 9000 could provide a positive image for the company, the long-term market valuation of a firm might principally rely on the actual performance of the company, in terms of operational and financial performance. Investors might evaluate the value of a company based on the actual operational performance and financial measures (e.g., ROA). Therefore, there is no

direct relationship between the adoption of ISO 9000 and abnormal changes in *Tobin's q*, and the abnormal change in *Tobin's q* might be related the abnormal performance in ROA.

Secondly, we may view ISO 9000 certification as a scarce intangible resource. Based on the resource based view (Barney, 1991), if ISO 9000 certified companies have become the norm in the market, ISO 9000 certification is no longer a scarce resource that confers competitive advantage. Therefore the early adopters' certificate should have a higher market valuation than the late adopters'. This perspective could explain the results of the diminishing *Tobin's q* but not the diminishing operational efficiency, and the increment in sales and senior executive compensation. The original technical contents of ISO 9000 were, in fact, improved after its revision in the ISO 9000:2000 version (Wiele et al., 2005). Unless it is due to operational efficiency, the growth in abnormal sales is not explained by the resource-based view. This perspective predicts, with reasonable certainty, a diminishing of marketing benefits, as the competitive advantage of being an ISO 9000 certified company diminishes. Therefore, given our findings in the current study, the institutional perspective provides a better explanation of the paradox between operating performance, sales performance, and senior executive compensation.

ISO 9000 certified firms can gain wider market access by complying with the standard (Anderson et al., 1999). This argument is supported by the significant growth in abnormal sales performance among late adopters (H4). The supporting evidence for Hypotheses 1, 2, and 3 indicates that improved sales performance was not supported by higher operational performance as a result of more effective use of

ISO 9000. The data actually show that ISO 9000 certified firms gained higher abnormal sales performance despite any deteriorating abnormal operating performance. This result might point to the existence of institutional decoupling, indicating that industrial customers have a different perspective from that of investors. Industrial customers may select their suppliers based on ISO 9000 certification while investors may not take ISO 9000 certification seriously. Instead, they more likely select a firm based on financial and operational indicators.

This interesting observation of the relationship between pre-certification manufacturing cost efficiency and ROS might provide additional insights into the technical benefits of ISO 9000. The results suggest that late adopters obtain less technical benefit in operational efficiency, including labor productivity and operating cycle. However, they still have higher manufacturing cost efficiency and ROS, possibly induced as sales improve. If sales improve while other things remain unchanged, the manufacturing cost efficiency measure (more efficient) would drop and ROS would increase. Table 6.4 shows the formula for MCE and ROS.

Table 6.4 Formulae of manufacturing cost efficiency and ROS

Indicator	**Formula**
Manufacturing Cost Efficiency (MCE)	$MCE = \frac{COGS}{S}$
Return on Sales (ROS)	$ROS = \frac{S - COGS}{S}$

S – Sales
COGS – Costs of good sold

We argue that the increase in manufacturing cost efficiency is due to economies of scale as the sales volume of certified firms increase. In a highly institutionalized business environment, late adopters could gain the needed legitimacy by

implementing ISO 9000 (even before formal certification as shown in this research). As shown in Table 6.3a, the pre-certification abnormal sales for late adopters was higher compared to early adopters, and similar results were obtained for both pre-certification ROS and pre-certification manufacturing cost efficiency. This might imply that the abnormal sales improvement due to legitimacy could eventually lead to a sort of efficiency due to higher sales volume and economies of scale, in place of labor productivity or time-based efficiency.

The evidence we found in this study might imply that the institutionalization of a management practice could be costly for the supply chain. The institutional effects among the late adopters changed the original nature of ISO 9000. Our study found that late adopters of ISO 9000 actually did not improve their operational performance. We also found that CEOs of the late adopters were better rewarded for the adoption of ISO 9000 compared with early adopters, despite the absence of improved operational performance. One of the possible explanations is that CEOs have gained legitimacy and are held in higher regard as a result of ISO 9000 certification. According to agency theory, an executive compensation system is an incentive scheme to align management interests to those of the shareholders (i.e. maximizing profit). However, such a function might be distorted under institutional forces. Adopting an internationally recognized management standard might be a means for senior executives to demonstrate their management skills, and a tool to acquire personal legitimacy to justify a higher compensation. We suggest that this is one of the major reasons for the global diffusion of ISO 9000.

