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The impact of the extent of Activity-Based Costing use and the extent of ISO 9000 implementation on organisational performance

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ABSTRACT

Activity-based costing (ABC) is one of the most-researched management accounting areas that can improve organisational performance (OP). However, the studies on ABC and its impact on OP were still deficient and contradictory. Furthermore, ABC might be the most advantageous approaches used concurrently with ISO 9000. This study aims to investigate the impact of the extent of ABC use and the extent of ISO 9000 implementation on OP in order to identify the role of ABC and ISO 9000 in improving OP, and, in addition, to assess the combined effects of ABC and ISO 9000 on OP. Two conceptual models were developed to illustrate the relationships between variables.

There were 601 usable questionnaires (19.36 percent) received; 191 organisations that adopted both ABC and ISO 9000 compared to 410 organisations that adopted only ISO 9000. Three data analysis techniques were employed: exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modelling (SEM). EFA and CFA results provide evidence that the extent of ABC use (CA: cost analysis, CS: cost strategy, CE: cost evaluation), the extent of ISO 9000 implementation (MP: management principle, CP: Cooperation principle) and organisational performance (OPP: operational performance, FP: financial performance) are multidimensional.

SEM results indicate the extent of ABC use directly improves OPP and subsequently indirectly improves FP through OPP. On the other hand, the extent of ISO 9000 implementation of organisations that adopted only ISO 9000 improves neither OPP nor FP. However, the management principle (MP) of organisations that adopted both ABC and ISO 9000 can directly improve both OPP and FP, and subsequently indirectly improve FP through OPP. The result implies a potential synergy effect of ABC and ISO 9000, which extends the body of knowledge of management accounting and quality management research.

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List of abbreviation

Activity-based costing (ABC)

Adjusted goodness-of-fit statistic (AGFI)

Akaike information criterion (AIC)

Asymptotic distribution free (ADF)

Average variance extracted (AVE)

Bayesian information criterion (BIC)

Chief Executive Officer (CEO)

Common method variance (CMV)

Comparative fit index (CFI)

Confirmatory factor analysis (CFA)

Construct reliability (CR)

Corrected item-total correlation (CITC)

Covariance structures analysis (COVS)

Expected cross validation index (ECVI)

Exploratory factor analysis (EFA)

Financial performance (FP)

General systems theory (GST)

Generalised least squares (GLS)

Goodness-of-fit statistic (GFI)

International Organization for Standardization (ISO)

Maximum likelihood estimation (ML)

Normed fit index (NFI)

Operational performance (OPP)

Organisational performance (OP)

Return on assets (ROA)

Root mean square error of approximation (RMSEA)

Root mean square residual (RMR)

Standardised root mean square residual (SRMR)

Structural equation modeling (SEM)

Tucker-Lewis index (TLI)

Unweighted least squares (ULS)

Weighted least squares (WLS)

Chapter 1: Introduction

Introduction

This thesis addresses the contributions of Activity-based costing (ABC) and ISO 9000 to organisational performance. This chapter provides an overview of the research, which is presented in four sections. Section 1.1 introduces the research problem of the study. The aims, the objectives and the research hypotheses are identified in Section 1.2. The research structure is outlined in Section 1.3. The last section discusses the research contribution.

1.1 Research problem

Management accounting provides information in relation to managing organisational resources for managers (Langfield-Smith et al., 2009). It helps managers plan, evaluate and control activities (Proctor, 2002). Moreover, it contributes to improving organisational performance through process improvement and cost management techniques (Langfield-Smith et al., 2009). Phadoongsitthi (2003) pointed out that management accounting practices form an organisation's infrastructure, adding value by enabling and facilitating the effective use of scarce resources.

Activity-based costing (ABC) has enjoyed a high profile in management accounting research worldwide over the last 25 years (Jankala & Silvola, 2012). Improving organisational performance is a positive role for ABC, as illustrated in the literature (Askarany & Yazdifar, 2012). Topics in the area of ABC research include "the diffusion levels of ABC in various countries, the reasons for adopting ABC, the problems associated with ABC and critical success factors relating to its successful implementation" (Sartorius et al., 2007: 2). Elhamma (2015) has indicated that most of the research on ABC have been conducted by using a contingency theory approach. Researcher have focused on the relationship between ABC adoption and several contingency factors such as strategy, firm size, organisational structure, structure of changes. However, the studies related to the impact of ABC on performance are still insufficient. Maiga and Jacobs (2008) point out that the link between ABC and its impact is still questionable.

Previous studies have investigated the association (Ittner et al., 2002; Cagwin & Ortiz, 2005; Hardan & Shatnawi, 2013) and the impact (Banker et al., 2008) of ABC on performance. Some studies have most frequently measured ABC using a category scale (a 0–1 variable), namely ABC-adopter and non-ABC adopter; or in a continuum of ABC adoption levels by applying only one indicator (Jankala & Silvola, 2012); or in three dimensions of ABC implementation (Zaman, 2009). Banker et al. (2008) suggested that employing a more granular scale to measure ABC might give greater insight into the association between ABC and performance. In this study, in contrast, ABC is measured as a theoretical construct, which cannot be observed directly, rather than as a single observed variable. However, few studies have measured ABC in term of a construct (Cagwin & Bouwman, 2002; Maiga & Jacobs, 2008). At present, little is known about measuring ABC in term of a construct and, in particular, there is an absence of clarity regarding the dimensional structure of ABC, and its impact on performance.

The current study will fill this gap by empirically investigating the impact of ABC on organisational performance in terms of the extent of ABC use for a range of purposes. As Malmi and Granlund (2009: 598) pointed out, "the goodness of any Management Accounting practice depends on the objective of users of the MA as well as the organisational and social context in which the MA practice takes place".

In some literature, ABC was found to show no association with financial performance, particularly return on assets (ROA), profitability and return on investment (ROI) (Cagwin & Bouwman, 2002; Ittner et al., 2002; Cagwin & Ortiz, 2005; Maiga & Jacobs, 2008). However, interestingly, Cagwin and Bouwman (2002) found that ABC had a positive relationship with ROI improvement, but only when ABC was employed concurrently with alternative initiatives, such as just-in-time, theory of constraints, computer integrated manufacturing, value chain analysis, business process reengineering, flexible manufacturing systems, and total quality management . The reason for this finding is that as "ABC often provides more and better information about processes, ABC may be most beneficial if other initiatives are employed concurrently" (Cagwin & Bouwman, 2002: 10). Banker et al. (2008) indicated that employing ABC by itself did not lead to performance improvement. As a result, Cagwin and Bouwman (2002) and Jankala and Silvola (2012) recommended that further research was needed to investigate which combinations of initiatives provide a positive effect when used concurrently with ABC.

Previous studies have attempted to link ABC and other initiatives such as technology integration, supply chain management (Cagwin & Ortiz, 2005), balance scorecard (Maiga & Jacobs, 2003), total quality management (Cagwin & Barker, 2006) and just-in-time (Huson & Nanda, 1995; Kaynak, 1996). However, the establishment of a relationship between ABC and technology integration, supply chain management, and balance scorecard and organisational performance showed only a weak significance (P<0.10). Some other initiatives, namely total quality management and just-in-time, have difficulty in specifying the exact implementation claimed and identifying the practice adoption date (Sharma, 2005). It may not be reliable to use public announcements because organisations seldom announce the beginning of using the total quality management system (Easton & Jarrell, 1998).

This study responds to the call for additional research using ABC in order to discover which combinations of initiatives provide a positive effect when used concurrently with ABC. Focusing on organisational performance improvement, ISO 9000 is one of the most popular and enduring programmes (Gershon, 2010) which organisations can employ to improve performance through process improvement (ISO 9004, 2009). ISO 9000 identifies eight principles to "be used by top management as they lead their organisations and improve performance" (Oakland, 2003: 209). ISO 9000 and ABC are relatively similar in their particular emphasis on managing activities and their documentation (Larson & Kerr, 2002). Many processes considered for the accomplishment of ISO 9000 certification are also necessary when employing ABC, as Larson and Kerr (2007) concluded in Figure 1.1.

Figure 1.1: The processes of ISO 9000 and ABC

ISO 9000	Activity-Based Costing
1. Process mapping 2. Documentation 3. Performance 4. Audit 5. Corrective action	1. Process mapping 2. Link resources to activities 3. Link activities to entities 4. Cost accounting 5. Corrective action

Source: Larson and Kerr (2007: 203)

ISO 9001 is based on a process-orientation approach of managing organisational activities (Yu et al., 2012). The general requirement is to determine the activities needed and the sequence and interaction of these in relation to the processes being performed. Documents are required for ISO 9001 certification, "including records, determined by the organisation to be necessary to ensure the effective planning, operation and control of its processes" (ISO 9001, 2008: 2). The next step is an action that contributes to performance such as management responsibility, resource management, and product realisation. The ISO 9001 (2008) indicated that performance measurement in the quality management system was related to customer satisfaction, internal audit, monitoring, processes and product measurement. In order to continually improve quality, corrective action is appropriate in response to the nonconformities encountered and also preventive action is taken in response to the effects of potential problems (ISO 9001, 2008).

In the ABC process, Horngren et al. (2008: 150) illustrated that ABC "first accumulates indirect resource costs for each of the activities of the area being costed, and then assigns the costs of each activity to the products, services or other cost objects that require that activity". "Activity-based costing also causes managers to look closely at the relationships among resources, activities, and cost objects, especially analysing the unit's production process" (Horngren et al., 2008: 151). A process map is recommended in order to capture the interrelationship among cost objects, activities and resources (Horngren et al., 2008). In summary, ABC begins with conducting a process map, followed by a two-stage allocation process.

As discussed above when looking at the similarity of ABC and ISO 9000 processes, it is possible that both ABC and ISO 9000 are complementary (Larson & Kerr, 2007). Grieco and Pilachowski (1995) and Hilton et al. (2000) also supported the idea that there are benefits to combining ABC and ISO 9000. Documentation of an organisation's process for ISO 9000 certification can be relatively straightforward compared to the activity list of ABC. Both ISO 9000 and ABC support the process view of management, that is, a horizontal orientation of business management. This relationship can be explained by general systems theory (GST), in which an organisation is considered as a system and each process is viewed as a sub-system. The benefits derived from the use of ABC and ISO 9000 depend on the extent to which they become incorporated into the organisation sub-systems. They are both expected to be beneficial in processing activities and subsequently contributing to performance improvement. However, few studies have previously been conducted into ABC and ISO 9000 complementarity and their impact on performance (Grieco & Pilachowski, 1995).

Only two recent scholarly articles have focused on ABC and ISO 9000 (Larson & Kerr, 2002; Larson & Kerr, 2007). Surprisingly, Larson and Kerr (2002) found ABC-only organisations outperformed organisations that adopted both ABC and ISO 9000; also, ISO 9000-only organisations showed better performance than organisations that adopted both ABC and ISO 9000. In follow-up research based on interviews, Larson and Kerr (2007) suggested there was evidence of the potential for complementary use of ABC and ISO 9000, but there was evidence that both actually competed for scarce funding and organisational attention hence performance fell.

The finding of Larson and Kerr (2002)'s survey above, might be due to limitations such as measuring ABC and ISO 9000 in a category scale (a 0–1 variable), and also measuring organisational performance using only non-financial performance indicators. This study attempts to address these limitations by operationalising ABC and ISO 9000 in term of a construct. In addition, it measures organisational performance in terms of a construct concerning both non-financial and financial performance measures. In particular, organisational performance has been measured by performance indicators which were previously used in the ABC and ISO 9000 literature. These indicators include sales, return on assets (ROA), cost, quality, delivery reliability, process efficiency, and process effectiveness. Thus, this research contends that, it is possible that if organisations adopted both ABC and ISO 9000, they could achieve greater organisational performance than organisations adopting only one of them, due to a likely synergy effect in relation to the general systems theory (GST), in particular, process and output.

Turning to ISO 9000, the principles of ISO 9000 are broadly accepted as necessary for effective quality management (Munting & Cruywagen, 2008). These principles could lead to organisational performance improvement (ISO 9004, 2009). Earlier studies focused on the requirements for implementing ISO 9001, and the association between ISO 9000 and performance. Little is known about measuring ISO 9000 in terms of a construct. In particular, there is a relative absence of studies of ISO 9000 in the context of principles and the impact of ISO 9000 on organisational performance. Further, the findings concerning ISO 9000 and performance that do exist are contradictory (Naveh & Marcus, 2005; Feng et al., 2008; Jang & Lin, 2008; Psomas et al., 2013; Fatima, 2014).

There is an absence of clarity relating to the dimensional structure of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance (in relation to the ABC and ISO 9000 literature). Then, this study tests the dimensionality of these three constructs. Finally, regarding previous studies and contingency theory, the current study also tests the moderating impacts on organisational performance.

In this study, the target population is organisations that adopted ABC and ISO 9000. ABC provides the guideline in calculating product/service costing based on their main activities whilst ISO 9001, dictates the requirements for a quality management system. Therefore, it is possible for any organisation to adopt both ABC and ISO 9000 or either of them in the similar way. All Thai ISO 9001-registered organisations, including organisations that adopted ABC and ISO 9000, were selected in this study as a sample representing the population.

1.2 The aims, the objectives and the research hypotheses

The study aims to test the impact of the extent of ABC use on organisational performance, and in addition, to the impact of the extent of ISO 9000 implementation on organisational performance. It also aims to test the significant differences between organisations that adopted both ABC and ISO 9000, and organisations that adopted only ISO 9000, in order to discover whether there is a synergy effect between ABC and ISO 9000 in relation to the explanation of general systems theory (GST). The moderating impacts of these techniques on organisational performance are also studied.

Prior to conducting the study, previous research into the relationship and the impact of ABC and ISO 9000 on organisational performance has been critically reviewed. Furthermore, conceptual models for the study based on previous empirical studies and relevant theories have been developed. According to these main aims, the research can be separated into seven objectives, as follows:

1. To test the dimensionality of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance.

2. To test both direct and indirect impacts of the extent of ABC use on organisational performance of organisations that adopted both ABC and ISO 9000.

3. To test both direct and indirect impacts of the extent of ISO 9000 implementation on organisational performance of organisations that adopted both ABC and ISO 9000.

4. To test both direct and indirect impacts of the extent of ISO 9000 implementation on organisational performance of organisation that adopted only ISO 9000.

5. To test both direct and indirect impacts of the extent of ISO 9000 implementation on organisational performance of all organisations studied.

6. To test whether there are significant differences between organisations that adopted both ABC and ISO 9000 and organisations that adopted only ISO 9000.

7. To test the moderating impacts of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance.

According to these objectives, the main hypotheses address: the extent to which ABC use has a direct/indirect impact on organisational performance; the extent to which ISO 9000 implementation has a direct/indirect impact on organisational performance; whether there are significant differences between organisations that adopted both ABC and ISO 9000 and organisations that adopted only ISO 9000; and the strength of the impact of the extent of ABC use/ISO 9000 implementation on organisational performance depending on the type of business, size of business, age of ABC, age of ISO 9000 and frequency of ABC use. All the hypotheses were explored by conducting surveys and employing structural equation modelling (SEM).

1.3 Research structure

The thesis is organised into six chapters in relation to the research process as shown diagrammatically in Figure 1.2. Chapter 1 is the introduction, which includes the research problem of this study. It also describes the research aims, objectives, and main hypotheses. The research structure and contribution of this study to knowledge are also discussed. The literature review (Chapter 2) covers management accounting, ABC, quality management, ISO 9000, and organisational performance improvement and the impact of the extent of ABC use and the impact of the extent of ISO 9000 implementation on organisational performance. The combined impacts of ABC and ISO 9000 are also critically discussed. This chapter points out the factors moderating organisational performance, followed by the appropriate conceptual models based on earlier studies. It concludes with the development of hypotheses that relate to the research objectives and are linked to the research methodology in the next chapter.

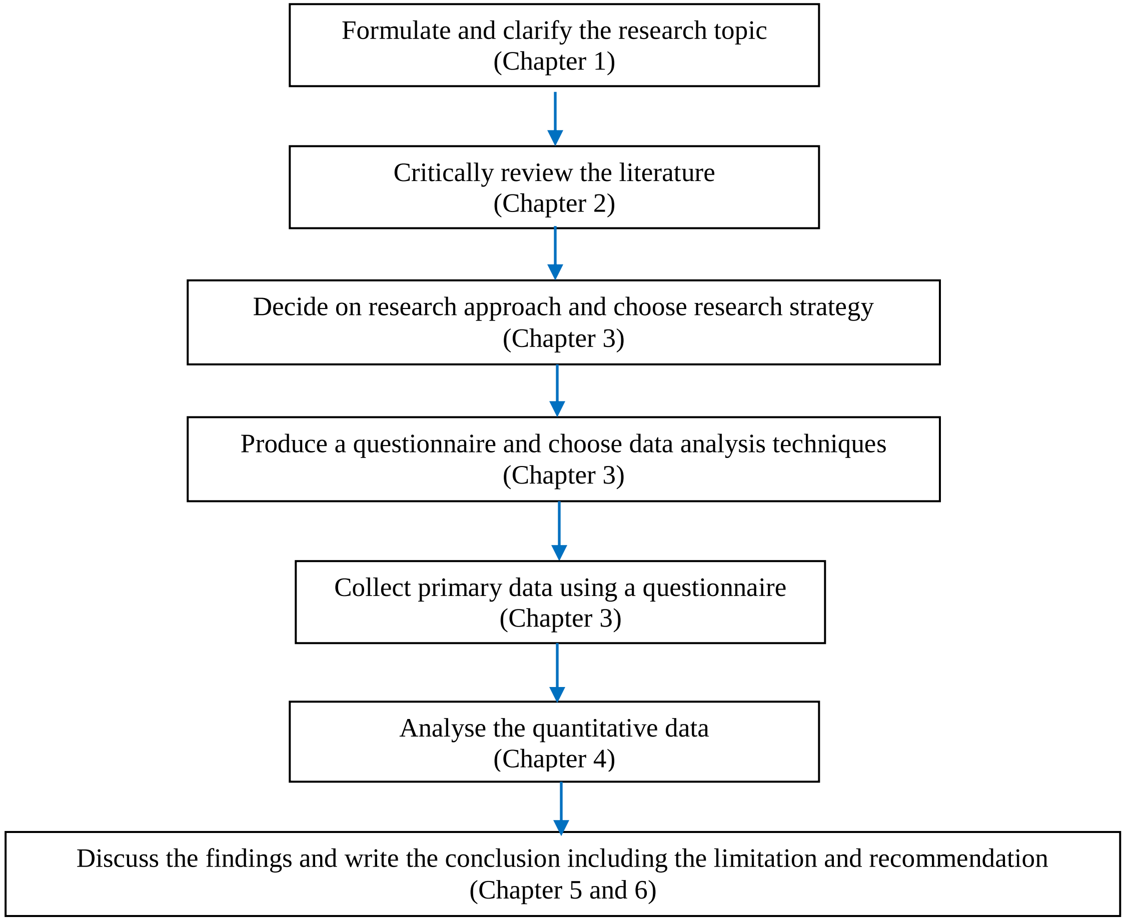
Chapter 3 discusses the research methodology used in this study. It contains research philosophy, research approach, methodological choice, research strategy, time horizons, and collection methods. Questionnaire design, target population, operationalisation of study constructs and data analysis techniques are also discussed.

Chapter 4 reports the research results, such as preliminary analysis of response rate and sample size, tests of non-response bias, and screening data (missing data, normality, linearity, outliers, multicollinearity, and homoscedasticity). Descriptive analysis includes demographic data and organisation characteristics including central tendency, dispersion and distribution of scores. In addition, it shows the results of EFA, CFA, SEM, and multi group analysis, respectively. All hypotheses are also tested and discussed in this chapter.

Chapter 5 discusses the research results including comparison with the findings of previous studies. It starts with the factorial structure of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance through EFA and CFA. The impact of the extent of ABC use, the extent of ISO 9000 implementation on organisational performance as well as differences between organisations that adopted both ABC and ISO 9000, and organisations that adopted only ISO 9000, are also discussed. Additionally, this chapter shows the results of the moderating impacts of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance.

Chapter 6 presents the conclusion of the whole thesis. It includes the research contribution, research limitations and implications for future study.