6.7 Conclusion of Research Part Three

We have found empirical evidence on the decoupling of operational efficiency and institutional benefits in the diffusion of the ISO 9000. Our research might help explain some contradictory results on the benefits of ISO 9000 in previous literature, as we found that early adopters obtained significant improvement in operational and financial performance, while late adopters did not. We found that, despite a lack of improvement in operational performance among late adopters, these firms obtained significantly higher abnormal sales and their senior executives were better rewarded in all types of compensation. The paradoxical relationships between operational performance, sales, and senior executive compensation are best explained by institutional theory.

Chapter 7 Conclusions

7.1 Summary of Findings

In Research Part One, we showed that the adoption of ISO 9000 improved operational and financial performance. We compared the ISO 9000 certified firms to a portfolio of control firms with similar firm size and pre-certification performance in a similar industry. We found that labor productivity, operating cycle, manufacturing cost efficiency are improved upon implementation of ISO 9000. Regarding financial performance, ROA, ROS, and sales growth were also enhanced upon the adoption of ISO 9000. However, *Tobin's q* was not improved, which contradicts the previous findings by Corbett et al. (2005). Overall, the empirical evidence supports the argument that adoption of ISO 9000 leads to higher operational and financial performance of the certified firms.

In Research Part Two, we investigated the causal relationship between ISO 9000 adoption and senior executive compensation. Behavioral-based compensation, fixed salary, and performance-based compensation, bonuses and stock options, of senior executives were all significantly increased with the implementation of ISO 9000. The changes in performance-based compensations were consistent with the operational and financial improvements found in Research Part One. In terms of the time period, CEOs and senior executives obtained abnormal bonuses and stock options in the t-2 to t period, when operational and financial performance improved. We also found that senior executives were rewarded with base salary increment after formal certification. This might imply that they are recognized for their capabilities

and efforts in obtaining ISO 9000 certification and rewarded for its legitimacy. We suggest that personal legitimacy for senior executives is one of the driving forces behind the global diffusion of ISO 9000. The adoption of popular management practices such as ISO certification might be a means for senior executive to raise their personal reputation and subsequently their benefits (Staw and Epstein, 2000).

In Research Part Three, we discussed the decoupling of the technical benefit and symbolic value of ISO 9000. Using regression analysis of abnormal performance for the operational and financial indicators, we found that abnormal performance significantly dropped after the time of adoption. For example, the overall period (from t-2 to t+3) abnormal ROA diminished by 0.4% on average every year. At the same time, we noticed that the company sales and senior executive compensation significantly improved for late adopters. This paradoxical phenomenon suggests that both the organization and its senior executives obtained benefits, not necessarily because of improved operational performance, but in recognition of the symbolic value of ISO 9000. This follows the insight, provided by institutional theory, that the adoption of an institutional management practice among late adopters is driven by legitimacy rather than technical benefits (Meyer and Rowan, 1977; Westphal and Zajac, 2001).

Moreover, we documented that late adopters enjoyed higher sales performance in the pre-certification period, compared to early adopters. This finding is interesting, because it suggests that the abnormal sales increase due to conferred legitimacy might result in economies of scale, which in turn leads to a sort of efficiency. The relationship between technical benefits and symbolic value is not necessarily

mutually exclusive in all operational aspects. We found that, in contrast, the abnormal manufacturing cost efficiency and ROS of late adopters were significantly higher, compared to early adopters upon implementation. We argue that institutional approval leads to higher sales, and thus there is a sort of efficiency due to economies of scale.

In Research Part Three, we explained the possible reasons that *Tobin's q* was not significantly improved upon ISO 9000 implementation. We found that early adopters obtained significant abnormal positive change in *Tobin's q*, which is consistent with previous studies on the same time period from 1990-1997 (Corbett et al., 2005). However, the late adopters experience (1997-2005) a significant drop in *Tobin's q*, leading to insignificant results for the overall sample (1990-2005) in Research Part One. This finding also suggests that the market valuation of a firm, *Tobin's q*, is based on operational and financial measures, but not on the adoption of ISO 9000.