Figure 1.2: The research process diagram



1.4 Research contribution

The current study contributes to the body of knowledge concerning the development of performance improvement theory by investigating the impact of the extent of ABC use and the impact of the extent of ISO 9000 implementation on organisational performance. Furthermore, the study tests the difference between organisations that adopted both ABC and ISO 9000 and organisations that adopted only ISO 9000 in order to discover whether there is a synergy effect between ABC and ISO 9000 in relation to the explanation of general systems theory (GST). The moderating impact of various variables is also studied with regard to contingency theory and previous studies. The three levels of the main contribution are discussed as follows.

1.4.1 Theoretical level

ABC, viewed as the theory of cost accounting (Malmi & Granlund, 2009), has been questioned regarding its potential to generate performance improvement. There is an absence of research examining the impact of the extent of ABC use on organisational performance: in particular, measuring ABC in terms of a construct rather than a binary approach (adopting/ non-adopting) approach. Rather than focusing on ABC only, ISO 9000 system is considered as having a process orientation approach to managing organisational activities. In the ISO 9000 literature, there is an absence of studies examining its impact on organisational performance, especially an absence of studies measuring ISO 9000 in terms of a construct consisting of the principles mentioned in ISO 9004 (2009).

The findings of this study provide evidence that improves the understanding of the roles of ABC and ISO 9000 in management accounting and quality management research. In other words, the results advance our knowledge of the causal relationship between the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance. That is, it examines a synergy effect between ABC and ISO 9000 by comparing the significant differences between organisations that adopted both ABC and ISO 9000 and organisations that adopted only ISO 9000. No previous study examines the impact of both ABC and ISO 9000 on organisational performance.

Moreover, there were no studies testing the dimensionality of the extent of ABC use, or the extent of ISO 9000 implementation, as to whether it is unidimensional or multidimensional. If it is considered as a multidimensional construct, this study reveals the purposes of using ABC and the principles of implementing ISO 9000 that can help to improve organisational performance.

1.4.2 Methodological level

This study employs three main techniques: namely, EFA - exploratory factor analysis; CFA - confirmatory factor analysis; and SEM - structural equation modelling. These techniques are employed in covariance structural analysis to test the dimensionality and the causal relationship between the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance. In addition, multi-group analysis is employed with the objective of discovering a synergy effect of ABC and ISO 9000 as well as testing the moderating impact of five contingent factors. The use of SEM is relatively rare in management accounting research; the use of this technique in this research is a further methodological contribution.

1.4.3 Practical level

The findings provide an understanding of how the extent of ABC use and the extent of ISO 9000 implementation may improve organisational performance, and in particular, may motivate organisations extensively using ABC and implementing ISO 9000 principles to achieve greater organisational performance improvement. Further if ABC and/or ISO 9000 are revealed as multidimensional then this research will demonstrate which dimension will have the most significant effect on organisational performance. Moreover, the findings could be beneficial for an organisation engaged in the decision to adopt ABC or ISO 9000 individually or combined in term of potential to improve organisational performance as a strategy in running their business.

Chapter 2: Literature Review

Introduction

The objective of this chapter is to discuss critically the literature regarding the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance in order to develop the hypotheses and eventually propose the appropriate conceptual models. These conceptual models, based on earlier studies, relate to the research objectives, and are linked to the research methods as discussed in the next chapter. The first section concerns management accounting and organisational performance improvement, including relevant theories, followed by the impact of the extent of ABC use on organisational performance and the impact of the extent of ISO 9000 implementation on organisational performance (see Sections 2.2 and 2.3). Section 2.4 discusses the combined impact of ABC and ISO 9000 on organisational performance. Factors moderating the impact of ABC and ISO 9000 on organisational performance are presented in Section 2.5, followed by the conceptual models in the last section.

2.1 Management accounting (MA) and organisational performance improvement

Management accounting (MA) is defined as "processes and techniques that are focused on the effective use of organisational resources to support managers in their task of enhancing both customer value and shareholder value" (Langfield-Smith et al., 2009: 6). It is relevant as it can provide important information to managers from employees who direct and control the organisation's operation (Seal et al., 2015). Moreover, it is particularly crucial to use MA information at the chief executive officers (CEOs) level, as CEOs have the greatest capacity to affect their organisation's behaviour and therefore performance (Vandenbosch & Higgins, 1996; Tripsas & Gavetti, 2000). They perceive and interpret information and then take action regarding this information (Daft & Weick, 1984; Hambrick & Mason, 1984).

Accordingly, management accounting (MA) provides information to support the development and evaluation of organisational strategies concerning the business direction and implementation of initiatives. Therefore, "management accounting may contribute to activities that seek to improve the organisation's performance in terms of quality, delivery, time, flexibility, innovation and cost, through modern process improvement and cost management techniques” (Langfield-Smith et al., 2009: 27). In other words, management accounting is associated with an organisation’s performance. Previous studies suggest relation between management accounting techniques and organisational performance, however, some of these studies produced mixed results (see Section 2.2).

Given the above discussion, organisational performance improvement is considered a central topic in management accounting research for the following reasons:

(1) Management accounting may increase organisational performance via process improvement and cost management. However, successful management accounting alone cannot necessarily ensure organisational performance improvement. Therefore, studying the implications of management accounting, particularly the improvement of organisational performance, is a highly relevant issue in management accounting research (Langfield-Smith et al., 2009).

(2) Management accounting is generally concerned with information and managing resources. This raises the question whether or not an organisation’s information usage and resource management will lead to benefits such as performance improvement. In order to answer this question or evaluate the role of management accounting, examining organisational performance is central to understanding the management accounting role and the implications.

Van Tiem et al. (2012: 5) indicated performance improvement (PI) is “the science and art of improving people, process, performance, organisations, and ultimately society”. In other words, performance improvement is systems process that relates organisation, objectives, and strategies with the workforce responsible for achieving those goals (Van Tiem et al., 2012). As this study focuses on performance improvement (the output in system theory), it needs to specify and define organisational performance.

Organisational performance is a very broad topic. Neely (2007: 126) reviewed a variety of dictionary definitions of performance, and described that performance is:

> “1) measurable by either a number or an expression that allows communication; 2) to accomplish something with specific intention; 3)

> the result of an action; 4) the ability to accomplish or the potential for creating a result; 5) a comparison of a result with some benchmark or reference selected or imposed – either internationally or externally; 6) a surprising result compared to expectations; 7) acting out, in psychology; 8) a show in the performance arts; 9) a judgment by comparison"

The literature on organisational performance of management accounting does not provide an exact meaning for organisational performance but expresses the measures used to evaluate organisational performance. In this study, the definition of "*organisational performance"* has been determined in two parts: first is the meaning of "*organisational*", and the latter is "*performance".* The definition of "*organisational*" is viewed as "relating to an organisation", while "*performance*" is defined as the outcome of an action. Consequently, this study defines "*organisational performance"* as the outcomes of an organisation's action. For instance, when an organisation performs well in controlling costs in relation to product/service contribution, it may suppose that reduction in costs has occurred, and consequently that financial performance has also improved.

Neely (2007) described four different perspectives on performance measurement consisting of accounting and finance, marketing, operations management, and supply chain management, as displayed in Table 2.1. Table 2.1 indicates the measures which are normally used in measuring the four different perspectives. Rather than measuring intangible assets within a financial framework, several articles recommend integrating nonfinancial indicators into the measurement (Kaplan, 2010). For example, financial measures are aggregate and provide effective feedback on gaining an appreciation of overall performance improvement.

Table 2.1: Perspective of four main performance measurements

Perspective	Measures
1. Accounting and Finance	Cash flow planning Profitability Gross profit margin ROE ROA Operating profit margin Asset EPS Net profit margin Residual income
2. Marketing	Marketing return on investment Marketing activity Customer satisfaction Customer loyalty
3. Operations management	Quality Dependability Speed Flexibility Cost
4. Supply chain management	Prove dysfunctional Customer and supplier profitability report

Source: Summarised from Neely (2007)

So management accounting has implications, particularly in organisational performance improvement to focus on process improvement and cost management. Business is the set of activities that combine processes to create products and services for customers (Dooley, 2007). In terms of process improvement, prior to improving the process, it is necessary to realise the current situation and consider any weak stages in the processes (Dooner et al., 2001). Cost management systems concentrate on the identification and eradication of non-value-added activities (Langfield-Smith et al., 2009). Drury (2005) reiterated that cost management focuses on cost reduction and continuous improvement. Therefore, it can be implied that cost management includes the actions that are taken by managers to reduce costs.

Activity based costing (ABC) has been a high-profile management accounting technique worldwide over the last 25 years (Jankala & Silvola, 2012). Pike et al. (2011: 65) states “ABC has been applied in a wide variety of commercial manufacturing businesses, public utilities, wholesale and retail organisations and a range of service firms”. “The benefits of ABC system and its impacts on companies’ performance have motivated numerous empirical studies on ABC systems and it is considered as one of the most-researched management accounting areas in developed countries" (Fei & Isa, 2010: 144). The term ABM or ABCM (activity-based cost management) is used to describe the cost management applications of ABC (Drury, 2005).

ABC began with the work of Robin Cooper and Robert Kaplan as a substitution for traditional cost methods (Cooper & Kaplan, 1999; Maelah & Ibrahim, 2006). It is designed to address the problems with traditional costing by identifying cost drivers. Designation of cost drivers allows an organisation to gain better quality information in order to understand the behaviour of an activity and specify the root causes of overhead costs (Maelah & Ibrahim, 2006; Tseng & Lai, 2007). ABC, therefore, concentrates on exact information about the "true cost" of products, services, processes, activities and customers. In other words, an ABC system focuses on activities involved in production of a product/service and the consumption of those activities (Mansor et al., 2012). It provides a detailed mechanism that assists managers in understanding how the organisation's activities affect costs. During ABC analysis, organisations gain a deeper understanding of their business processes, cost behaviour (Drury, 2005), and cost structure (Mansor et al., 2012).

Understanding the costs of each activity is useful; an organisation can identify activity as either valued-added or non-value-added (Drury, 2005). The non-value added activity may possibly be eliminated; this is an opportunity for cost reduction. Additionally, "ABC can help identify the drivers of quality problems by highlighting the quality-related non-value-added activities, which can therefore facilitate quality improvement" (Maiga & Jacobs, 2008: 535). Ittner (1999) referred to Cooper et al. (1992) and indicated that some organisations ranked all activities in the ABC system based on customer value. This was a useful supplement as it focused on improving and eliminating the low customer value activities. This implies that the ABC concept can be used to identify non-value-added activities and quality improvement opportunities along the value chain. In addition, due to the customer's preference to purchase the product or/and service of the lowest price as well as having satisfactory quality, this is also a chance for organisations to increase sales, and consequently increase profitability.

In the past two decades, ABC literature has featured ABC from different perspectives (Mansor et al., 2012). The research topics contain "the diffusion levels of ABC in various countries, the reasons for adopting ABC, the problems associated with ABC and critical success factors relating to its successful implementation" (Sartorius et al., 2007: 2). However, Elhamma (2015: 5) stated that in the ABC literature "the studies on its performance are still insufficient". Banker et al. (2008: 2) also supported the view that "a more rigorous approach is needed to measure the impact of ABC" on performance.

Within this stream of literature, Cagwin and Bouwman (2000) found ABC demonstrated a positive relationship with ROI improvement when ABC was employed concurrently with other initiatives, because "ABC often provides more and better information about processes, ABC may be most beneficial if other initiatives are employed concurrently" (Cagwin & Bouwman, 2000: 10). The researchers recommended further research was needed to investigate which combinations of initiatives provide a positive effect when used with ABC. In addition, Banker et al. (2008) asserted ABC alone may not transform a firm into a world-class competitor but information from ABC can help a firm make strategic decisions (Gupta & Galloway, 2003). Jankala and Silvola (2012: 518) recommended studying ABC with "some other management practices such as balanced scorecard, just-in-time production, enterprise resource planning systems, for example" as the package.

Hence, ABC might be the most advantageous in organisational improvement if other initiatives are used concurrently. It is therefore a valuable system when supporting other systems by considering activities and cost drivers as follows:

(1) Highlighting the valuable activities and the non-value activities (Innes & Mitchell, 1995). These non-value activities could be eliminated for cost reduction (Anderson & Young, 1999).

(2) Providing more accurate information for making decisions on processes which require improvements (Gupta & Galloway, 2003): for example, quality improvement opportunities (Ittner, 1999), and effective operations decision-making processes (Gupta & Galloway, 2003).

(3) Examining all activities that are truly relevant to production and determining what portion and value of each resource is consumed (Gupta & Galloway, 2003).

In this study, ISO 9000 is addressed when used concurrently with ABC, that is, they may act in combination to provide a synergy effect to enhance organisational performance, for the following reasons:

(1) ABC and ISO 9000 are similar in their emphasis on documenting and managing activities (Larson & Kerr, 2002). Many processes considered in the achievement of ISO 9000 registration are also necessary to implement ABC (Larson & Kerr, 2007).

Grieco and Pilachowski (1995) and Hilton et al. (2000) also supported the idea that there are benefits to combining ABC and ISO 9000. Both require documentation of the organisation’s processes; however, ISO 9000 certification may be relatively straightforward when compared to the activity list of an ABC system.

(2) “Activity-based costing causes managers to look closely at the relationships among resources, activities, and cost objects, especially analysing the unit’s production processes” (Horngren et al., 2008: 151). Similarly, ISO 9001 is based on a process orientation approach to managing organisational activities (Yu et al., 2012). Within an ISO 9001 framework, and with ABC activities organisations can be considered as chains in interlinked processes along a firm’s value chain.

It is noticeable that both ABC and ISO 9000 support the process management, horizontal orientation of business management. They both take a process view; though, in breaking down the processing activities, ABC might require greater detail.

(3) ISO 9000 is part of a process improvement programme (Gershon, 2010). ISO is related to total quality management (TQM). “With TQM, the quality movement began, and the notion of continuous improvement entered the consciousness of management” (Gershon, 2010: 62). TQM was established using the 14 points of Deming. “Deming and Juran had contributed to building Japan’s success in the 1950s and 1960s and it was appropriate that they should set down their ideas for how organisations could achieve success” (Oakland, 2003: 18). TQM aims “to provide a quality product to customers, which will, in turn, increase productivity and lower cost” (Besterfield et al., 1995: 3)

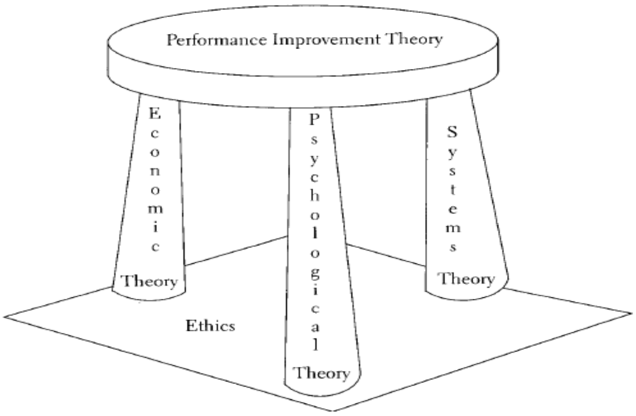
Just as the quality management system (QMS) actively works to improve business performance, ISO 9000 also provides a sound basis for QMS (Munro-Faure et al., 1993). Eight principles in ISO 9000 were indicated to "be used by top management as they lead their organisations and improve performance" (Oakland, 2003: 209). Furthermore, ISO 9001 "promotes the adoption of a process approach when developing, implementing and improving the effectiveness of a quality management system, to enhance customer satisfaction by meeting customer requirements." (ISO 9001, 2008: V). "Certification programs will always be important and ISO is a very helpful one with regard to quality" (Gershon, 2010: 67).

This study believes that using ABC as process improvement and cost management, while also implementing ISO 9000 certification as process improvement, can lead to the performance improvement of organisations. The ABC research recommends that adopting ABC helps organisations in their decision-making to accomplish organisational performance improvement (Cooper & Kaplan, 1999). "The information elicited through ABC is stated to be especially beneficial to firms facing diminishing financial performance" (Jankala & Silvola, 2012: 501). Similarly, ISO 9000 provides the direction for systematic and continual improvement in overall organisational performance (ISO 9004, 2009). Both initiatives seem to be powerful systems increasing organisational performance. ISO 9000 provides important information about all processes in conducting products and services which help ABC in specifying the set of activities and allocation of costs.

As an initial step in the research of any empirical phenomenon, a theoretical foundation for the study is important. Various theories support the idea that ISO 9000 and ABC are complementary. Performance improvement (PI), is wider than an individual group of theoretical practices. In other words, performance improvement is wider than covered by any single theory.

Swanson (1999: 9) described the theory of improvement as deriving from three theoretical fields: "economic theory, psychological theory and systems theory". The researcher proposed "the theoretical foundations of performance improvement theory" (Swanson, 1999: 12), as shown in Figure 2.1.

Figure 2.1: The theoretical foundations of performance improvement theory



Source: Swanson (1999: 12)

Three specific economic theory perspectives are applicable to performance improvement - “scarce resource theory, sustainable resource theory, and human capital theory” (Swanson, 1999: 12). While “gestalt psychology, behavioral psychology, and cognitive psychology” (Swanson, 1999: 14) are proposed as the most appropriate psychological theory perspectives for performance improvement. Finally, three particular system theory views are suggested as suitable: namely, “general systems theory, chaos theory and futures theory” (Swanson, 1999: 16). Additionally, ethics is considered as a vital support for the body of knowledge for performance improvement (Swanson, 1999).

This study will employ *scarce resource theory*, *general systems theory* and *contingency theory* with the objective of the explanation of the relationship between ABC, ISO 9000, and organisational performance.

Scarce resource theory

Scarce resource theory suggests that there is only a limited number of available resources, such as money, time, workers, machines, factories, and raw materials, etc. Therefore, choices have to be made by selecting the best alternative to gain the most advantage with limited resources (Swanson, 1999).

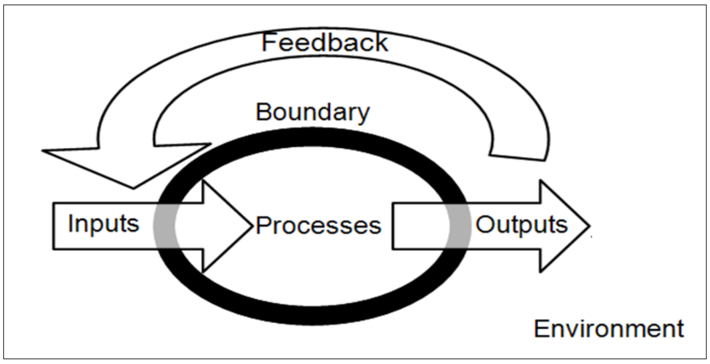
As this study focuses on management accounting and quality management, particularly the ABC and the ISO 9000 system, if an organisation has adopted ABC, it is possible that ABC was selected as the best decision support system concerning organisational performance. Similarly, if ISO 9000 was implemented in some organisations, it can imply that ISO 9000 is beneficial in supporting organisation management. Thus, scarce resource theory supports the individual impact of ABC and ISO 9000 on performance in that applying ABC and ISO 9000 an organisation could gain additional performance. In other words, it is possible that management adopted either an ABC or ISO 9000 initiative because they believed ABC and ISO 9000 can improve organisational performance.

Cagwin and Ortiz (2005) referred to previous studies and concluded that researchers frequently recommended using ABC and other system initiatives that supplement each other instead of necessarily existing separately. As a result, they support each other, improve the effectiveness of each and together raise performance to a greater level. ISO 9000 certification is considered for use with ABC in this case due to the ISO 9000's process-orientation approach. All activities in organisations can be viewed as chains of interconnected processes (Yu et al., 2012). Regarding scarce resource theory, an organisation will adopt both ABC and ISO 9000 if they are viewed as effective complementary initiatives that increase organisational performance with given resource constraints.

General systems theory

In 1940, the concept of general systems theory (GST) was introduced, encouraged by Ludwig von Bertanlanffy, but it was not widely known until the 1960s. Bertalanffy (1968) defined a system as the complicated set of interacting components. In GST, a fundamental theory is its concentration on interactions: in other words, the fundamental systems-interactive paradigm consists of organisational analysis characteristics – that is, the continual stages of input, process, and output that illustrate the concept of openness/closeness. The core of general systems theory is concerned with inputs, processes, outputs, and feedback (Swanson, 1999), as presented in Figure 2.2. In addition, it indicates that there are systems, subsystems, and that all these systems are open systems. Swanson (1999: 6) points out "General systems theory helps professionals from being drawn into espoused performance theories that have little substance".

Figure 2.2: Simple system model



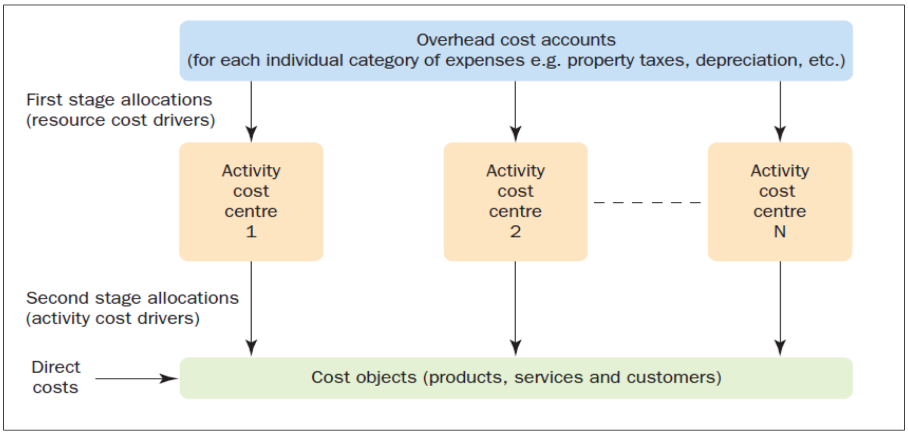
Source: adapted from Bertalanffy (1968)

The output of a system can be presented in terms of goods/services. In particular, Swanson (1999: 5) indicated that "the actual fulfilment of the goods or services requirement is thought of in terms of units of performance. These goods or services units of performance are usually measured in terms of quantity, time, and quality".

This study mainly focuses on processes and outputs. "The output from a process is that which is transferred to somewhere or to someone - the customer" (Oakland, 2003: 12). ABC and ISO 9000 are both concerned with the process approach, as shown in Figures 2.3 and 2.4. Cohen (2002: 14) explained that ABC is "widely seen to provide a better understanding of what processes were being performed and how these processes react to different inputs and variables…when problems did occur the users had the necessary data at their fingertips to simulate trade-offs that could quickly highlight potential corrective action". Similarly, in terms of ISO 9000, "for an organisation to function effectively, it has to determine and manage numerous linked activities. An activity or set of activities using resources, and managed in order to enable the transformation of inputs into outputs, can be considered as a process. Often the output from one process directly forms the input to the next" (ISO 9001, 2008: V).

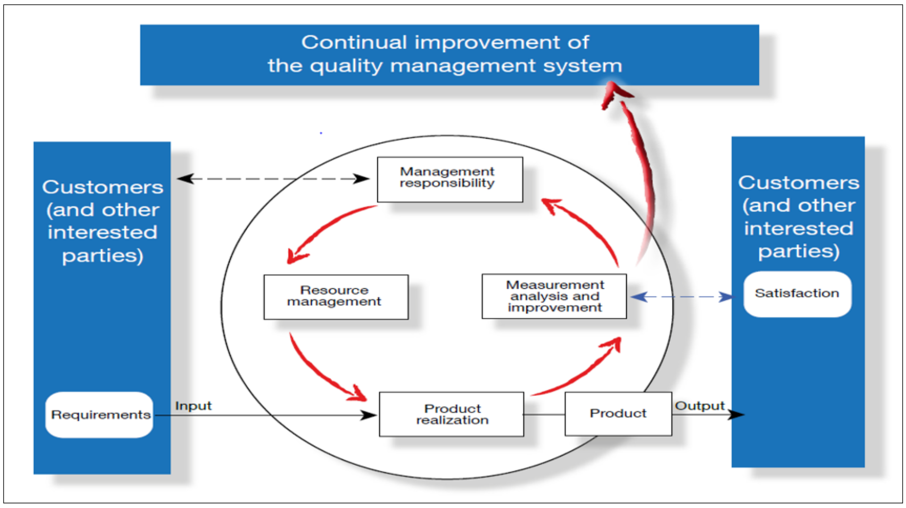
An organisation is viewed as a system; each activity is a sub-system. ABC and ISO 9000 relate to process and the appropriate sequence of these processes in the system. In order to improve performance, the organisation needs to ensure that each process is effective. The benefits of ABC and ISO 9000 depend on the extent to which they become incorporated sub-systems. They are expected to be beneficial in processing activities as a “synergy effect” (discussed next) and subsequently contribute to performance improvement.

Figure 2.3: Activity-based costing process



Source: Drury (2015: 260)

Figure 2.4: The ISO 9000 process



Source: ISO 9001 (2008: VI)

Synergy effect

Synergy effect is explained as “the combined return of the whole is greater than the sum of the returns from the individual parts” (Knoll, 2008: 14). “When complementary activities are undertaken, they must all be done together to achieve maximum effect” (Milgrom & Roberts, 1992: 118). Hence, it is possible that the organisational performance improvement occurs when both ABC and ISO 9000 are adopted; it is greater than the performance of the organisations that adopted only ISO 9000 or ABC.

The process approach is highlighted in both ABC and ISO 9000. ISO 9000 promotes the development of formal internal processes for continuous quality improvement. It provides both general information and specific procedures in producing products/ services. It underlines the important need of considering the value-added processes (ISO 9001, 2008). Similarly, the ABC concept aims to allocate resource costs to products based on activity consumption (Van Tiem et al., 2012). ABCM emphasises non-value-added activity and value-added activity. The ISO 9000 procedure helps ABC increase the degrees of information and accuracy in calculating product/service costs. Thus, ABC and ISO 9000 are complementary in relation to the following steps:

(1) In the first step of ABC, overhead costs will be categorised into cost pools, such as orders, machine set-up, packaging, and inspection. Although ISO 9000 processes do not provide directly the cost amount of each cost pool, ISO 9000 documentation concerns an activity and set of activities related to resources. This information can be used when considering the appropriate cost pools.

(2) The next step of ABC is to find out the specific activities performed by product/ services in order to identify cost drivers or structural determinants of the organisation’s activities. ISO 9000 provides details of the necessary components of a formal quality assurance system, such as activities or a set of activities.

(3) These activities can be grouped into specific categories, such as administration, manufacturing, and maintenance. The next step is classifying the activities into value-added activity and non-value-added activity. Rather than being based on only an accounting classification, the ISO 9000 concept helps highlight the interaction of cost drivers, increasing the understanding of cause and effect activities, rather than being based on only an accounting classification.

Similarly, the steps of ISO 9000 include determining the major activities linked to manage the quality of the activities before processing inputs into outputs. It assists ABC in determining the activities in relation to product/service by providing the consumption of each product/service, or customer requirement. In the meantime, ABC helps identify the non-value-added activities, leading to improvement in the ISO 9000 procedure, and consequently decreases costs because of the elimination of non-value-added activities and improvement of organisational efficiency.

(4) In calculating product/service costs, activity rate equals cost pools divided by cost drivers. It thus provides details relating the cost of each activity, then the calculating product/ service costs by using the activity rate of each activity and the number of units which the product/service consumed. In this process, the units of product/service which each activity consumed likely came from ISO 9000 documentation.

In general systems theory (GST), the system is viewed as either closed or open: “An open system recognises the dynamic interaction of a system with its environment” (Robbins & Barnwell, 2002: 11). This environment might include government, financial institutions, labour force, and supplier etc. (Robbins & Barnwell, 2002). However, in this study, environment variables are assumed to be equal under the *ceteris paribus* assumption, discussed next.

Ceteris Paribus

Ceteris paribus means that other things stay the same or other things are held constant or equal. “The *ceteris paribus* condition in economic theory assumes that the world outside the environment described by the theoretical model does not change, so that it has no impact on the economic phenomena under review” (Bierens & Swanson, 2000: 223).

In general systems theory (GST), this study mainly focuses on processes (independent variables: ABC and ISO 9000) and output (dependent variables). However, most economic variables are usually affected by more than one cause, but models often depend on an assumption of independent variables. According to the *ceteris paribus* tautology, this study intends to hold constant these factors other than ABC and ISO 9000, so the effect of ABC and ISO 9000 on organisational performance is in isolation, assuming other factors constant such as law regulation, inflation rate, and other initiatives.

Contingency theory

Contingency theory (CT) has contributed importantly to different research areas, such as management accounting (Sofiah Md & Langfield-Smith, 2005; Al-Omiri & Drury, 2007) and operations management (Jayaram et al., 2010; Zhang et al., 2012; Ashidirad et al., 2013).

Contingency theory indicates any operations system and organisational management are unequally effective in all environments and contexts (Drazin & Van de Ven, 1985). This means a particular context could contribute to a particular system more than in other contexts. "One of the most important concepts in this theory is fit" (Donaldson, 2001: 313). Venkatraman (1989) introduced the operationalisation of "fit" within the contingency theory by focusing on six perspectives: namely, fit as moderation, matching, mediation, profile deviation, gestalts, and covariation. The two most frequently used variants are the moderation approach and the mediation approach in the strategy management accounting system literature (Gerdin & Greve, 2004).

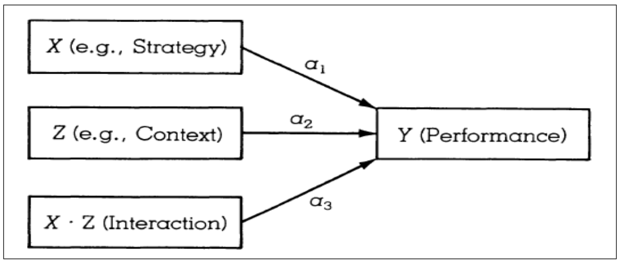
The first stream of fit is "fit as moderation". The moderator is determined as "a qualitative or quantitative variable that affects the direction and/or strength of the relation between an independent and dependent or criterion variable" (Baron & Kenny, 1986: 1174). As shown in Figure 2.5, "in a formal representation Z is a moderator if the relationship between two (or more) variables, say X and Y, is a function of the level of Z" (Venkatraman, 1989: 425). The fit between the independent variable and the moderating variable is the primary determinant of the dependent variable.

Contingency factors

The current study views "fit" as moderation. It is believed that not all organisations received the same organisational performance from using ABC or implementing ISO 9000 or both; rather, it depends on various variables which might affect the strength of the relation between ABC, ISO 9000, and organisational performance.

Based on the literature, the moderator variables including type of business, size of business, age of ABC, age of ISO 9000 and frequency of ABC use are used as potential significant influential factors. Greater detail as well as the rationale behind the choice of these moderators, is discussed in Section 2.5.

Figure 2.5: A diagram representation of fit as moderation



Source: Venkatraman (1989: 425)

In summary, this study employs scarce resource theory, general systems theory, and contingency theory as explanations of the relationship between ABC, ISO 9000 and organisational performance in relation to moderating variables. In addition, these relevant theories were used to interpret the results in this study. Synergy effect is applied as the explanation of the combined effect of ABC and ISO 9000, particularly in the process approach. While the *ceteris paribus* tautology implies the impact of ABC and ISO 9000 on organisational performance are isolated.

2.2 The impact of the extent of activity-based costing use on organisational performance

Activity-based costing (ABC) was developed early 1980s, followed by various publications (Kaplan & Johnson, 1987). It began with the work of Robin Cooper and Robert Kaplan as a substitution for traditional cost methods (Cooper & Kaplan, 1999; Maelah & Ibrahim, 2006). ABC is defined by CIMA official terminology (CIMA, 2008) as "An approach to the costing and monitoring of activities which involves tracing resource consumption and costing final outputs. Resources are assigned to activities, and activities to cost objects based on consumption estimates. The latter utilise cost drivers to attach activity costs to outputs".

Traditional costing captures the same cost per unit without consideration of change in both size, set-up times and economy of scale (Vercio & Shoemaker, 2007). The traditional approach may distort product and service costs. Traditional costing looks at what was spent, while ABC focuses on resources consumed in terms of activities (Rasiah, 2011).

ABC is designed to address the problems with traditional costing by identifying cost drivers. At the heart of ABC is the cost accumulation model (Hicks, 1992), Drury (2015) illustrated a two-stage allocation process for ABC. The first stage concerns the allocation of original indirect resources costs to activity cost pools, such as activity cost centres 1, 2, and 3. The second stage is relevant to the allocation of activity costs to the products, services and customers. A cost driver will be chosen for each activity centre. Horngren et al. (2008: 154) concluded "the cost objects in the first stage are activities, and the cost objects in the second stage are the products". Designation of cost drivers allows an organisation to gain better quality information in order to understand the cost behaviour of an activity and specify the root causes of the overhead costs (Maelah & Ibrahim, 2006; Tseng & Lai, 2007). ABC, therefore, concentrates on more exact information about the "true cost" of products, services, processes, activities and customers. During ABC analysis, organisations gain a deep understanding of their business processes and cost behaviour. Management then applies this insight to improve decision-making at the operating and strategic levels; this is known as activity-based management (ABM). Simply put, ABM is ABC in action (CIMA, 2008).

> "ABC may be thought of as a theory of cost accounting if we consider that following certain cost assignment procedures accounting produces more useful information for managerial decision-making. Improved decision-making is assumed to lead to better performance. Hence, the theory of ABC, or more broadly, the theory of cost accounting explains how cost accounting should be done, and why, to ensure better performance" (Malmi & Granlund, 2009: 607)

However, Malmi and Granlund (2009) considered ABC is not a theory but a tool: "It might be better to refer to the theory of cost accounting, or theory of product costing, instead of the theory of ABC" (Malmi & Granlund, 2009: 607).

Drury and Tayles (2005) described the themes of research studied in the ABC literature. Their explanation of the development of ABC and first concerned the theory, followed by the features and applications of ABC and the extent of ABC use.

Other issue referred to the function of ABC and using a contingency approach, investigating the antecedents of ABC employment and non-ABC employment, and the organisational factors effecting achievement and failure of ABC systems. The final theme was testing the relationship between adopting ABC and financial performance improvement.

Related to the final stream, Kennedy and Affleck-Graves (2001), revealed that organisations that adopted ABC accomplish higher abnormal returns than organisations that did not adopt ABC at approximately 27 percent. Ittner et al. (2002) reported that ABC had a positive association with quality levels and cycle time. Banker et al. (2008) also found an impact of ABC on costs and time improvement. However, these studies focused on the usage of ABC versus non-usage of ABC (a 0-1 variable). This might not adequately explain the ability of ABC to influence performance since ABC can be used for various different purposes. As Swenson (1995: 8) reported, “the applications of ABC techniques were quite varied, and the participants represented a wide variety of industries, yet each firm appeared to benefit from at least one dimension of its ABC system”. This suggests organisations can receive benefit from using ABC for either one particular purpose or more than one purpose.

Swenson (1995) described the ABC applications by all firms in his sample as product costing, pricing decisions, customer profitability, sourcing decision, performance measurement, cost reduction, product design, and process improvement. Likewise, Krumwiede (1998) indicated the purposes of using ABC as product costing, cost reduction, pricing decisions, budgeting, outsourcing decisions, performance measurement, and others. Innes et al. (2000) and Cotton et al. (2003) defined ABC applications as cost reduction, performance measurement, product/service pricing, cost modelling, budgeting, output decision, customer profitability analysis, stock valuation, new product/service design, and other applications. Cagwin and Bouwman (2002) defined purposes of using ABC as including product costing, outsourcing decisions, pricing decisions, budgeting, product mix decisions, determining customer profitability, cost management, as an off-line analytic tool, and performance measurement. So a number of researchers used very similar categories.

Cagwin and Bouwman (2002) found that organisations tended to employ ABC for various purposes with statistical significance. Cost reduction and product costing showed the highest levels of employment, whereas outsourcing decisions showed the least use. The findings supported the idea that there were different degrees of using ABC for specific purposes among organisations. This might have an effect on whether ABC impacts on organisational performance or not. Therefore, it would be interesting to investigate the extent of ABC use in different contexts and consisting of different purposes. Interestingly, it leads to particular questions, such as: for which purposes do organisations mainly employ ABC? Is ABC employed for a wide range of different purposes? In addition, does ABC use for different purposes impact performance?

Maiga and Jacobs (2008: 539-540) referred to Cagwin and Bouwman (2002) and concluded that "one would expect the benefits received from an innovation, such as ABC, to depend on the extent to which it becomes incorporated into an organisational sub-system". Thus it is possible that using ABC for more purposes might yield higher performance improvement than others.

In previous studies Maiga and Jacobs (2008) pointed out that the extent of ABC use was defined as the breadth of use. Jankala and Silvola (2012) defined the extent of ABC use as frequency of use. In contrast to Maiga and Jacobs (2008), Jankala and Silvola (2012), in this research, the definition of "*The extent of ABC use"* is determined into two parts: first is the meaning of "*the extent of*", and the latter is "*ABC use". "The extent of"* is generally defined as "the degree of something", while the Cambridge Dictionary defines "*use"* as "a purpose for which something is used". Consequently, "*The extent of ABC use"* is defined as "the degrees which ABC is used".

Previous studies have examined the **relationship/association** between ABC (in different contexts) and organisational performance (in different measures) as follows:

Cagwin and Bouwman (2002) indicated that there was no direct relationship between ABC and return on investment (ROI) with p-value of 0.348 ($P>0.05$). On the other hand, there was a positive relationship between ABC and the improvement of return on investment (ROI) once ABC was employed concurrently with alternative initiatives. They qualified this finding as applicable when used in complex and diverse firms, where implemented in environments, where costs were particularly crucial, and where there were limited numbers of intra-company transactions. This provides evidence that there was no relationship between using ABC alone and ROI. On the contrary, results showed the impact of ABC complementary with other initiatives (TQM, JIT, BPR, CIM, JIT, FMS, TOC and VCA, complexity and diversity) was significant at 0.05 (more details are discussed in Section 2.4).

Ittner et al. (2002) examined the association between ABC and performance by focusing on extensive use (1=yes and 0=no) rather than a continuum of ABC use levels. They found ABC use had no significant relationship with return on assets (ROA). On one hand, the results showed that ABC use demonstrated positive impact on time improvement at a highly significant level ($P<0.001$). ABC use was also positively associated with quality levels at weak significance ($P<0.10$), whereas ABC use was not positively associated with cost reduction. However, cost reduction was indirectly associated with ABC use via quality and cycle time ($P<0.001$).

Cagwin and Ortiz (2005) studied whether a context-specific benefit was received from using ABC with the initiatives, such as technology integration (TI) and supply chain management (SCM). ABC was measured by a single survey item. Multiple regression results showed an insignificant association between ABC and financial performance (proxied by ROA). However, the impact of ABC complementary with SCM was significant ($P<0.05$), and also with TI at a weak significance ($P<0.10$).

Maiga and Jacobs (2008) investigated whether the extent of ABC use contributes direct profitability improvement or indirectly through plant operational performance. In this case, the extent of ABC use was operationalised as consisting of design manufacturing, manufacturing engineering, product management, and plantwide. They found that extent of ABC use had significant association with the improvement of quality ($P<0.001$), the improvement of cycle time ($P<0.001$), and the improvement of cost ($P<0.05$). Conversely, the extent of ABC use had no significant association with profitability (consisting of market share, turnover on assets, return on sales and ROA). However, extent of ABC use was indirectly related with profitability via operational performance measures (improvement of quality, improvement of cycle-time, and improvement of cost). In addition, the extent of

ABC use was indirectly related with the improvement of cost via improvement of quality and improvement of cycle-time.

Jankala and Silvola (2012) examined the relationship between the extent of ABC use and financial performance (namely sales and ROI) in small firms. The results showed that the extent of ABC use had a positive relationship with subsequent sales improvement over the two following years ($P<0.10$). On the one side, results showed an insignificant relationship between the extent of ABC use and return on investment (ROI). However, the extent of ABC use had a positive indirect relationship with return on investment (ROI) via sales growth over two following years ($P<0.001$). Jankala and Silvola (2012: 515) concluded that “more extensive ABC use has a positive lag in sales growth that also impacts positively on ROI”.

Hardan and Shatnawi (2013) examined the relationship between ABC and performance in Jordan. The results were based on a questionnaire survey and structured interviews. This research found that there was a significant positive relationship between employing ABC and the reduction in expenses of telecom organisations, which subsequently led to profitability improvement.

Subsequently, concerns with ABC literature about the **impact** of ABC and performance are as follows.

Banker et al. (2008) studied the effect of ABC on world-class manufacturing practices (WCM) and performance (cost, quality and time). The researchers indicated ABC had no direct impact on overall plant performance but was significant on individual measures such as cost ($P<0.05$) and time ($P<0.10$). Results showed the impact of ABC, complementary with WCM, was not significant (greater detail is discussed in Section 2.4). On the other hand, ABC had an indirect impact on plant performance via world-class manufacturing (WCM) practices ($P<0.01$). In addition, ABC had a significantly indirect impact on return on assets (ROA) via WCM. This study recommended that organisations could reap significant advantages by adopting ABC with other advanced manufacturing practices (such as JIT, TQM, pull system, competitive benchmarking, continuous process improvement, and self-directed teams).