7.2 Limitations of the Study

Although we controlled industry type by mainly 2 digit SIC codes, more accurate results would be obtained if we could match 3 or even 4 digits of the codes. According to previous research based on event study methodology (e.g., Corbett, Montes-Sancho and Kirsch, 2005; Hendricks and Singhal, 1997; Naveh and Marcus, 2005), 2-digit SICs provide a good balance between the control on industrial type and the availability of the control firms. To control firm size (total assets), we adopted a 33 to 300% range in matching control firms, which might also be considered quite wide. However, we apply a tighter control on pre-certification

performance (or compensation), which is shown empirically to be the most significant factor in event studies (Barber and Lyon, 1996).

In Research Part Three, we found significant results in the regression analysis on the changes in abnormal performance over time. However, one may argue that the statistical significance of this part of research seems limited, as the R^2 value is very small (ranging from 0.001 to 0.021 among various indicators). We were not surprised by the small R^2 value, as the impact of time only explains a small percent of the total variance of the diminishing operating performance (or the increment of sales, and executives' compensation). In fact, the practical significance of our findings is sound. For example, referring to the Table 6.2, the R^2 value of ROA for the overall period is 0.012 and B is -0.004. It implies that 1.2% in the variance of abnormal ROA can be explained by the time of adoption, and the actual drop of ROA will be 0.4% every year. According to Table 4.3, the mean of ISO 9000 certified firms' total asset is 2195 million US$. For a 10 years period (for example from year 1993 to 2003), the abnormal ROA would drop 4%, which translated into an 87,800,000 US$ difference in abnormal operating income between early and late adopters of ISO 9000 that have similar firm sizes (Total assets). This figure suggests that the practical significance of our findings is remarkable, although the statistical significance is small.

In Research Part Three, we also carried out independent sample t-tests of the abnormal performance (or compensation) between the early and late adopters of ISO 9000, by simply dividing the early and late adopters based on the mean and median year of the first adoption of ISO 9000. One might argue that this is not be the best

method for such classification, especially since there was a transition from ISO 9000:1994 version to ISO 9000:2000 in year 2000. Although there is no rigorous research into the impact of the new version on ISO 9000, anecdotal evidence suggests that the new version of ISO 9000 is more effective (Wiele et al., 2005). As a result, it is unlikely that the new improved version would have induced a negative impact on operational performance. In other words, it is unlikely that the deteriorating effectiveness of ISO 9000 among late adopters is due to the introduction of a new version of ISO 9000.

Finally, although this study focused only on manufacturing firms in the US, similar results are likely to be found in other countries and industries. Firstly, the ISO 9000 standard has the same technical content for different countries, and both services and manufacturing firms follow the same quality system standards. Secondly, research shows that manufacturing firms in different countries face similar institutional pressures to adopt ISO 9000. In fact, the manufacturing firms in North America may face relatively less institutional pressure compared to the firms in Europe or China. For example, Chinese manufacturing firms, which are mainly OEMs and highly export oriented, are under high institutional pressure to adopt various quality management standards (Yeung et al., 2003). As a result, the problem of institutional decoupling is likely to be even more serious in these regions.

7.3 Future Study

One of the limitations of this research is that our financial data is at firm level, while ISO 9000 can be issued to individual plants or sites. Therefore, would be worth replicating the study if the financial performance data of individual sites was

available. Moreover, the number of certificated sites per company may also moderate the relationships that we have examined in this study. A company with 1 out of 100 plants certified is likely to show less improvement than that of a company with all 100 of its plants certified. For future studies, it would be worthwhile studying the percent of ISO 9000 certificates on abnormal performance and senior executive compensation.

As the adoption of ISO 9000 has a significant impact on operational performance, it would be interesting to further investigate the impact of other quality-oriented standards, such as QS 9000, TL 9000 and ISO 16949. If the adoption of other standards is similarly institutionalized, the firms adopting them might simply pursue their symbolic value, rather than their technical values. If so, would the CEO and senior executives be rewarded for obtaining more business certifications, regardless of the actual effectiveness of the adoption? The answers to these questions will bring valuable insights to both practitioners and researchers in operations management.

It would also be interesting to investigate the impact of ISO 14000 on operating performance and senior executive compensation. We might compare the "abnormal" company performance and executive compensation upon the adoption of ISO 9000 and ISO 14000. Although we found that senior executives were rewarded for the adoption of ISO 9000, this would not necessarily be the case for ISO 14000. Researchers argue that the adoption of ISO 14000 is entirely for legitimacy reasons (Bansal and Hunter, 2003), and it thus might not have any positive impact on the operating performance of a firm. If this is the case, would senior executive still be rewarded for the adoption of ISO 14000? Further research will provide the answers.