Zaman (2009) investigated the impact of using ABC on overall organisational performance based on survey strategy. All respondents were ABC-organisations. The independent variables were strategic cost allocation method, increased efficiency and increased effectiveness, whereas overall performance was the dependent variable. The regression findings were significantly positive at 5 percent significance. ABC use (strategic cost allocation method, increased efficiency, increased effectiveness) impacted on increased overall performance. The multiple correlation coefficient value of 0.924 implied that there was a strong relationship between the predicted values of the dependent variable and the observed variables.

It appears that little emphasis is devoted to investigating the impact of ABC on organisational performance, especially in the context of the degrees to which ABC is used. All relevant studies are summarised in Table 2.2 below, by classifying impact/influence, relationship/association, and significant difference studies, respectively.

Table 2.2: The ABC literature in terms of impact/influence, relationship/association, and significant differences

Authors (impact/influence)	**Classifying group**	**Financial Performance**								**Marketing Performance**	**Operational Performance**				
		S	**ROA**	**ROI**	**HPR**	**CAR**	**ROS**	**TOA**	**P**	**MS**	**C**	**E**	**EF**	**Q**	**T**
Banker et al. (2008)	-Using or not		I								D/I			ND/I	D/I
Zaman (2009)	-Using ABC	D										D	D		
Authors (relationship/association)	**Classifying group**														
Cagwin and Bouwman (2002)	-Using (Breadth of ABC use, Depth of ABC use, Integration in evaluation systems, Time since implementation.) -Not using ABC			ND											
Ittner et al. (2002)	-Using or not		ND								ND/I			D	D
Cagwin and Ortiz (2005)	-Using or not		ND												
Maiga and Jacobs (2008)	-Using (Breadth of ABC use) -Not using ABC		ND/I				ND/I	ND/I		ND/I	D/I			D	D
Jankala and Silvola (2012)	-Using (Frequent use) -Not using ABC	D		ND/I											
Hardan and Shatnawi (2013)	-Using ABC								D						
Authors (significant difference)	**Classifying group**														
Kennedy and Affleck-Graves (2001)	Using or not				/	/									
		2	4	2	1	1	1	1	1	1	3	1	1	3	3

Note: D: direct impact/association, **I**: indirect impact/association, **ND:** no direct impact/association, **NI**: no indirect impact/association

S: sales **ROA:** return on assets (ROA) **ROI:** Return on investment **HPR:** Holding Period Returns **CAR:** Cumulative Abnormal Returns **ROS:** Return on Sales **TOA:** Turnover on Assets **P:** Profitability **MS:** Market Share **C:** Cost **E:** Efficiency **EF:** Effectiveness **Q:** Product/service quality **T:** Time improvement

To sum up, previous studies studied both the relationship and impact of the extent of ABC use and organisational performance in different contexts such as measuring ABC and organisational performance differently, employing methodology differently, etc., the finding were as follows.

In financial performance, Zaman (2009) found ABC impacted on overall revenues. In addition, Jankala and Silvola (2012) indicated that the extent of ABC use was positively related with subsequent performance (sales growth over two immediate years). Hardan and Shatnawi (2013) reported the association between ABC and profitability. Recently, Maiga (2014) found that ABC adoption was related to profitability by employing econometric analysis.

On the other hand, Cagwin and Bouwman (2002) concentrated on the financial performance results of ABC in relation to use with the initiatives. They reported that there was no evidence indicating the direct association of ABC and return on investment (ROI). However, ABC had a positive relationship with improvement in ROI when ABC was used various other initiatives.

Ittner et al. (2002) and Cagwin and Ortiz (2005) examined the association between ABC and return on assets (ROA). They reported that there was no significant association. Moreover, Maiga and Jacobs (2008) indicated that the extent of ABC use had no significant positive relationship with profitability. Similarity, Jankala and Silvola (2012) indicated no positive direct association between the extent of ABC use and return on investment (ROI).

Based on the studies above, there was both the association (Ittner et al., 2002; Cagwin & Ortiz, 2005; Hardan & Shatnawi, 2013; Maiga, 2014) and the impact (Banker et al., 2008) of ABC on performance by measuring ABC in category scale (a 0–1 variable), namely ABC-adopter and non-ABC adopter, in a continuum of ABC adoption levels by applying only one indicator (Jankala & Silvola, 2012) in the three dimensions of ABC implementation (Zaman, 2009). A few studies measured ABC in term of a construct, such as Cagwin and Bouwman (2002), Maiga and Jacobs (2008), and Zaman (2009). There was no study investigating ABC in terms of the degrees which ABC is used (the extent of ABC use).

According to the mixed results mentioned above about the association and impact between ABC and financial performance, this issue needs further examination. Hence, this current study proposes the following hypothesis:

H1: The extent of ABC use has positive impact on financial performance

In term of operational performance, the ABC literature highlights three potential aspects of operational advantages, such as lower costs (Anderson & Young, 1999), improving quality, and time (Bescos & Charaf, 2013). Ittner et al. (2002) found ABC use had a positive relationship with quality and cycle time. Maiga and Jacobs (2008) found that extent of ABC use was significantly related with improvement of quality, cycle time and cost. Similarly, Maiga (2014) found that ABC adoption was related to quality, cycle time and cost. In addition, Banker et al. (2008) indicated a direct impact of ABC on costs and time. Apart from three potential types of operational benefits, Zaman (2009) found that ABC could lead to increased efficiency and effectiveness.

On the other hand, there was no association between operational performance, particularly costs and ABC, according to Ittner et al. (2002). Moreover, Banker et al. (2008) revealed that there was no impact of ABC on quality. The findings however were still inconclusive; thus, it needs further investigation. Therefore, the following hypothesis is suggested.

H2: The extent of ABC use has positive impact on operational performance.

There was only one previous study which found operational performance, such as cost, quality, and time, mediated between ABC and financial performance (Maiga & Jacobs, 2008). Apart from operational performance, Banker et al. (2008) reported that there was an indirect association between ABC and return on assets (ROA) through world-class manufacturing (WCM).

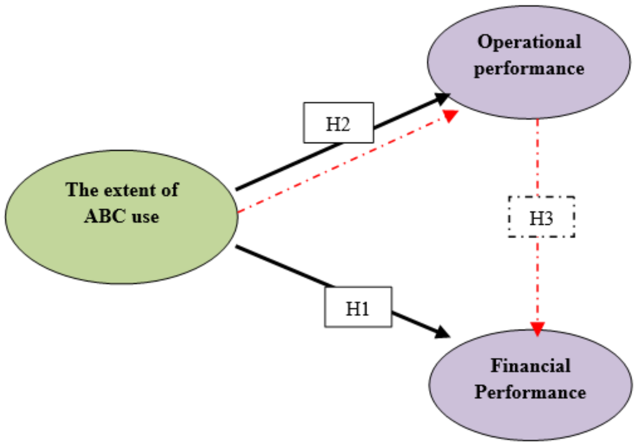
It is possible that ABC will impact on financial performance as mediation, through operational performance. Previous research has shown that ABC had a direct relationship and impact on operational performance, as per the studies of Ittner et al. (2002), Zaman (2009), Banker et al. (2008), and Maiga and Jacobs (2008), and ABC also had direct relationship and impact on financial performance as shown in the studies of Zaman (2009), Jankala and Silvola (2012), and Hardan and Shatnawi

(2013). It is possible that ABC may affect financial performance through operational performance. In short, it is appropriate to test the indirect impact of ABC on financial performance. Therefore, this study examines the following hypothesis.

H3: The extent of ABC use has positive impact on financial performance via operational performance.

In summary, hypotheses H1-H3 are depicted below in Figure 2.6

Figure 2.6: The impact of the extent of ABC use on organisational performance



2.3 The impact of the extent of ISO 9000 implementation on organisational performance

The ISO 9000 family deals with several aspects of quality management and includes some of ISO's best-recognised certifications. It was established by the International Organisation for Standardization, based in Geneva, Switzerland, and was launched in 1987 (Abraham et al., 2000). The standards provide guidance and tools for organisations that desire to assure that their products/services consistently satisfy the requirements of customers as well as maintaining consistent improvement of the quality (ISO 9000, 2015).

There are many separate standards or guidelines in the ISO 9000 series: for example, ISO 9000 concerns the basic concepts and language. ISO 9001 includes the basic requirements to achieve a quality management system (QMS). An organisation has to fulfil these requirements to demonstrate the ability to provide consistent products/ services enhancing customer satisfaction, meeting regulatory requirements, and applicable statutory regulations. ISO 9001 is used for ISO 9000 certification/registration. It has been organised in a user-friendly format with terms that are easily recognised by all business sectors (ISO, 2009).

ISO 9004:2009 “provides guidance to support the achievement of sustained success for any organisation in a complex, demanding, and ever-changing environment, by a quality management approach” (ISO 9004, 2009: E). This standard addresses both the requirements and expectations of all related parties. It also provides the direction for both systematic and continual improvement in organisational performance (ISO 9004, 2009). Based on ISO 9004, it can be concluded that following these principles can lead to organisational performance improvement.

Principle 1: Customer focus means that “organisations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations” (ISO 9004, 2009: 38).

Principle 2: Leadership means that “leaders establish unity of purpose and direction of the organisation. They should create and maintain the internal environment in which people can become fully involved in achieving the organisation's objectives” (ISO 9004, 2009: 39).

Principle 3: Involvement of people means that “people at all levels are the essence of an organisation and their full involvement enables their abilities to be used for the organisation's benefit” (ISO 9004, 2009: 39).

Principle 4: Process approach means that “a desired result is achieved more efficiently when activities and related resources are managed as a process” (ISO 9004, 2009: 40).

Principle 5: System approach to management means that “identifying, understanding and managing interrelated processes as a system contributes to the organisation's effectiveness and efficiency in achieving its objectives” (ISO 9004, 2009: 40).

Principle 6: Continual improvement means that “continual improvement of the organisation's overall performance should be a permanent objective of the organisation” (ISO 9004, 2009: 41).

Principle 7: Factual approach to decision-making means that "effective decisions are based on the analysis of data and information" (ISO 9004, 2009: 41).

Principle 8: A mutually beneficial supplier relationship means that "an organisation and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value" (ISO 9004, 2009: 42).

Recently, ISO 9001:2015 replaced previous editions (ISO 9001:2008). It introduces significant changes and was published in September 2015. All organisations that use ISO 9001 are recommended to transition to ISO 9001:2015. "ISO 9001:2008 certifications will not be valid after three years from publication of ISO 9001:2015" (IAF ID 9, 2015: 6). In other words, ISO 9001:2008 will not be eligible in 2019.

ISO 9001:2015 reduces the earlier existing eight principles to seven quality management principles. The fifth principle of the eight quality principles, *"System approach to management"*, no longer exists. The terms of some principles have been changed: for example, the term "*Involvement of People"* has been changed to "*Engagement of People".* "*Continual Improvement"* has been changed to "*Improvement*"**.** *"Factual approach to decision making"* has been changed to *"Evidence-based Decision Making"*. Finally, the term *"Mutually beneficial supplier relationships"* has been changed to *"Relationship Management"*. However, during data collection for the study in 2014, the standard was based on eight quality management principles, as mentioned above. Therefore, eight principles are studied in this current research.

Most previous empirical studies have focused on the requirements of implementing ISO 9001. However, "ISO 9001 certified organisations can implement the standard in very different ways" (Lee et al., 2009: 647). Lee et al. (2009) examined performance consequences (overall performance and behavioural performance) and contextual factors that were related with different ISO 9000:2000 principles. They found that organisations with differently implemented ISO 9000 had significantly different performance consequences (customer satisfaction, internal administration efficiency, the improvement of the quality cost, and the employee turnover rate).

Therefore, it will be interesting to investigate ISO 9000 in the context of implementing eight principles, as (ISO 9004, 2009) mentioned.

The definition of "*The extent of ISO 9000 implementation"* has been determined into two parts: first is the meaning of "*the extent of*", and the latter is "*ISO 9000 implementation".* The definition of "*extent*" is generally accepted as "the degree of something", whereas "*implementation*" is defined as "the act of putting something into effect". To sum up, "*the extent of ISO 9000 implementation"* is defined as *"*the degree of putting ISO 9000 into effect". The extent of ISO 9000 implementation operationalisation is discussed later in Chapter 3 (See section 3.2.2.2).

Previous studies have investigated the **association/ relationship** between ISO 9000 (in different contexts) and organisational performance (in different measures), as follows.

Naveh and Marcus (2005) tested hypotheses by applying hierarchical linear models (HLM). The study found two phases in employing ISO 9000: namely, 1) installation (external coordination and integration); and 2) usage (in daily practice and as a catalyst for change). The performance was explained in two dimensions (operational performance and business performance), which were tested against the measurement model by CFA. The researchers indicated that using ISO 9000 was positively associated with operating performance (lower defect rates, reduced cost of quality, higher productivity, on-time delivery, and customer satisfaction) and was positively associated with business performance (growth in sales and gross profit margins improvement). The indirect relationship between the usage and business performance was not fully supported, because cost of goods sold had an insignificant relationship. In addition, the result showed the high-usage ISO-9000-registered-organisations exceeded non-ISO-9000 registered-organisations in ROA.

Feng et al. (2008) developed an ISO 9000 relationship model in order to examine the association between ISO 9000 certification and organisational performance. The researchers focused on approaches for implementing ISO 9001: namely, planning for ISO 9000, organisational commitment, and implementing procedures. The results showed that the three approaches were strongly associated with operational performance (cost reduction, improvement of quality, increase of productivity, improvement of internal procedures, increase of customer satisfaction, improvement in employee morale) but demonstrated a weak positive association with business performance (increase of market share, improvement of corporate image, improvement of competitive advantage, increase of access to global markets, increase of profits).

Prajogo et al. (2012) tested the relationship among different aspects of ISO 9000 implementation, operational performance, and supply chain management practices. The study employed structural equation modelling (SEM) in order to test the research model and the hypotheses. The results showed there were three different aspects of ISO 9000 - 1) basic, 2) advanced, and 3) supportive implementation - and three aspects of supply chain management practices (internal processes, supplier relationships, and customer relationships). The research found that supplier and internal process management both had a positive association with operational performance, whereas customer process management had no significant association with operational performance (on time delivery, cost effectiveness, product innovation, or product performance).

Fatima (2014) studied the association between ISO 9000 and financial performance (gross profit, sales, net profit before tax, and net profit after tax) of ISO-registered organisations in Pakistan. The results concluded that ISO 9000 certification had an association with financial performance of medium firms and large firms, whereas there was no evidence of an association between ISO 9000 certification and the financial performance of small firms. Therefore, it could not indicate that ISO 9000 certification always leads to financial performance improvement in Pakistani organisations.

In the context of past **impact studies** of ISO 9000 on performance findings were interpreted as follows.

Jang and Lin (2008) concluded that depth of ISO 9000 implementation had a direct impact on operational performance (as measured by improvement of internal procedures, increase of productivity, cost reductions, improvement of employees' morale). It also indirectly influenced marketing performance (as measured by improvement of on time delivery, improvement of customer satisfaction, and improvement of perceived quality) and business performance (increased profitability) via operational performance. These results suggest a positive impact exists between ISO 9000 implementation and organisational performance.

Psomas et al. (2013) found that the three ISO 9000 objectives - namely, customer satisfaction focus, continuous improvement, and prevention of nonconformities - impacted on the product/service quality dimension (product/service quality, consistent and reliable products/services, product/service conformance to specifications), and the operational performance dimension (company efficiency, company productivity, process effectiveness). However, the financial performance (net profit, company financial results, profitability, cash flow from operations, sales growth) was not directly influenced by ISO 9000.

It appears that little emphasis has been placed on investigating the impact of ISO 9000 on organisational performance, especially in the context of the principles as ISO 9004:2009 mentioned. All relevant studies are summarised in Table 2.3 below, by classifying by impact/influence, relationship/association, and significant differences, respectively.

Table 2.3: The ISO 9000 literature in terms of impact/influence, relationship/association, and significant differences

Authors (impact/influence)	**Classifying group**	**Financial Per.**									**Marketing Per.**					**Operational Per.**																
		CFR	**P**	**CF**	**S**	**ROA**	**SP**	**GP**	**NPB**	**NPA**	**CS**	**MS**	**CI**	**GM**	**CL**	**IAE**	**CQ**	**C**	**ET**	**OE**	**PR**	**EF**	**Q**	**CR**	**CO**	**ID**	**EM**	**LD**	**CA**	**PI**	**PP**	**T**
Jang and Lin (2008)	Depth of implementation		I								I	I						D			D		ND/I			D	D					ND/I
Psomas et al. (2013)	Objectives	ND/I	ND/I	ND/I	ND/I				ND/I											D	D	D	D	D	D							
Authors (relationship/association)	**Classifying group**	**Financial Per.**									**Marketing Per.**					**Operational Per.**																
		CFR	**P**	**CF**	**S**	**ROA**	**SP**	**GP**	**NPB**	**NPA**	**CS**	**MS**	**CI**	**GM**	**CL**	**IAE**	**CQ**	**C**	**ET**	**OE**	**PR**	**EF**	**Q**	**CR**	**CO**	**ID**	**EM**	**LD**	**CA**	**PI**	**PP**	**T**
Naveh and Marcus (2005)	Usages				D/I		ND/I	D/I			D						D	N			D							D				D
Feng et al. (2008)	Approaches		D								D	D	D	D				D			D		D			D	D		D			
Prajogo et al. (2012)	Aspects																	I												I	I	I
Fatima (2014)	N/A				D			D	D	D																						
Authors difference	**Classifying group**	**Financial Per.**									**Marketing Per.**					**Operational Per.**																
		CFR	**P**	**CF**	**S**	**ROA**	**SP**	**GP**	**NPB**	**NPA**	**CS**	**MS**	**CI**	**GM**	**CL**	**IAE**	**CQ**	**C**	**ET**	**OE**	**PR**	**EF**	**Q**	**CR**	**CO**	**ID**	**EM**	**LD**	**CA**	**PI**	**PP**	**T**
Lee et al. (2009)	Principles										/					/		/	/													
Psomas and Kafetzopoulos (2014)	-Adopted -Non-adopted			/	/				/		/				/					/	/	/	/	/	/							
Naveh and Marcus (2005)	Usages					/																										
Total		1	3	2	4	1	1	2	3	1	5	2	1	1	1	1	1	5	1	2	5	2	4	2	2	2	2	1	1	1	1	3

Note: D: direct impact/association, **I**: indirect impact/association, **ND:** no direct impact/association, **NI**: no indirect impact/association

CFR: Company financial results **P:** profitability **CF:** Cash flow from operations **S:** Sales **ROA:** return on assets (ROA) **SP:** long-run stock price performance (buy-and-hold abnormal return) **GP:** gross profit **NPB:** net profit before tax **NPA:** net profit after tax **CS:** customer satisfaction **MS:** market share **CI:** corporate image **GM:** increased access to global markets **CL:** customer loyalty **IAE:** internal administration efficiency **CQ**: reduced cost of quality **C:** cost **ET:** the employee turnover rate **OE:** organisational efficiency **PR:** productivity **EF:** process effectiveness **Q:** product/service quality **CR:** consistent and reliable products/services **CO:** product/service conformance to specifications **ID:** improved internal procedures **EM:** improved employees' morale **LD**: lower defect rates **CA:** competitive advantage **PI:** product innovation **PP:** product performance **T:** time improvement

In summary, previous studies (see Table 2.3) found either the relationship or impact of the extent of ISO 9000 implementation and organisational performance in different contexts, as follows.

In financial performance, Naveh and Marcus (2005) indicated that using ISO 9000 was positively associated with financial performance, particularly in sales, and profit margin. Feng et al. (2008) also found the relationship between ISO 9000 and organisations' profits. Similarly, the findings of Fatima (2014) reported that there was a direct relation between ISO 9000 certification and financial performance (gross profit, sales, net profit before tax and net profit after tax) of medium organisations and large organisations.

However, Naveh and Marcus (2005) reported no direct association between ISO 9000 and financial performance, particularly in the long-run stock price. Moreover, Psomas et al. (2013) indicated that ISO 9001 had no significant direct impact on financial performance, namely, net profit, company financial results, profitability, cash flow from operations, and sales growth.

It is noted that some previous studies supported as association/relationship between using ISO 9000 and financial performance, whereas others not. Adopting ISO 9000 might act as a sign of high-quality products and services, leading to charging a higher price or attracting clients, and consequently an increase in revenue. Regarding the econometric model, Starke et al. (2012) found ISO 9000 was associated with increased sales revenues, decreased cost of goods sold, and increased asset-turnover ratios. According to mixed findings, this needs further investigation to understand the association between variables, in addition it is noted that most previous studies treated simply measuring ISO 9000 as a dichotomous variable (a 0–1 variable). Further, there was no study investigating ISO 9000 as measured in the context of the extent of ISO 9000 implementation. Hence, the following hypothesis is suggested.

H4: The extent of ISO 9000 implementation has positive impact on financial performance.

In the process management model, ISO 9000 might assist organisations in cutting down production costs and thereby allowing development time for new products (Dimara et al., 2004) as well as enhancing internal process efficiency (Santos &

Escanciano, 2002). Cost reduction, quality improvement, customer cost reduction, internal improvement, and greater involvement of employees were found as important motivations for obtaining the certification (Anderson et al., 1999). Starke et al. (2012: 982) indicated "the main reason for adopting the ISO 9000 standards is to improve organisational performance through a more efficient use of resources and processes in order to generate better quality products and services". This is consistent with the concept of quality management, as all procedures assure that quality is assessed and the corrective steps carried out if necessary. In short, it seems the role of ISO 9000 relates to operational performance improvement.

In previous studies, Naveh and Marcus (2005) and Feng et al. (2008) confirmed that using ISO 9000 was positively associated with operational performance. Moreover, in the impact analysis, Jang and Lin (2008) and Psomas et al. (2013) indicated that ISO 9000 had a significant direct impact on operational performance. However, not all indicators measuring operational performance were statically significant: for example, Naveh and Marcus (2005) found ISO 9000 had no positive relationship to operational performance, particularly costs of goods sold. Jang and Lin (2008) revealed that ISO 9000 had no significant direct effect on operational performance, especially in terms of improved delivery time and quality. These show contradictory results.

It is noticeable that there was no study investigating ISO 9000 as measured by the context of the extent of ISO 9000 implementation. Hence, the current study proposed the following hypothesis.

H5: The extent of ISO 9000 implementation has positive impact on operational performance.

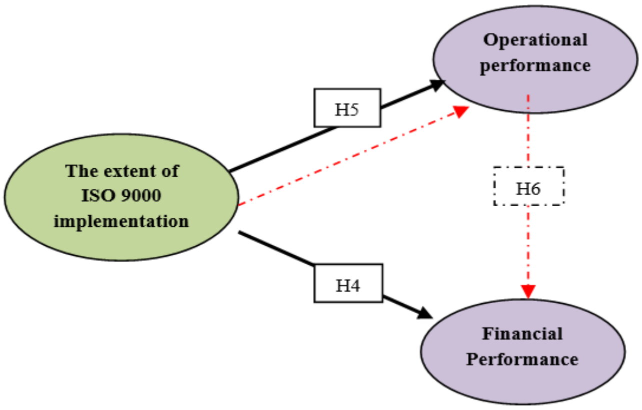
In terms of a non-directional hypothesis, Naveh and Marcus (2005) found ISO 9000 had an indirect relationship with financial performance (sales, profit margin and long-run stock) via operational performance. Furthermore, Psomas et al. (2013) indicated that ISO 9000 indirectly impacted financial performance (net profit, profitability, cash flow from operations, company financial results, and sales growth) via operational performance. Similarly, Jang and Lin (2008) found the indirect impact of ISO 9000 on financial performance, particular increased profitability through operational performance.

Based on previous studies, it is possible that ISO 9000 impacts on financial performance through operational performance. Consequently, this study examines the following hypothesis.

H6: The extent of ISO 9000 implementation has positive impact on financial performance via operational performance.

In summary, hypotheses H4-H6 are depicted below in Figure 2.7

Figure 2.7: The impact of the extent of ISO 9000 implementation on organisational performance



2.4 The combined impact of activity-based costing and ISO 9000 on organisational performance

In light of previous related studies which are related to this study, there was a need for further tests using ABC to find whether the degrees of using of ABC is related to the use of some other management practices (Cagwin & Bouwman, 2002). Banker et al. (2008) indicated that adoption of ABC only might not increase performance. Cagwin and Bouwman (2002) found no positive relationship between ABC and return on investment (ROI) improvement, but there was a significant relationship when using ABC with other initiatives such as TQM, business process reengineering (BPR), computer-integrated manufacturing (CIM), JIT, flexible manufacturing systems (FMS), theory of constraints (TOC), and value chain analysis (VCA). It implies that the positive synergies were achieved from concurrent use of other initiatives together with ABC. Results revealed organisations that disclosed financial performance improvement were those organisations that employed ABC alongside the other initiatives.

Other research found the association of ABC complementary with technology integration (TI) and supply chain management (SCM) had a beneficial effect on ROA (Cagwin & Ortiz, 2005). Maiga and Jacobs (2003) reported the association of using ABC complementary with balance scorecard (BSC), had a positive impact on performance variables of product quality, margin on sales, and customer satisfaction. On the other hand, Banker et al. (2008) indicated that using ABC with world class manufacturing did not provide evidence of a beneficial impact on costs, quality, and time.

All relevant studies above are summarised in Table 2.4 (FP) - 2.5 (OPP), classifying the association and the impact of using ABC with other initiatives on financial performance and operational performance.

With reference of the study of ISO 9000 in isolation, Han et al. (2007) indicated that ISO 9000 could not assure a firm's business performance improvement or customer satisfaction by itself. In the literature, there were only two scholarly articles that have focused on ISO 9000 and ABC (Larson & Kerr, 2002; Larson & Kerr, 2007). However, the result of these two examinations were inconclusive.

Larson and Kerr (2002) found that ISO and ABC were not complementary in their impact upon performance (performance constructs included customer service, efficiency, flexibility, on-time delivery, and productivity). In addition, their findings reported that there was statistically significant differences between performances of organisations that adopted only ABC and organisations that adopted both ABC and ISO 9000 ($P<0.05$). Similarly, there was a statistically significant link between performance of organisations that adopted only ISO 9000 and organisations that adopted both ABC and ISO 9000. Their research disclosed that ABC-only organisations outperformed organisations that adopted both ABC and ISO 9000; ISO 9000-only organisations had better performances than organisations that adopted both, ABC and ISO 9000.

Interestingly, in subsequent research Larson and Kerr (2007) reported the potential for complementary employment of ABC and ISO 9000 for: 1) providing better understanding of costs to serve particular customers; 2) customer service improvement; 3) helping maintain margin objectives; 4) order accuracy; and 5) cycle times improvement. However, they pointed out that was evidence that ABC and ISO 9000 projects may compete for scarce funding and managerial attention.

Larson and Kerr (2002) pointed out a number of limitations to their work. First, the measure of complementarity was indirect: it was based on the judgement of a single respondent; further organisations may be using both tools without any thought of exploiting their complementary nature. In the second article based on a case study and interview, they drew attention to the fact that their case study was not generalisable and an overall dearth of case study in the area. As the results from the two articles are still unclear and have limitations, further investigation is appropriate for understanding the possible complementarity between ISO 9000 and ABC.

The possible synergy between ABC and ISO 9000 can be explained by general systems theory (GST), as discussed in Section 2.1. ABC and ISO 9000 are considered as process improvement and cost management techniques, thus enhancing performance. Scarce resource theory underpins the decision-making of an organisation. When ABC and ISO 9000 are complementary, investing in both of them may lead to the better outcome. However, companies may not realise the complementarity or have the resources to invest in both systems.

In addition, if ABC and ISO 9000 impact on both financial performance and operational performance (as proposed in hypotheses H1-H6). It is logical to assume that organisations that have adopted both ABC and ISO 9000 could get better performance than organisations that adopted only ISO 9000.

Because of this, it is possible that organisations that adopted both ABC and ISO 9000 have positive impact on financial performance and operational performance differently from organisations that adopted only ISO 9000. The following hypothesis is proposed.

H7: There are significant differences in performance between organisations that adopted both ABC and ISO 9000 and organisations that adopted only ISO 9000.

Table 2.4: Previous studies in the association and the impact of ABC complementary with other initiatives (FP)

The positive association and impact	Using with other initiatives	findings from Previous Studies		Responses and Methods
		Rejected Null Hypothesis (H *null*)	Fail to reject H *null*	
ABC X *other initiative* --> FP **Note**: Financial performance (FP)	*(1) TQM, JIT, BPR, CIM, JIT, FMS, TOC and VCA* *(2) Complexity and diversity*	Cagwin and Bouwman (2002) ABC X *(1)*, ROI, path = 0.10 (P= 0.003 <0.05) ABC X *(2)*, ROI, path = 0.12 (P= 0.012 <0.05)		204 members of Institute of Internal auditors (IIA) in U.S. Using Structural Equation Modelling (Lisrel)
	(1) Technology integration (TI) *(2) Supply chain management (SCM)*	Cagwin and Ortiz (2005) ABC X *(1)*, ROA, beta = 0.014 (P= 0.020 <0.10) ABC X *(2)*, ROA, beta = 0.009 (P= 0.059 <0.10)		305 firms in the motor carrier industry Using multiple regression analysis
	(1) BSC-customer perspective *(2) BSC-internal process perspective* *(3) BSC-learning growth perspective* *(4) BSC-financial perspective*	Maiga and Jacobs (2003) ABC X *(1)*, Margin on sales, beta = 0.14 (P<0.10) ABC X *(2)*, Margin on sales, beta = -0.03 (P>0.10) ABC X *(3)*, Margin on sales, beta = 0.19 (P<0.10) ABC X *(4)*, Margin on sales, beta = 0.19 (P<0.10)		83 US companies Using regression analysis

Table 2.5: Previous studies in the association and the impact of ABC complementary with other initiatives (OPP)

The positive association and impact	Using with other initiatives	findings from Previous Studies		Responses and Methods
		Rejected Null Hypothesis (H_{null})	**Fail to reject H_{null}**	
ABC X *other initiative* --> OPP **Note**: Operational performance (OPP)	*World-class manufacturing (WCM)*		Banker et al. (2008) ABC X *WCM* Costs (beta = -0.04, P= 0.48 > 0.10) Quality (beta = -0.02, P= 0.57 > 0. 10) Time (beta = -0.03, P= 0.39 > 0. 10)	1250 manufacturing plants across the US. Using ordinary least squares (OLS) regressions
	(1) BSC-customer perspective *(2) BSC-internal process perspective* *(3) BSC-learning growth perspective* *(4) BSC-financial perspective*	Maiga and Jacobs (2003) ABC X *(1)*, product quality, beta = 0.22 (P<0.10) ABC X *(2)*, product quality, beta = 0.25 (P<0.05) ABC X *(3)*, product quality, beta = 0.18 (P<0.10) ABC X *(4)*, product quality, beta = 0.21 (P<0.10)		83 US companies Using regression analysis

2.5 Factors moderating the impact of activity-based costing and ISO 9000 on organisational performance

In discussion of the impact of independent variable on dependent variable, it is appropriate to consider the significance of moderating factors. Moderator is defined as "a qualitative or quantitative variable that affects the direction and/or strength of the relation between an independent and dependent or criterion variable" (Baron & Kenny, 1986: 1174). Based on the literature and contingency theory, some factors may moderate the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance (OP), as follows.

2.5.1 Factors moderating the impact of the extent of ABC use on organisational performance

These moderating variables include type of business, size of business, age of ABC, age of ISO 9000, and frequency of ABC use.

Type of business

ABC has its origins in manufacturing organisations (Clarke & Mullins, 2001; Al-Omiri & Drury, 2007) however, empirical studies also showed that ABC has been implemented by non-manufacturing organisations. Innes and Mitchell (1995) indicated that ABC has been used by both manufacturing and non-manufacturing in the same manner, even it was first intended for development in a manufacturing context. Cagwin and Bouwman (2002: 12) described that "ABC research suggests that the efficacy of initiatives may fundamentally differ between manufacturing and service companies" (Rotch, 1990; Cooper, 1988, 1989). Thus, it is possible that the strength of the impact of the extent of ABC use on organisational performance depends on the types of business. And therefore, the following hypotheses are proposed.

H8: The strength of the impact of the extent of ABC use on financial performance depends on type of business.

H9: The strength of the impact of the extent of ABC use on operational performance depends on type of business.

Size of business

In the literature, small organisations have not implemented ABC because they face the substantial costs of development and implementation (Kim LaScola et al., 2003). Innes and Mitchell (1995) reported that an obviously significant higher rate of adoption of ABC was evident in the larger organisations surveyed. However, Kim LaScola et al. (2003) found that a small manufacturing organisation with modest resources could undertake some ABC implementation. However, "Larger organisations have relatively greater access to resources to experiment with the introduction of more sophisticated accounting systems" (Al-Omiri & Drury, 2007: 407). It could therefore be reasonably assumed that ABC implementation in small organisations differ from larger organisation, subsequently; the different sizes of businesses might influence the strength of the impact of the extent of ABC use on organisational performance. The following hypotheses are therefore proposed.

H10: The strength of the impact of the extent of ABC use on financial performance depends on size of business.

H11: The strength of the impact of the extent of ABC use on operational performance depends on size of business.

Age of initiative

Kennedy and Affleck-Graves (2001) found that the superior performance of organisations adopting ABC did not occur immediately; it took at least one or two years for performance improvement become apparent. This implies that the length of time using ABC might influence to organisational performance. Jankala and Silvola (2012: 517) concluded that "the effects of ABC may not be visible in financial performance immediately after adoption, and it may take even several years before any improvements in financial performance are achieved". Maiga and Jacobs (2008) also suggested further performance studies comparing subsamples in relation to length of ABC use.

With respect to ABC, an organisation can gain knowledge of ABC method through implementing it. Thus, greater experience may generate gains in organisational performance. This study proposes that the age of ABC moderates the strength of the impact of the extent of ABC use on performance and the following hypotheses are proposed.

H12: The strength of the impact of the extent of ABC use on financial performance depends on the age of the ABC.

H13: The strength of the impact of the extent of ABC use on operational performance depends on the age of the ABC.

Age of ISO 9000 is also considered as a moderating variable when examining the impact of ABC on organisational performance (greater details is provided in Section 2.5.2).

H14: The strength of the impact of the extent of ABC use on financial performance depends on the age of the ISO 9000.

H15: The strength of the impact of the extent of ABC use on operational performance depends on the age of the ISO 9000.

Frequency of use of ABC

Jankala and Silvola (2012) indicated that more extensive ABC use has a positive impact and lag in sales growth that also impacts positively on ROI. Their research classified the extent of ABC use by using a five-point scale with the range from “not used at all” (scored 1) up to “used systematically as a part of normal routines” (scored 5). Therefore, it is possible that the strength of the impact of the extent of ABC use on organisational performance might depend on the frequency of ABC use. The following hypotheses are proposed.

H16: The strength of the impact of the extent of ABC use on financial performance depends on the frequency of ABC use.

H17: The strength of the impact of the extent of ABC use on operational performance depends on the frequency of ABC use.

2.5.2 Factors moderating the impact of the extent of ISO 9000 implementation on organisational performance

Type of business

There are fundamental differences between manufacturing and service organisations (Glautier & Underdown, 1997). Martínez-Costa and Martínez-Lorente (2007) tested the impact of ISO 9000 on organisational performance, indicating that some organisations acheived better performance after certification depending on the way of application and the specific company circumstances. They suggested that "the differences amongst different industries and amongst other company characteristics in relation to the benefits of ISO application could be interesting to analyse" (Martínez-Costa & Martínez-Lorente, 2007: 497). Therefore, it is possible that the strength of the impact of the extent of ISO 9000 implementation on organisational performance depends on the type of business as a moderating variable. The following hypotheses are therefore proposed.

H18: The strength of the impact of the extent of ISO 9000 implementation on financial performance depends on the type of business.

H19: The strength of the impact of the extent of ISO 9000 implementation on operational performance depends on the type of business.

Size of business

Previous research found that large and medium organisations had higher operational and business performance improvement than small organisations (Feng et al., 2008). Also, Fatima (2014) found that there was significant differences between ISO 9000 implementation and financial performance of medium-sized and large-sized firms compared to small firms. Ismyrlis and Moschidis (2015) also reported that companies with more than 250 employees achieved better performance than those with less than 250 employees. Based on the above, this study presumes that the strength of the impact of the extent of ISO 9000 implementation on organisational performance might depend on size of business as a moderating variable. The following hypotheses are proposed.

H20: The strength of the impact of the extent of ISO 9000 implementation on financial performance depends on size of business.

H21: The strength of the impact of the extent of ISO 9000 implementation on operational performance depends on size of business.

Age of initiative

With respect to ISO 9000 certification, firms can gain knowledge of quality improvement, international standard and international markets through implementing this certification. Thus, experience with ISO 9000 certification seems to help firms increase quality, fulfil customer needs, and achieve competitiveness (Anderson et al., 1999; Docking & Dowen, 1999; Santos & Escanciano, 2002). Haversjo (2000) found ISO 9000 affected sales growth when organisations adopted ISO 9000 for more than three years. Ismyrlis and Moschidis (2015) also confirmed that the more years that a company achieved ISO 9001 certification resulted in better performance. Therefore, it is possible to assume that the strength of the impact of the extent of ISO 9000 implementation on organisational performance might depend on the age of the ISO 9000 as a moderating variable. The following hypotheses are proposed.

H22: The strength of the impact of the extent of ISO 9000 implementation on financial performance depends on age of ISO 9000 certification.

H23: The strength of the impact of the extent of ISO 9000 implementation on operational performance depends on age of ISO 9000 certification.

Apart from these three moderating variables as discussed above, age of ABC and frequency of ABC use are also considered as moderator variables in relation to the impact of the extent of ISO 9000 implementation on organisational performance; therefore, these hypotheses are suggested.

H24: The strength of the impact of the extent of ISO 9000 implementation on financial performance depends on the age of the ABC system.

H25: The strength of the impact of the extent of ISO 9000 implementation on operational performance depends on the age of the ABC system.

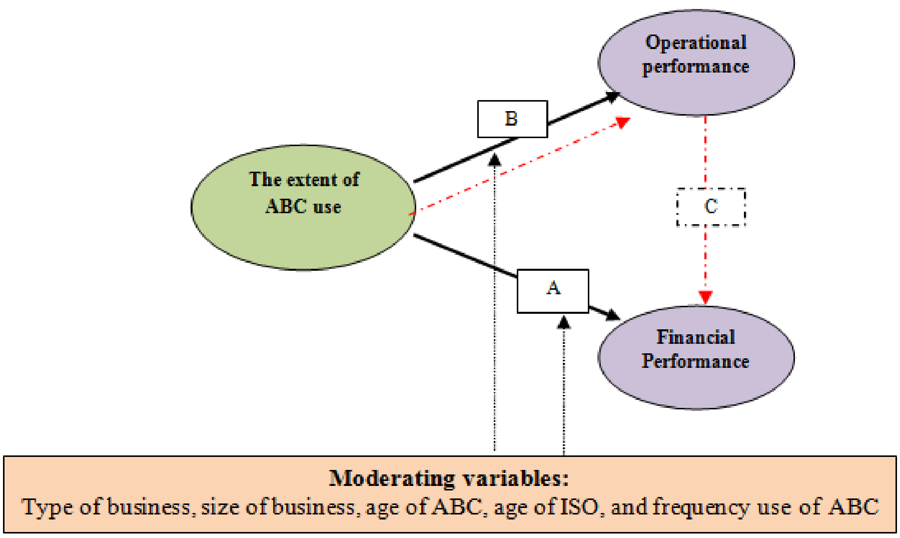
H26: The strength of the impact of the extent of ISO 9000 implementation on financial performance depends on frequency of ABC use.

H27: The strength of the impact of the extent of ISO 9000 implementation on operational performance depends on frequency of ABC use.