7.4 Implications for Academics and Practitioners

This research contributes to three areas in management literature. Firstly, we documented the operational and financial benefits of the adoption of a quality management standard using event study methodology. This research found the empirical evidence for the relationship between financial benefits and ISO 9000 certification. In particular, previous research has not studied the impact of ISO 9000 on labor productivity and operating cycle. We also found, that in the long-term, the adoption of ISO 9000 does not necessarily lead higher *Tobin's q*, which is more highly correlated with financial indicators in an efficient market (Fama, 1998; Malkiel, 2003).

Secondly, we conducted a large scale study into the possible decoupling of the symbolic value and technical merit inherent in adopting ISO 9000, using objective data. We found that the symbolic value of ISO 9000 eventually replaces its technical benefits. Such finding contributed to the knowledge of institutional decoupling. This might imply that other institutionalized management standards face a similar decoupling problem. This research contributes to institutional theory by revealing that institutional approval adds to economic and efficiency explanations of the prosperity of an organization – a business mode that might have emerged in global business. Institutional approval clearly leads to higher senior executive compensation, regardless of the actual benefits of the institutionalized rules.

Finally, this study leads to two important implications for research into senior executive compensation. Firstly, we documented that the adoption of a popular management standard could lead to higher performance-based and behavioral-based

compensation of senior executives. Meanwhile, we studied the specific impact of ISO 9000 adoption on different types of senior executive compensation, with results showing that senior executives could be rewarded for the symbolic value and legitimacy they obtained, leading to a higher salary upon the formal ISO 9000 certification. Secondly, ISO 9000 leads to higher bonuses and more stock options among late adopters, but not because of its technical merits. Despite the fact that such technical merits decrease over time, the impact of ISO 9000 adoption on senior executive compensation remains consistent and positive.

This study shows that the implementation of ISO 9000 leads to higher operating performance. Nevertheless, management should not only pursue the symbolic value of the certification, but should also take the opportunity to improve their internal operations. Otherwise, ISO 9000 will become “an iron cage” (Boiral, 2003) that promotes bureaucracy and lower operational efficiency. On the other hand, organizations obtaining ISO 9000 can obtain both technical efficiency and legitimacy. The latter, in turn, leads to higher sales performance and thus a sort of efficiency. However, the credibility of ISO 9000 is questionable as it becomes institutionalized. As our results show, late adopters of ISO 9000 obtain significantly less technical benefit.

APPENDIX A THE DATA COLLECTION PROCEDURES FOR OBTAINING META-STANDARD INFORMATION

1. Check company website for an idea of the industry type
2. Check any subsidiaries' names from the company website
3. Check www.whosregistered.com for the number of certified sites for each company on the list
4. Check www.qualitydigest.com for the earliest date of certification
5. If there is no information for a certified company in www.qualitydigest.com, please check their company website or search in Google for the registration year information.
6. If subsidiaries' company names are found in the website, use that to search in QualityDigest.com for the issue date information
7. If you still could not find the certification date of the company, mark it "certified" to avoid using it as a control firm.

Remarks:

- Do not use the full name to search, as there may be some subsidiary companies with similar names in other countries.
- Check whether the description of the certification process is related to the company business nature. If not, it may belong to another company instead.
- Pay attention to the certification year. An incorrect certification year will seriously damage the results.
- The number of certified sites found in www.qualitydigest.com is usually less than www.whosregistered.com, as they do not have certification data outside North America

APPENDIX B THE CALCULATION OF OPERATING CYCLE

Operating cycle = Number of inventory days + Number of account receivable days

$$OC = I + AR$$

I = Number of inventory days
AR = Number of account receivable days
OC = Operating cycle

Number of inventory days

$$I = \frac{365}{IT}$$

I = Number of inventory days
IT = Inventory turnover ratio

$$IT = \frac{COGS}{Avg.Inv.}$$

COGS – Cost of good sold
Avg.Inv. – Average inventory balance

Number of receivable days

$$AR = \frac{365}{ART}$$

AR = Number of account receivable days
ART = Account receivable turnover ratio

$$ART = \frac{CS}{Avg.AR}$$

CS = Credit sales
Avg. *AR* = Average account receivable balance

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