2.6 Conceptual models

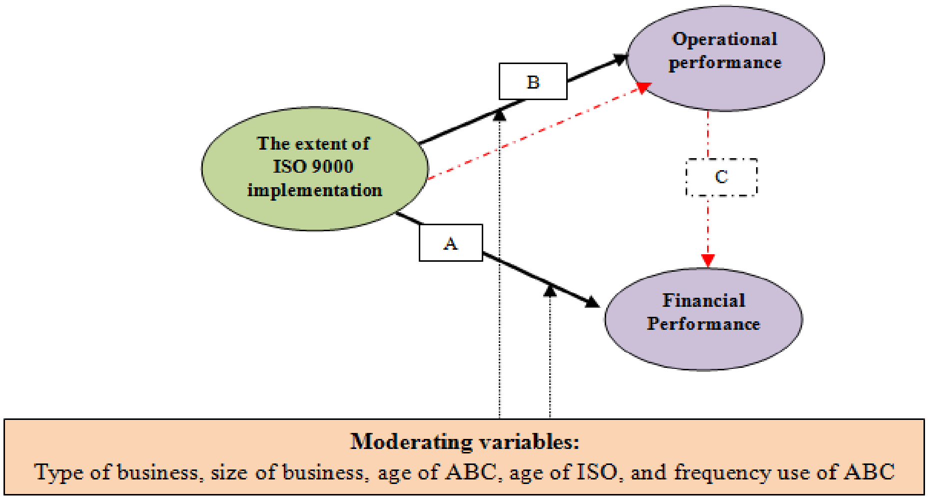
A conceptual model is a diagram that includes constructs based on relevant theories and logic to present visually all hypotheses that will be examined (Hair et al., 2007). There are two models in this study. They are developed with regard to the theories and previous studies discussed above in order to overview this study. The first model represents the relationship between the extent of ABC use and organisational performance including moderating variables (See Figure 2.8). The second model shows the relationship between the extent of ISO 9000 implementation and organisational performance including moderating variables (See Figure 2.9).

Figure 2.8: The impact of the extent of ABC use on organisational performance (Model 1)



In Figure 2.8, the first model consists of three constructs: the extent of ABC use, operational performance, and financial performance presenting the relationship with the three main paths (A-C). Path A depicts the direct impact between the extent of ABC use and financial performance. Path B illustrates the direct impact between the extent of ABC use and operational performance. Path C presents the indirect impact between the extent of ABC use and financial performance through operational performance. Additionally, type of business, size of business, and age of ABC, age of ISO 9000 and frequency of ABC use are considered factors moderating the strength of these relationships (see Section 2.5). The hypotheses are proposed (see Section 2.2) in order to examine whether the extent of ABC use impacts on financial performance and operational performance.

Figure 2.9: The impact of the extent of ISO 9000 implementation on organisational performance (Model 2)



In Figure 2.9, the second model consists of three constructs: the extent of ISO 9000 implementation, operational performance, and financial performance presenting the relationship with the three main paths (A-C). Path A depicts the direct impact between the extent of ISO 9000 implementation and financial performance. Path B illustrates the direct impact between the extent of ISO 9000 implementation and operational performance. Path C presents the indirect impact between the extent of ISO 9000 implementation and financial performance through operational performance. Additionally, type of business, size of business, and age of ABC, age of ISO 9000 and frequency of ABC use are considered as factors moderating the strength of these relationships (see Section 2.5). The hypotheses are proposed (See Section 2.3) in order to examine whether the extent of ISO 9000 implementation impact on financial performance and operational performance.

2.7 Summary

This chapter started with critical discussion about management accounting and organisational performance improvement including the relevant theories. It specified the definition of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance. The previous studies concerning ABC, ISO 9000 and organisational performance have been reviewed in order to assess the role of ABC and ISO 9000 in generating an understanding of the causal relationship between ABC, ISO 9000 and organisational performance.

In the literature, there is an absence of clarity concerning: 1) the dimensionality of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance; 2) the direct impact on organisational performance of the extent of ABC use as measured by nine purposes of ABC use (see Chapter 3) and the extent of ISO 9000 implementation as measured by eight principles (see Chapter 3); and 3) a synergy effect of ABC use and ISO 9000 implementation on organisational performance all of these items measured in terms of a construct. Two conceptual models illustrated the relationship between the extent of ABC use, the extent of ISO 9000 implementation, financial performance, operational performance, and moderating variables.

Chapter 3: Research Methodology

Introduction

This chapter is organised into four sections. Section 3.1 briefly outlines the rudimentary concepts of research design, which subsequently directs the appropriate choice of research design, including research philosophy, research approach, methodological choice, research strategy, time horizon, and techniques and procedures. Questionnaire design, target population, and operationalisation of study constructs are discussed in Section 3.2. Section 3.2 also discusses pre-test questionnaire, pilot studies, ethical and validity issues, and reliability. Section 3.3 explains data analysis techniques including preliminary analysis, descriptive analysis, factor analysis, structural equation modelling (SEM), and multiple group analysis.

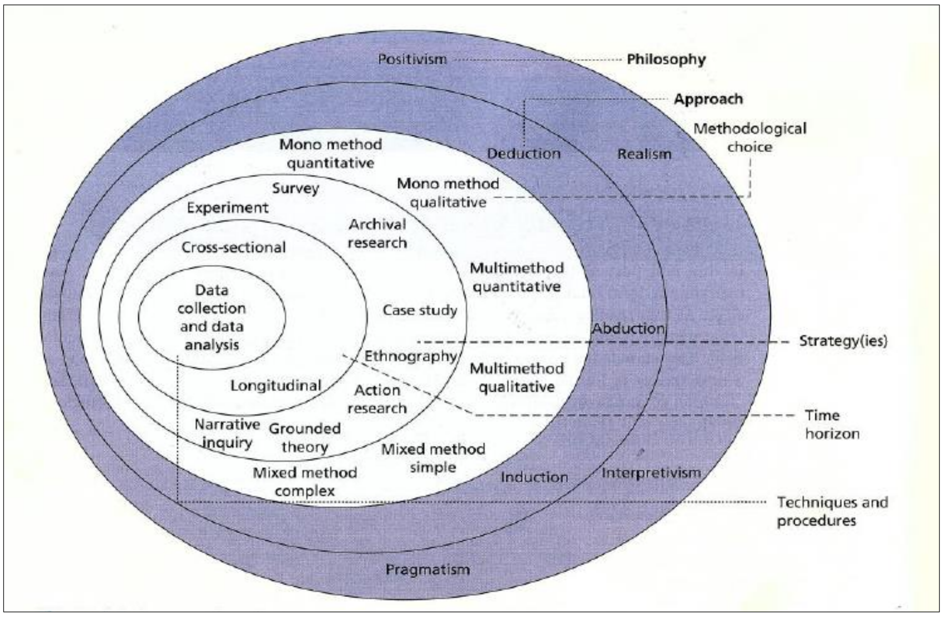
Methodology is primarily concerned with conducting research. It implies the route the researcher needs to take to achieve these objectives: namely, knowledge, insight, design, solution, and intervention (Jonker & Pennink, 2010). McBurney and White (2004: 81) stated that “the method section is the heart of the paper”. Research methods are procedures as ways or tools of addressing research problems (Ghauri & Grønhaug, 2010).

3.1 The research design

“Research design is the blueprint for fulfilling objectives and answering questions. Selecting a design may be complicated by the availability of a large variety of methods, techniques, procedures, protocols, and sampling plans” (Cooper & Schindler, 1998: 132). It is a plan for collecting and analysing data in order to answer questions or problems the researcher has posted. In other words, research design presents the framework for data collection and data analysis.

Saunders et al. (2012) introduced the research process onion as presented in Figure 3.1. Its six layers contain research philosophy, research approach, methodological choice, research strategy, time horizon, and techniques and procedures, and is discussed next.

Figure 3.1: The research onion



Source: Saunders et al. (2012: 128)

3.1.1 Research philosophy

Before choosing research methods, it is crucial to understand what research philosophy is. Research philosophy is dependent on the way a researcher thinks about the development of knowledge (Saunders et al., 2009). In addition, the critical understanding of philosophical issues is very important to help a researcher identify and elucidate the research design (Easterby-Smith et al., 2004). Research philosophies are the belief systems or the worldviews of the researcher (Punch, 1998). That is, the adopted philosophy could be imagined as the assumptions about the direction in which the researcher views the world. Saunders et al. (2012: 128) also supported Johnson and Clark's (2006) description that "the important issue is not so much whether our research should be philosophically informed, but how well we are able to reflect upon our philosophical choices and defend them in relation to the alternatives we could have adopted".

Two paths concerning research philosophy are: 1) ontology, and 2) epistemology. Ontology is concerned with the nature of reality, leading to questions about the way the world operates (Saunders et al., 2012). Objectivism and subjectivism are two aspects of ontology. "Objectivism is an ontological position that implies that social phenomena confront us as external facts beyond our reach or influence" (Bryman &

Bell, 2015: 32). Conversely, “subjectivism asserts that social phenomena are created from the perceptions and consequent actions of social actors” (Saunders et al., 2012: 132). It is often referred to as constructionism.

Epistemology is related to what constitutes acceptable knowledge in a research area (Saunders et al., 2012). They assert that two basic compelling research philosophies are, 1) positivism, which depends on existing theories; and 2) interpretivism, which gathers information to establish a new theory. Saunders et al. (2012: 134) suggested, “if your research reflects the philosophy of positivism then you will probably adopt the philosophical stance of a natural scientist. You will prefer collecting data about an observable reality and search for regularities and causal relationships in your data to create law-like generalisations like those produced by scientists”. Positivism can be called a quantitative paradigm or scientific approach (Sekaran, 2000; Collis & Hussey, 2003). On the other hand, interpretivism is also known as social constructionism, which belongs to the qualitative paradigm (Collis & Hussey, 2003). Saunders et al. (2012: 137) explained that “interpretivism advocates that it is necessary for the researcher to understand differences between humans in our role as social actors”. Researchers in this paradigm perceive social reality as a complexity of human minds; they always attempt to examine the viewpoints of human beings who are involved with or relevant to the phenomena in their study (Burrell & Morgan, 1979).

Axiology (a branch of philosophy) investigates judgments about value. It is the social enquiry, in particular, with which researchers are concerned (Saunders et al., 2012). In summary, the research philosophy comprises assumptions about the global perspectives of the researcher (Walliman, 2006). They answer and question as: what is the relationship between the researcher and that which is studied (epistemology); what is the viewpoint of the nature of reality (ontology); what is the function of its values (axiology); and how is the study procedure produced, through an inductive or deductive approach (methodology) (Creswell & Clask, 2007; Saunders et al., 2007).

This current study employs positivism, for the following reasons:

1) The study intends to examine the impact of ABC and ISO 9000 on organisational performance. Based on the prior literature, the results are contradictory and there is a need for further investigation. Furthermore, this study also adopts the theories

(theory of cost accounting, theory of quality management, scarce resource theory, general systems theory, and contingency theory) which underpin the relationship between variables. These reflect the philosophy of positivism, as Creswell (1998) suggested the positivistic philosophy is suitable when studies are highly structured and variables can be easily identified.

2) Regarding the fact that the objective was to investigate the impact of two combined initiatives (ABC and ISO 9000) and an individual initiative (ABC or ISO 9000) on organisational performance, this can be accomplished by using the positivist paradigm. Collis and Hussey (2003: 53) noted, "according to the positivist paradigm, an explanation consists of establishing causal relationships between the variables by establishing causal laws and linking them to a deductive or integrated theory". This is consistent with an epistemological assumption which focuses on causality (Saunders et al., 2012).

3) This study involves the development of conceptual models in order to examine hypotheses, and consequently generate results from a chosen sample. These results can be generalised across the targeted population (all organisations that have adopted ABC and ISO 9000) regarding the epistemological assumption of the positivist paradigm (Easterby-Smith et al., 2004; Saunders et al., 2012).

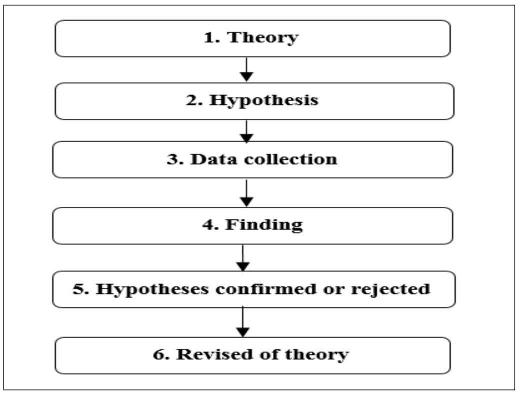
4) The current study uses the respondent's perception to test the impact of ABC and ISO 9000 on organisational performance without the researcher's involvement and interpretation. It is consistent with the epistemological assumption that "only the observable can provide believable data and fact" (Saunders et al., 2012: 142). Thus, the researcher is independent of the data (Saunders et al., 2012).

3.1.2 Research approach

It is important to categorise whether the research approach is inductive or deductive. The association between theory and research differs for deductive and inductive methods (Blackstone, 2012). However, both approaches comprise the steps of data collection and theory development, but in a different order (Saunders et al., 2009). Yin (2009) pointed out that the choice of the best approach to be used depends on the purpose of the study and the research question.

Bryman and Bell (2015) stated that the association between theory and research can be commonly viewed in a deductive approach. In other words, “it involves the development of a theory that is then subjected to a rigorous test through a series of propositions” (Saunders et al., 2012: 145). The important characteristics of the deductive approach are the finding of causal relationships between variables, the collection of quantitative data, controls to allow the testing of hypotheses, then a highly structured methodology for replication, operationalisation, reductionism and generalization (Saunders et al., 2003). Bryman (2012) clarified the process of deduction as shown in Figure 3.2. The deduction process begins with theory and hypothesis, followed by data collection and findings. Hypotheses can be confirmed or rejected, or theory revised. “The researcher, on the basis of what is known about a particular domain and of theoretical considerations in relation to that domain, deduces a hypothesis that must then be subjected to empirical scrutiny” (Bryman, 2012: 24). The implication can be examined and on the basic of the findings, the initial theory or hypothesis can be confirmed or rejected (Burns & Burns, 2008).

Figure 3.2: The process of deduction



Source: Bryman (2012: 24)

Conversely, the inductive approach focuses on obtaining an insight into the meaning of events, the collection of qualitative data and a more flexible structure to allow changes of research emphasis (Saunders et al., 2003). Thus the conclusions based on empirical observations are drawn and used as a basis for producing new theories. Theory is the consequence of research when working from an inductive stance (Bryman, 2012). Sekaran and Bougie (2010) pointed out that both deductive and inductive approaches can be used in qualitative and quantitative research; however, it should be noted that the inductive approach is regularly used in qualitative and exploratory researches while the deductive approach is more often used in quantitative and causal studies.

Saunders et al. (2012) also introduced a new approach called the abductive approach form. “Instead of moving from theory to data (as in deduction) or data to theory (as in induction) an abductive approach moves back and forth, in effect combining deduction and induction” (Saunders et al., 2012: 147). Thus, the researcher can mix both deductive and inductive approaches within the same piece of study.

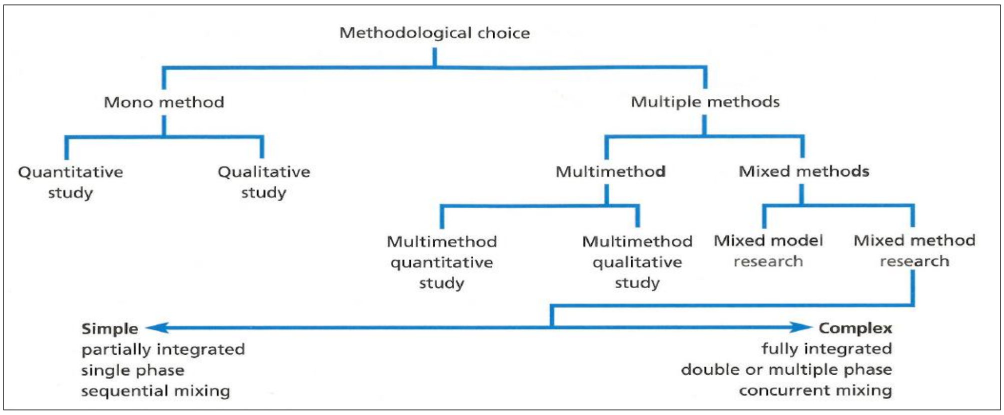
In conclusion, following the three forms of reasoning as Saunders et al. (2012) proposed, the deductive approach begins with theory and develops research from academic literature. The researcher in this approach designs a research strategy to examine theory. On the other hand, the researcher in an inductive approach starts by gathering data to explore a phenomenon and generates theory. Lastly, in the abductive approach, the researcher collects data to research a phenomenon and builds a new theory or modifies existing theory, then subsequently examines it through additional data collection.

Deduction is chosen, as the approach of this study as it aims to discover the impact of ABC and ISO 9000 on organisational performance using relevant theories drawn from literature (Bryman & Bell, 2015).

3.1.3 Methodological choice

The previous two sections discussed research philosophy and research approach, which subsequently influence the selection of methodological choice in this section and the next two layers of the research onion. The methodological choice, firstly, is related to following a mono method (quantitative or qualitative) or multiple methods. It needs to consider the research question through a philosophical lens, the way in which philosophical assumptions will inform the methodological choice. Saunders et al. (2012) indicated that a quantitative study is frequently employed, as a data collection technique, in order to supply operating numerical data. In contrast, qualitative study is normally used as a synonym for an interview, or for a data analysis procedure, namely, categorising for operating on non-numerical data.

Figure 3.3: Methodological choice



Source: Saunders et al. (2012: 165)

Mono method (quantitative or qualitative method)

"Conducting research on the basis of a quantitative method or methodology has a long tradition. This tradition can be traced back historically to natural science" (Jonker & Pennink, 2010: 65). It is based on the postulation that knowledge about reality can only be obtained independent of the researcher". Saunders et al. (2012: 162) stated, "quantitative research is generally associated with positivism, especially when used with predetermined and highly structured data collection techniques". It is normally related to a deductive approach by focusing on the testing of theory. The data is analysed by a range of statistic techniques. Experimental and survey research strategies are principally related to quantitative research (Saunders et al., 2012).

Qualitative research is "research in which the researcher makes an attempt to understand a specific organisational reality and occurring phenomena from the perspective of those involved" (Jonker & Pennink, 2010: 77). Saunders et al. (2012) indicated that qualitative research is concerned with an interpretive philosophy, as researchers are required to make sense of the subjective and socially constructed meanings depicted about the phenomenon being researched. Several strategies are related to qualitative research: namely, action research, grounded theory, case study, ethnography, and narrative research.

Given the above discussion, a mono method quantitative approach is selected in this study as Saunders et al. (2012) stated that in general, quantitative research related to positivism, particularly when employed with highly structured data collection techniques is appropriate.

Multiple methods

The philosophy of realism, often leads to a multiple methods research design (Saunders et al., 2012). Inductive and deductive approaches can apply multiple methods. As shown in Figure 3.3, multiple methods can be separated into two forms: multimethod and mixed methods. Multimethod is divided between multimethod quantitative study (researchers may use a questionnaire and structured observation analysing data with quantitative procedures) and multimethod qualitative study (researcher may choose in-depth interviews and diary accounts analysing data with qualitative processes). On the other hand, mixed methods research can combine both quantitative and qualitative research.

The multiple method has not been chosen as the quantitative research fits the objectives of this current study. In other words, the proposed hypotheses can be examined based on quantitative data alone.

3.1.4 Research strategy

“A strategy is a plan of action to achieve a goal” (Saunders et al., 2012: 173). Research strategies must be consistent with the research philosophy and research approach. These strategies provide a general plan to address research questions (Saunders et al., 2003). Either a deductive approach, inductive approach or both of them can use a variety of research strategies, such as experiments, surveys, case studies, grounded theory, ethnography, and action research. Saunders et al. (2012) suggested the choice of the research strategy will therefore be dependent upon your research question(s) and objectives. Research strategy is depicted in the research process onion as the fifth layer.

The research strategy for this current research is a survey based on questionnaires which is usually associated with deduction. A questionnaire approach is a popular method because of the benefits of a highly economical process and ease of comparison. Miller et al. (2010) explained the advantage of this survey strategy is that researchers can generalise the results from a chosen sample to a larger population when the research is conducted well. It is commonly used in business and management research for answering questions such as what, where, who, how many, and how much (Zikmund, 2000; Saunders et al., 2012). In addition, this survey strategy is generally perceived as authoritative. However, the limitation of using surveys is an inability to demonstrate causation between variables as only associations can be identified (Miller et al., 2010).

3.1.5 Time horizons

Studies can have varying time horizons, They can be cross-sectional and longitudinal (Saunders et al., 2003). A cross-sectional study is defined by Cooper and Schindler (1998: 132) as when "studies are carried out once and represent a snapshot of one point in time". In contrast, longitudinal studies are applied over an extended period (Cooper & Schindler, 1998). In a cross-sectional study, the data is collected at a single point in time; most surveys belong to this category. David and Sutton (2011: 209) indicated, "in cross-sectional design the exploration of relationships and associations between variables needs to be carefully thought through. With cross-sectional design there is no pre-test/post-test measure to compare, as the data is collected at one point in time". To address this problem, an extensive literature review and prior experience are required (David & Sutton, 2011).

The purpose of a longitudinal survey is to examine continuity of results and notice the action of changing something that occurs over time (Zikmund, 2000). Even though "the main strength of longitudinal research is its capacity to study change and development" (Saunders et al., 2012: 190), longitudinal studies are not frequently employed by individual researchers because this technique is more expensive and time-consuming (David & Sutton, 2011).

Regarding the constraints of time (Cooper & Schindler, 1998), this study adopts a cross-sectional survey because it aims to research the impact of ABC and ISO 9000 on organisational performance at one point in time. To sum up, the chosen approaches of research philosophy, research approach, methodological choice, research strategy and time horizons are presented with bold font in Figure 3.4.

Figure 3.4: The research process onion

Layer	Approaches*
3.1.1 Research philosophy	**Positivism**, Interpretivist, Realism, Pragmatism
3.1.2 Research approaches	**Deductive**, Inductive, Abductive
3.1.3 Methodological choice	**Mono method quantitative**, Mono method qualitative, Multimethod quantitative, Multimethod qualitative, Mixed method simple, Mixed method complex
3.1.4 Research strategies	Experiment, **Survey**, Archival research, Case study, Ethnography, Action research, Grounded theory, Narrative inquiry
3.1.5 Time horizons	**Cross sectional**, Longitudinal
3.1.6 Techniques and procedures	Sampling, Secondary data, Observation, Interviews, **Questionnaires**

***** Bold font indicates approaches chosen in this study

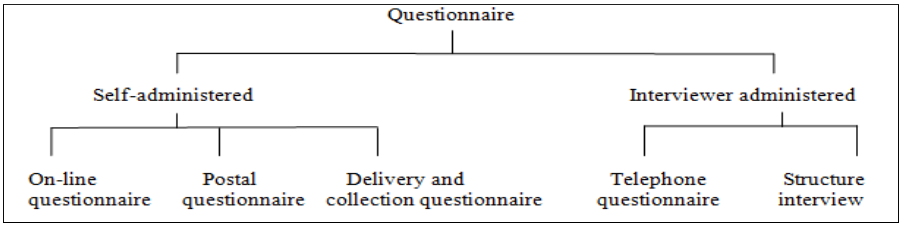
Source: Adapted from Saunders et al. (2012: 128)

3.1.6 Techniques and procedures

There are two basic sources of data: primary and secondary data. Primary data is "data gathered and assembled specifically for the research project in hand" while secondary data is, "data that have been previously collected for some project other than the one at hand" (Zikmund, 2000: 58). In order to achieve the objectives of the current research, primary data is needed.

There are many data collection methods related to a survey strategy, such as questionnaires, observation and interviews. However, the questionnaire is widely used as the data collection method in a survey strategy (Saunders et al., 2003). As shown in Figure 3.5, a questionnaire is separated into two types: 1) self-administered, which contains on-line questionnaires, postal questionnaires, and delivery and collection questionnaires; whereas, 2) interviewer administered questionnaires include telephone questionnaires and structured interviews (Saunders et al., 2003).

Figure 3.5: Types of questionnaire



Source: Saunders et al. (2003: 282)

In this study, the self-administered postal questionnaire is selected to test the hypotheses. This method helps this researcher to conduct a large scale survey at a relatively low cost; as Cooper and Schindler (1998) noted, “mail surveys typically cost less than personal interviews”. Additionally, the benefit of saving time is considered as an advantage. It is convenient for respondents to answer questions when they are free. “This method requires the questionnaire to be highly structured, with questions being predominantly closed-ended” (Remenyi et al., 1998: 156). However, mail surveys are not inexpensive as they include follow-up mailing, additional postage, and printing additional questionnaires (Zikmund, 2000). However, a disadvantage of self-administered postal questionnaires is that this method cannot guarantee that the right person has answered the questionnaire, there is greater risk of missing data or not collecting additional data and it is difficult to ask a lot of questions (Bryman & Bell, 2007). In this current study, such problems are addressed by writing a good covering letter, follow-up letters, stamped return envelopes, and an appropriate length of questionnaire (Sekaran, 2000).

3.2 Questionnaire design

“A questionnaire is a prepared set of questions (measures) used by respondents or interviewers to record answers (data)” (Hair et al., 2007: 257). Sekaran and Bougie (2010: 197) defined a questionnaire as “a preformulated written set of questions to which respondent record their answers, usually within rather closely defined alternatives”. Generally speaking, a questionnaire contains the questions and scales to generate the data: “The final outcome of a well-constructed questionnaire is reliable and valid data if the related phases of the research are executed well” (Hair et al., 2007: 257).

This section discusses the relevance of the process in designing a questionnaire and the relevant issues concerning the questionnaire design in this case. The questionnaire was developed between January and November 2014, and involved study of the literature, a pre-test stage, ethical issue stage, pre-contact stage and a pilot study in order to ensure the final version of a questionnaire was not misunderstood and was of manageable length.

Hair et al. (2007) recommended five steps for the questionnaire design process, as per the following sections:

3.2.1 Initial considerations (including sampling),

3.2.2 Clarification of concepts (including operationalisation of study constructs),

3.2.3 Determine question types,

3.2.4 Pre-test the questionnaire,

3.2.5 Administer the questionnaire

3.2.1 Initial considerations

At the beginning of developing a questionnaire, this current study has clearly identified what is being researched and what is aimed from this study. One of the critical early undertakings in a questionnaire is developing the questions: When the preliminary list of questions are incorporated in a questionnaire, they should be evaluated from the respondent's perspective (Hair et al., 2007). It needs potential respondents to answer using the self-completion approach. Hair et al. (2007) suggested that researchers must decide whether respondents will answer a particular question, and whether they will respond accurately. Respondents may refuse to reply to sensitive questions or questions that seem an invasion of their privacy.

Sampling

The target population

A target population is "the total collection of elements about which we wish make some inferences" (Cooper & Schindler, 1998: 215). Accordingly, this study aims to investigate the impact of ABC and ISO 9000 on organisational performance; thus, the target population is all the organisations that adopted ABC and ISO 9000 in Thailand. “The basic idea of sampling is that by selecting some of elements in a population, we may draw conclusions about the entire population” (Cooper & Schindler, 1998: 215). Cooper and Schindler (1998) also indicated that there are massive advantages for using a sample rather than census, such as cost of taking cencus and the speed of contribution.

All Thai ISO-9001-registered organisations are supposed to have a similar quality management system. In addition, Thai ISO-9001-registerd organisations that adopted ABC are assumed to employ similar processes for calculation of product/service costs. Therefore, all Thai ISO-9001-registered organisations were selected in this study as a sample representing the whole population. Consequently, the results of this current study can be generalised to the target population of Thai companies.

As discussed in Chapter 2, ABC is optional; this study cannot specify the number of organisations adopting ABC. Recently, there was a study of Intakhan (2014), which found 95 organisations had adopted ABC out of 174 ISO-9001-registered organisations in Thailand (from 900 sample ISO 9001-registered organisations). In order to increase the number of respondents and avoid receiving a low response rate, all ISO-9001-registered organisations in Thailand were selected for this current study (3,105 Thai ISO-9001-registered organisations; updated in December 2014). These organisations are considered the sample size (see Appendix H).

Regarding a general organisational structure, managers are divided into three groups: supervisory or first-line management, middle management, and senior or top management (Buchanan & Huczynski, 2004). The formal structure refers to the way tasks are administered and the authority of individuals. An organisation chart of a firm indicates both middle managers and first-line managers who have responsibility for reporting their work to top management (Dick and Ellis, 2005). Quality managers normally have responsibility for ISO 9000 whereas the accounting manager is usually responsible for ABC. Both of them commonly are the same level of management as middle managers, depending on the size of organisation (Dick and Ellis, 2005). Therefore, the top manager generally has authority to direct activities of lower level managers and use their information. In other words, the top manager or CEO is the highest-ranking executive in an organisation and whose main responsibilities include developing and implementing high-level strategies, making major corporate decisions, and managing the overall operations and resources of a firm.

Because of these reasons, the CEOs or staff members in a similar position, who have the ability and knowledge to answer the questionnaire, are targeted respondents. In order to ensure a questionnaire is directed to the right person, the cover letter describing the aim of this current study is attached in an envelope. Additionally, the pre-contact stage was administered before sending a questionnaire (discussed later in Section 3.2.5).

3.2.2 Clarification of concepts

"In designing the content, structure and appearance of a questionnaire a number of aspects need to be taken into account" (Hair et al., 2007: 264). The constructs that are to be measured must be clearly defined. Also, classification and outcome information, type and wording of questions, questionnaire sequence, and general layout must be considered (Hair et al., 2007).

Operationalisation of study constructs

Operationalising the concepts is the technique to reduce abstract notions of observable behaviour and characteristics in a tangible way (Sekaran & Bougie, 2010). It looks at "the behaviour dimensions, facets, or properties denoted by the concept" (Sekaran & Bougie, 2010: 127). Sekaran and Bougie (2010) indicated that four steps are needed in operationalisation:

1) Tautology of construct

2) Considering the content of the measure

3) Indicating a response format

4) Assessing the validity and reliability of measurement (also discussed in Section 3.3.3.2)

The three main constructs need to be clarified in operationalisation of constructs are, as follows.

The extent of ABC use construct operationalisation

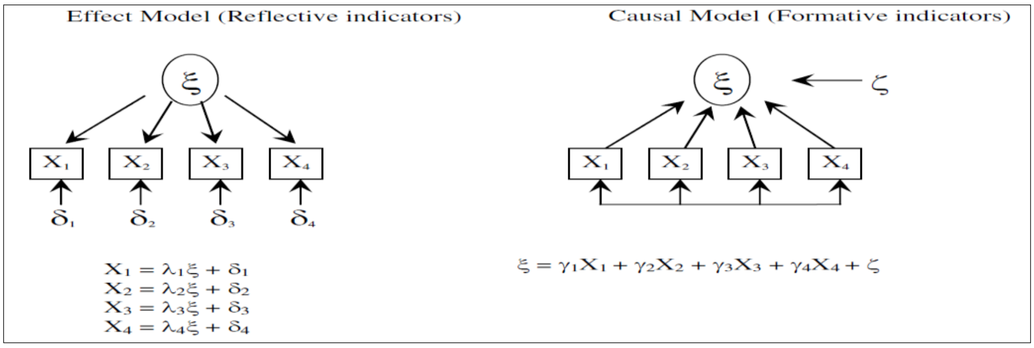
The definition of "*the extent of ABC use"* has been discussed in Chapter 2 (see Section 2.1.1). It is defined as "the degree which ABC is used". After the construct was defined, the next step in the process of measuring abstract constructs is finding out whether there are any existing measures of the construct in the literature (Sekaran & Bougie, 2010).

In previous studies Maiga and Jacobs (2008) measured the extent of ABC by four variables - namely, design engineering, manufacturing engineering, product management, and plant-wide while Jankala and Silvola (2012) measured the extent of ABC by one variable only. In contrast to these previous studies, this study particularly focuses on the "purposes" of using ABC because others focused on the purposes (or objectives) of adopting ABC (see Section 2.2).

Cagwin and Bouwman (2002) described the purposes of using ABC as consisting of product costing, cost management, pricing decisions, product mix decisions, determining customer profitability, budgeting, an off-line analytic tool, outsourcing decisions, and performance measurement. These nine indicators were used to measure the *APPLIC construct* in their research. The current study follows the use of ABC for specific purposes, as Cagwin and Bouwman (2002) indicated, because using an existing variable could enhance levels of reliability and validity of measurement. Additionally, the same indicator enables greater comparison across earlier evaluation studies. In summary, the construct "*the extent of ABC use"* consists of nine indicators.

Briefly put, the measurement model can be reflective or formative (Bollen & Lennox, 1991; Edwards & Bagozzi, 2000). The reflective measurement model represents the fact that the latent construct is considered as the cause and the measure of its reflective indicator. In the sense of domain sampling, reflective indicators can be interchanged. Therefore, deleting one specific indicator will not affect the sense of content (Nunnally & Bernstein, 1994). In contrast, in a formative measurement model, the indicators cause the latent construct. Elimination of relevant indicators will reduce the scale validity in the case (Coltman et al., 2008). In a reflective scale, all indicators are expected to correlate and each indicator is assumed to share a common basis. Thus, increasing the value of the construct will translate into an enhancement in the value for all indicators (Sekaran & Bougie, 2010). Most research supposed the relation between latent construct and observed variables is reflective: "The reflective view dominates the psychological and management sciences; however, the formative view is common in economics and sociology" (Coltman et al., 2008: 1).

Figure 3.6: Reflective measurement model (effect model) and formative measurement model (causal model)



Source: Coltman et al. (2008: 7)

As displayed in Figure 3.6, a formative construct is a summation of the indicators (Diamantopoulos & Winklhofer, 2001). The only variance (error) is the random variance at the construct level (Law & Wong, 1999). Thus, the error term is related to the construct as a whole and not with each indicator. In addition, "cause indicators are exogenous, their variances and covariances are not explained by a formative measurement" (Hancock & Mueller, 2006: 47). Hancock and Mueller (2006) indicated that a construct would be just a linear combination of its indicators, "in this sense it would be similar to a principal component in exploratory factor analysis or a predicted criterion score in multiple regression" (Hancock & Mueller, 2006: 46). Conversely, with a reflective construct, the individual indicator is individually related to the construct. The error terms are reflected individually for each indicator because the covariance of individual indicators is shared with other indicators, and the random variance for individual indicators is treated as an error for an indicator (Law & Wong, 1999).

This study focuses on the degree to which ABC is used by organisations. It is possible that when the degrees of using ABC increase, all indicators consequently increase. In other words, if an organisation uses a significant degree of ABC, ABC should be consistently used for various purposes (indicators). Then, eliminating any indicators should not change the conceptual domain of the construct. At the same time, it is not appropriate to consider the construct as formative, as removing an indicator would modify the definition of the construct. Based upon the above reasoning, this current study views the extent of ABC use as reflective construct.

The extent of ISO 9000 implementation construct operationalisation

In this study, the definition of "*The extent of ISO 9000 implementation"* construct has been previously determined in Chapter 2 (Section 2.1.1) as *"*the degree of putting ISO 9000 into effect". As discussed in Section 2.3, ISO 9004 is not intended for certification, and ISO-9001-registered organisations might implement the eight quality management principles (as ISO 9004 mentioned) differently. Therefore, it would be appropriate to investigate the extent of ISO 9000 implementation in terms of the different principles. There has been no study that operationalised the construct in terms of "the extent of ISO 9000 implementation", Kuncoro (2013) used these quality management principles as indicators to measure a ISO 9000 construct: namely, "*the ISO quality management principles"* construct as a formative construct. In contrast, this study uses quality management principles to measure a construct called "*the extent of ISO 9000 implementation*" as a reflective construct.

As mentioned earlier, the eight principles are not the requirements for implementing ISO 9001. The organisation does not need to employ all of them. It depends on the degree to which ISO 9000 is put into effect. When the extent of the ISO 9000 implementation construct changes, all principles (indicators) are supposed to change in a comparable way. For this reflective model, the principle (indicator) is interchangeable because a change in the extent of ISO 9000 implementation constructs causes changes in all of the indicators. Therefore, deleting one specific indicator will not affect the sense of content. Based upon these reasons, this current study views the extent of ISO 9000 implementation as a reflective construct.

Organisational performance construct operationalisation

"O*rganisational performance"* has been defined in Chapter 2 as "the outcomes of an organisation's action" (see Section 2.1). Neely (2007) suggested four dimensions in measuring organisational performance: namely, accounting and finance, marketing, operational management, and supply chain management. However, regarding the literature on ABC, ISO 9000 and performance, two dimensions (accounting and finance, and operational management) were frequently used to measure organisational performance. Table 3.1 presents the comprehensive indicators used in previous studies of both ABC and ISO 9000, which can be explained from two perspectives: firstly, accounting and finance, in particular, sales and return on assets; and secondly, operation management, in particular, cost, quality, time improvement, organisational efficiency and process effectiveness. Consequently, seven indicators are selected to measure organisational performance. Organisational efficiency has been changed to process efficiency because both ABC and ISO 9000 are associated with a process approach and activities (Kaplan & Anderson, 2004; ISO 9001, 2008).

In the ISO 9000 literature, time delivery was frequently used in measuring performance (Jang & Lin, 2008; Prajogo et al., 2012), whereas Naveh and Marcus (2005) measured on-time delivery. Improving time is also often cited as one of the ABC benefits (Charaf & Bescos, 2014). In the ABC literature, Ittner et al. (2002) and Banker et al. (2008) indicated that the time indicator consists of manufacturing cycle time and customer lead time. On the other hand, Maiga and Jacobs (2008) defined time as consisting of new production time, manufacturing lead time, delivery reliability, and customer responsiveness. In this study, time improvement particularly focuses on delivery reliability due to its relevance to both ABC and ISO 9000 measures. In addition, it also seems to be a sensible measure to use delivery reliability indicator for both manufacturing and non-manufacturing.

Operational performance construct operationalisation

Five out of seven indicators are considered as operational performance measures: namely, reduced total costs, product/service quality, delivery reliability, process efficiency, and process effectiveness. This study defines *operational performance* as the "the outcomes of an organisation relating to an organisation's process". It is considered as a reflective construct because these five indicators are caused by an operational performance construct and correlated highly with each other (see section 4.1.3.4). Therefore, when operational performance changes, all indicators are supposed to change in a comparative way.

Financial performance construct operationalisation

The remaining two indicators are considered as financial performance: namely, sales, and return on assets (ROA). This study defines *financial performance* as "the outcomes of an organisation relating to its financial situation". It is considered a reflective construct because these two indicators are caused by financial performance constructs and are correlated highly with each other (see section 4.1.3.4). Then, when financial performance changes, all indicators are supposed to change in a comparative way.

Table 3.1: The measures used in evaluating the association and the impact of ABC and ISO 9000

Indicators/variable	ISO	ABC	Authors
1. Accounting and Finance			
Net profit/increased profitability	/		Jang and Lin (2008), Feng et al. (2008), Psomas et al. (2013)
		/	Hardan and Shatnawi (2013)
Company financial results	/		Psomas et al. (2013)
Cash flow from operations	/		Psomas et al. (2013)
Sales growth	/		*Psomas et al. (2013), Naveh and Marcus (2005), Fatima (2014), Psomas and Kafetzopoulos (2014)*
		/	*Zaman (2009), Jankala and Silvola (2012)*
Return on assets (ROA)	/		*Naveh and Marcus (2005)*
		/	*Banker et al. (2008), Ittner et al. (2002), Cagwin and Ortiz (2005), Maiga and Jacobs (2008)*
Long-run stock price performance	/		Naveh and Marcus (2005)
Gross profit	/		Naveh and Marcus (2005), Fatima (2014)
Net profit before tax	/		Psomas et al. (2013) Fatima (2014)
Net profit after tax	/		Fatima (2014)
Return on investment		/	Cagwin and Bouwman (2000), Jankala and Silvola (2012)
Holding period returns		/	Kennedy and Affleck-Graves (2001)
Cumulative abnormal returns		/	Kennedy and Affleck-Graves (2001)
Return on sales		/	Maiga and Jacobs (2008)
Turnover on assets		/	Maiga and Jacobs (2008)
3. Operations management			
The improvement of internal administration efficiency	/		Lee et al. (2009)
Reduced cost of quality	/		Naveh and Marcus (2005)
The improvement of the cost	/		*Jang and Lin (2008), Naveh and Marcus (2005), Feng et al. (2008), Lee et al. (2009), Prajogo et al. (2012)*
		/	*Ittner et al. (2002), Banker et al. (2008), Maiga and Jacobs (2008)*
The low employee turnover rate			Lee et al. (2009)
Efficiency	/		*Psomas et al. (2013), Psomas and Kafetzopoulos (2014)*
		/	*Zaman (2009)*
Company productivity	/		Jang and Lin (2008), Psomas et al. (2013), Naveh and Marcus (2005), Feng et al. (2008)
Effectiveness	/		*Psomas et al. (2013), Psomas and Kafetzopoulos (2014)*
		/	*Zaman (2009)*
Product/service quality	/		*Jang and Lin (2008), Psomas et al. (2013), Feng et al. (2008), Psomas and Kafetzopoulos (2014)*
		/	*Ittner et al. (2002), Banker et al. (2008), Maiga and Jacobs (2008)*
Consistent and reliable products/services	/		Psomas et al. (2013)
Product/service conformance to specifications	/		Psomas et al. (2013)
Improved internal procedures	/		Jang and Lin (2008), Feng et al. (2008)
Improved employees' morale	/		Jang and Lin (2008), Feng et al. (2008)
Lower defect rates	/		Naveh and Marcus (2005)
Improved competitive advantage	/		Feng et al. (2008)
Product innovation	/		Prajogo et al. (2012)
Product performance	/		Prajogo et al. (2012)
Time improvement	/		*Jang and Lin (2008), Naveh and Marcus (2005), Prajogo et al. (2012)*
		/	*Ittner et al. (2002), Banker et al. (2008), Maiga and Jacobs (2008)*

Types of scales

"A scale is a tool or mechanism by which individuals are distinguished as to how they differ from one another on the variables of interest to our study" (Sekaran & Bougie, 2010: 141). Zikmund (2003: 296) defined a scale as "a continuous spectrum or series of categories". Scaling aims to represent quantitatively an item's, an event's or a person's place on the spectrum (Zikmund, 2003). Four types of scales are described as follows.

Firstly, nominal scale is "one that allows the researcher to assign subjects to certain categories or groups" (Sekaran & Bougie, 2010: 141). It is the simplest type of scale (Zikmund, 2003). There are only two groups, such as male or female, yes or no. Secondly, ordinal scale "not only categorizes the variables in such a way as to denote differences among the various categories, it also rank-orders the categories in some meaningful way" (Sekaran & Bougie, 2010: 142). This scale provides information on how participants discern them by rank-ordering them. Thirdly, interval scales "allow us to perform certain arithmetical operations on the data collected from the respondents" (Sekaran & Bougie, 2010: 143). This can measure the distance on the scale between two points. Zikmund (2003) also pointed out that interval scales indicate order and measure order or distance in units of equal intervals. "It is a more powerful scale than nominal and ordinal scales and has for its measure of central tendency the arithmetic mean. Its measures of the dispersion are range, the standard deviation, and variance" (Sekaran & Bougie, 2010: 144-145). Finally, ratio scale "not only measures the magnitude of the differences between points on the scale but also taps the proportions in the differences" (Sekaran & Bougie, 2010: 145).

A previous study of Cagwin and Bouwman (2002), (in an APPLIC construct equivalent to *the extent of ABC use* construct in this study), operationalised their survey items by asking whether ABC is consistently used for the following nine purposes by using a five-point Likert scale (1=strongly disagree, 2=disagree, 3=no opinion, 4=agree, and 5=strongly agree). Based on the literature, Likert scales are normally treated as ordinal scales (Bertram, 2006). For data collection, Likert surveys are speedy, efficient and inexpensive methods. However, "as a general rule, mean and standard deviation are invalid parameters for descriptive statistics whenever data are on ordinal scales" (Allen & Seaman, 2007: 64-65). Ordinal scale fails to measure the space between each choice, which cannot necessarily be equidistant.

Many researchers aim to treat Likert scales as continuous variables when the range of values is relatively large and when the gap among values are equivalent (Larsen & Marx, 1981; Kerlinger, 1992). Allen and Seaman (2007) indicated that in some circumstances Likert scales might be used with an interval procedure. The interval should be an attribute of data, not of labels, and a "scale item should be at five and preferably seven categories" (Allen & Seaman, 2007: 65). For instance, using a continuous line or track bar in measuring the pain measurement (worst ever to best ever) can yield a continuous interval measure (Allen & Seaman, 2007).

This study initially created a 10-point scale without a label for each value, only for extreme values: namely, strongly disagree and strongly agree (each point shows approximately 10%, the maximum at 100%). However, after the pre-test study, five of seven colleagues suggested using the scale with a less than 10-point scale due to it being too much and difficult to discriminate between the 10 different options. This study decided to use the scale from 1 to 7 as a continuous scale with markers in equality of each point as showed in Figure 3.7. In addition, in the pilot study, ten organisations had no problem with this scale. Based on the pilot study, the scale establishes the quality of magnitude of differences in scales point. For instance, respondents circled the number 4, 5, 6, and 7 for the item 5.1a, 5.1b, 5.1c, and 5.1d, respectively (See Figure 3.7). They indicated that the extent of ABC use for product costing (5.1a) for cost management (5.1b) was the same as the extent of ABC use for pricing decisions (5.1c) over product mix decision (5.1d). That was, the magnitude of difference represented by space between points 4 and 5 on the scale was the same as the magnitude of difference represented by space between points 6 and 7, or between any other two points. As such, this scale was viewed as a continuous scale, which is more powerful than the nominal and ordinal scales. This scale was applied when measuring the respondent's view toward the object of interest, such as the extent of ABC use, the extent of ISO 9000 implementation, operational performance, and financial performance.

The category scale, is applied to ask demographic questions, on areas such as manufacturing or non-manufacturing in Section C (see Appendix A). Additionally, multiple choice is appropriately used when there are multiple alternatives for respondents: for example, respondents are asked for their positions, namely, Chief Executive Officer (CEO), Managing Director, and Other (specify: ___), as shown in Section D (see Appendix A).

Figure 3.7: The questions and scales measuring the extent of ABC use construct

The extent of ABC use	Strongly disagree						Strongly agree
5.1 ABC is consistently used for the following purposes:							
a. Product costing	1	2	3	4	5	6	7
b. Cost management	1	2	3	4	5	6	7
c. Pricing decisions	1	2	3	4	5	6	7
d. Product mix decisions	1	2	3	4	5	6	7
e. Determine customer profitability	1	2	3	4	5	6	7
f. Budgeting	1	2	3	4	5	6	7
g. As an off-line analytic tool	1	2	3	4	5	6	7
h. Outsourcing decisions	1	2	3	4	5	6	7
i. Performance measurement	1	2	3	4	5	6	7

One question is used in measuring one indicator in order to minimise questionnaire size and avoid a low response rate. Saunders et al. (2012) indicated using a shorter questionnaire increased response rates. In addition, respondents may not respond to a question which is too difficult or too long as Sekaran and Bougie (2010: 202). The questions 5.1a - 5.1i showed the exact name of each indicator. Definitions of the relevant term are presented in the glossary on the last page of the questionnaire (see Appendix A). It is assumed that respondents understand the definitions of each indicator as these indicators are general terms and used as the purpose of ABC in organisations. None of the organisations (in the pilot study) confused the definition of nine purposes.

For the extent of the ISO 9000 implementation construct, Kuncoro (2013) used a five-point Likert scale for measuring a construct and included three or four questions for measuring each principle. Unlike this previous study, this study uses one question in measuring each principle as an interval scale.

In the operational performance construct, five indicators have been discussed in previous studies, as follows.

First, the *reduced total cost indicator* is previously measured by both ordinal scales and ratio scales. In ABC studies, Zaman (2009) also used a five-point Likert type scale. Ittner et al. (2002) measured cost by asking respondents to specify the *changes* in manufacturing costs while Maiga and Jacobs (2008) used a seven-point Likert scale to measure cost improvement (four variables account for cost improvement). Banker et al. (2008) asked respondents about the change in manufacturing costs in the last five years by providing multiple choices: namely, “1 = Increased more than 20%, 2 = increased 11–20%, 3 = increased 1–10%, 4 = no change, 5 = decreased 1–10%, 6 = decreased 11–20%, and 7 = decreased more than 20%” (Banker et al., 2008: 12). In the ISO 9000 literature, the studies of Jang and Lin (2008), Naveh and Marcus (2005), Feng et al. (2008), Lee et al. (2009), and Prajogo et al. (2012) applied a five-point Likert scale with “1” specifying “strongly disagree” and “5” specifying “strongly agree” to measure the reduced cost variable.

In the *product/service quality measure*, ABC literature, Ittner et al. (2002) asked respondents to specify the amount of 1) finished product first pass quality yield in percentage terms and 2) scrap and rework costs as a percentage of sales. Banker et al. (2008) asked about the change in plant first-pass quality yield in the last five years by providing multiple choices namely “1 = declined more than 20%, 2 = declined 1–20%, 3 = stayed the same, 4 = improved 1–20%, 5 = improved more than 20%” (Banker et al., 2008: 12). Conversely, Maiga and Jacobs (2008) used a seven-point Likert scale measuring quality improvement (three variables account for cost improvement). In the ISO 9000 literature, Jang and Lin (2008) and Feng et al. (2008) applied a five-point Likert scale, whereas Psomas et al. (2013) used a seven-point Likert scale where 1 represented “strongly disagree” and 7 represented “strongly agree”.

Discussing *time improvement* in previous studies of ABC, Ittner et al. (2002: 715) asked respondents to specify “manufacturing cycle time from start of production to completion of product in hours and standard lead-time from order entry to shipment in days”. Banker et al. (2008: 9) asked about “the change in manufacturing cycle time and the change in lead-time during the last five years” by providing multiple choices. On the other hand, Maiga and Jacobs (2008) used a seven-point Likert scale measuring time improvement (four variables account for time improvement - namely, manufacturing lead time, new product introduction time, customer responsiveness, and delivery reliability/dependability). In the ISO 9000 literature, particularly on time delivery, was measured by applying a five-point Likert scale with “1” indicating “strongly disagree” and “5” indicating “strongly agree” (Naveh & Marcus, 2005; Jang & Lin, 2008; Prajogo et al., 2012).

For *efficiency*, Psomas et al. (2013) used a seven-point Likert scale where 1 represented “strongly disagree” and 7 represented “strongly agree” to measure a particular company efficiency whereas Zaman (2009) used a five-point Likert type scale to measure effectiveness. Similarly, for the *effectiveness* measure, Psomas et al. (2013) used a seven-point Likert scale (1 represented strongly disagree and 7 represented strongly agree) in measuring particular process effectiveness whereas Zaman (2009) used a five-point Likert type scale measuring effectiveness.

In the financial performance construct, two indicators have been discussed as follows.

Psomas et al. (2013) used a seven-point Likert scale where 1 represented “strongly disagree” and 7 represented “strongly agree” to measure sales, whereas Naveh and Marcus (2005) measured sales by using a five-point Likert scale with “1” indicating “strongly disagree” and “5” indicating “strongly agree”. In the ABC literature, Zaman (2009) also used a five-point Likert type scale while Jankala and Silvola (2012) collected annual sales from the two-year period, after the survey, from statutory financial information

In ISO 9000 literature, return on assets (ROA) is measured by using a five-point Likert scale (Naveh & Marcus, 2005). As in previous studies of ABC, Ittner et al. (2002) asked respondents to specify ROA. Conversely, Maiga and Jacobs (2008) used a seven-point Likert scale measuring ROA.

Unlike the previous studies, this study uses one question in measuring each performance indicator (sales, return on assets, reduced total cost, product/ service quality, delivery reliability, process efficiency, and process effectiveness) as an interval scale (see Appendix A).

3.2.3 Determine question types, format and sequence

There are two forms used in questionnaires: closed and open-ended questions. In the closed questions, the researcher specifies the answer alternatives, whereas open questions allow respondents to provide answers in their own way (Saunders et al., 2016). However, open questions may not motivate busy participants to provide answers. So, this study decides to use closed questions which are relatively convenient for collecting data and which are also normally easy to analyse (Collis & Hussey, 2003). Respondents can also compare responses that have been predetermined (Saunders et al., 2016). In addition, it is more appropriate to a positivist, deductive approach (Zikmund, 2003; Saunders et al., 2012).

After considering the type of question, the next step is creating the questionnaire structure. Hair et al. (2007: 266) showed that “the structure follows a three-part sequence of questionnaire sections. The questions in the initial section are referred to as opening questions. The middle section has questions directed specifically at the topics addressed by the research objectives. The final section includes the classification questions that help the researcher to better understand the results”. The classification questions are shown at the end of questionnaire, such as age and income, as “there is simply an effort to increase response and reduce error” (Hair et al., 2007: 271). The questionnaire contains relevant questions about ISO 9000 in the first part as all respondents are ISO-9001-registered organisations. Questions regarding the organisation’s characteristics and personal details (demography) are placed in the last two sections of the questionnaire.

Collis and Hussey (2003: 125) referred to Kerlinger (1986), suggesting that “good research questions for a positivistic study should express a relationship between variables, be stated in unambiguous terms in question form, and imply the possibility of empirical testing”. Hair et al. (2007) recommended that questions should use simple words, brief sentences, avoiding ambiguity, leading questions, and double-barrelled questions. Ideally, a question should “be no longer than 20 words, excluding possible answers” (Saunders et al., 2016: 452). In addition, questions should be asked in logical order. In other words, early questions should be general and the latter be more specific for minimizing position bias.

Reliability and validity issues

Bryman and Bell (2007: 162) explained, "reliability is fundamentally concerned with issues of consistency of measures". It has different meanings from validity. "When a measure has low reliability, some of the differences in scores between people which it produces are spurious differences, not real differences" (Punch, 1998: 100). The careful construction and piloting of the questions and using the existing questions from reputable surveys can improve the reliability (David & Sutton, 2004).

In summary, reliability and stability of the questionnaire mean that if this study is done again by the same researcher in different times and places or other researchers similar results with occur. In this study, the questions are predominantly drawn from earlier research (see sections 2.2-2.4).

Cronbach's alpha

Establishing measurement reliability is crucial in applied and theoretical research as reliability constitutes an important primary step for assuring construct validity (Iacobucci & Duhachek, 2003). This study employs Cronbach alpha in order to test internal consistency (reliability). It is defined as follows.

$$\alpha = \frac{p}{p-1}\left[1 - \frac{\sum_{i=1}^{p}\sigma_i^2}{\sigma_T^2}\right],$$

Where p is the number of items in the scale, σ is the variance of the i^{th} item, i = 1, 2, .… p and σ_T^2 is the variance of the entire test, hence, it is the summation of the item variances and covariances, as$\sigma_T^2 = \sum_{i=1}^{p}\sigma_i^2 + \sum_{i\neq}\sum_{j}\sigma_{ij}$

It is noted that a high value for Cronbach's alpha shows good internal consistency of the items in the scale; however, it does not imply that there is scale unidimensionality (Gliem & Gliem, 2003). Alpha value can be high despite low item intercorrelations and multidimesionality (Panayides, 2013). In other words, a coefficient alpha is appropriate to test internal consistency (reliability), but not a suitable technique to test dimensionality.

SPSS software is used in the current study for examining Cronbach alpha. Its value is generally accepted at a minimum criterion level of 0.60 (Nunnally, 1978). However, for exploratory studies, alpha ranges from 0.50 to 0.60 are considered adequate (Nunnally, 1978). SPSS outputs also show the corrected item-total correlation (CITC) and the value that Cronbach's alpha would be if that particular item was deleted from the scale. The Corrected Item-Total Correlation (CITC) is the correlation of the item designated with the summated score for all other items (Gliem & Gliem, 2003). These values should be at least 0.40 (Nunnally & Bernstein, 1994). An Alpha score is helpful in that it can demonstrate whether an improvement can be made by dropping an item from a construct. In the pilot study, ten questionnaires were sent to respondents in Thailand, overall they showed 0.71, which met the cut off value of 0.60 (Nunnally, 1978).

"Validity refers to the extent to which a test measures what we actually wish to measure" (Cooper & Schindler, 1998: 166). The objective of measurement is to measure whatever we propose, which is complicated and difficult to understand (Zikmund, 2000). As Sekaran and Bougie (2010) expressed, validly can be separated into three groups; namely, content validity, criterion-related validity, and construct validity. Zikmund (2000: 282) illustrates that "face validity or content validity refers to the subjective agreement among professionals that the scale logically appears to reflect accurately what it purports to measure".

The questionnaire was first revised by the supervisors and also a professional lecturer at Hull University, then seven colleagues, three PhD academic researchers who had graduated from the UK, and academics from Khon Kaen University and Kasetsart University in Thailand. Moreover, the questionnaire was piloted with ten ISO-9001-registered organisations in Thailand. These steps ensure that the measures employed by the researcher actually measure what this study is supposed to measure, thus achieving content validity.

Construct validity is established by the degree to which the measure confirms a network of related hypotheses generated from a theory based on the concepts. Establishing construct validity occurs during the statistical analysis of the data. In construct validity, the empirical evidence is consistent with the theoretical logic of the concepts. In its simplest form, if the measure behaves the way it is supposed to, in a pattern of intercorrelation with a variety of other variables, there is evidence for construct validity (Zikmund, 2000). Construct validity is the most normally cited validity assessment in social science fields (Cooper & Schindler, 1998; Punch, 1998). It is relevant to how the measurement conforms to theoretical expectations (Cooper & Schindler, 1998; Punch, 1998). The construct validity is also described with confirmatory factor analysis (CFA) in section 3.3.3.2.

The positivist approach taken in this research implies that validity was ensured through content and construct validity. The research was taken from previous studies and their theoretical concepts. Moreover, the questionnaire was sent to experts such as CEOs, who form the target population, and other researchers in the field as part of the pilot study. Therefore, since selection of the primary measurement items was based on extensive review of theories and the literature, it was considered to have content validity. The researcher tried to increase validity and reliability during data analysis by using only completed questionnaires in order to present accurate and reliable results. Thus, any returned questionnaires with missing data were excluded from data analysis.

3.2.4 Pre-test the questionnaire

The processes of pre-test and pilot study have been employed to ensure that the questionnaire is validated and reliable. A draft questionnaire was then subjected to pre-test study by seven colleagues. Additionally, the questionnaire was revised by supervisors and also a professional lecturer at the University of Hull. After that, the questionnaire continued onto the process of translation into a Thai version, discussed next.

As the targeted population is in Thailand, the questionnaire needed to be translated into the Thai language. Saunders et al. (2012) referred to Usunnier (1998) and summarised both the advantages and disadvantages of the four techniques for translating a questionnaire as consisting of direct translation, back-translation, parallel translation, and mixed techniques. The study employed a mixed technique. This technique provides the best match between source and target questionnaires. The questionnaire was first checked for grammar and translated into Thai by a professional translator. After that, the questionnaire with the Thai version has been translated back into English by another professional translator and three PhD academic researchers who graduated from the UK to ensure the accuracy of translation. Additionally, it was tested again by an academic from Khon Kaen University and an academic from Kasetsart University in Thailand. Subsequently, the Thai version of the questionnaire continued on to pilot testing.

The first phase of the pilot study began with an in-depth interview of top management: namely, two CEOs, a manager, a quality manager and an accounting manager (two organisations which adopted both ABC and ISO 9000, whereas three organisations which adopted only ISO 9000). The final phase of the pilot study was conducted (five organisations) to test the research process of drop and collect by the researcher (in November 2014).

3.2.5 Administration of the questionnaire

This step involved ethical issues, the pre-contact phase, and collecting data, as follows.

Ethical issue

"The goal of ethics in research is to ensure that no one is harmed or suffers adverse consequences from research activities" (Cooper & Schindler, 1998: 108). Researchers cannot ignore ethical issues because they are directly related to the integrity of a piece of work, including any disciplines that they involve. It is crucial to consider the way a researcher within social sciences more generally has dealt with ethical research issues (Bryman & Bell, 2007). This study follows the ethical procedures for research documented in the Hull University Business School (HUBS): "The School's ethical procedures for research are designed to establish a research ethics system which provides guidance, advice and monitors this important issue" (HUBS, 2011). HUBS (2011) suggested a flowchart of document in order to depict what the researcher needs to be aware of regarding ethical obligations. Before sending the *pro forma* (copy of proposal) and an informed consent letter to the ethics committee for approval, they need to be approved and signed by supervisors and the researcher. Diener and Crandall (1978) described that four main areas should be considered: harm to participant, lack of informed consent, invasion of privacy, and deception. Subsequently, this *pro forma* and the informed consent letter were sent to the HUBS research ethics committee to approve in mid-November 2014. Finally, the research ethics committee approved them at the end of November 2014.

Pre-contact

As mentioned in section 3.1.6, there are some disadvantages to self-administered postal questionnaires. These are addressed here. Firstly, the disadvantage of self-administered postal questionnaire was indicated by Bryman and Bell (2007), who said this method cannot ever be sure that the right person has answered the questionnaire. This can be addressed by describing in the cover letter and pre-contact as Hair et al. (2007) suggested via preliminary contact such as letter, email or phone. In this study, before the survey was operated, phone calls to all ISO-9001-registered organisations were undertaken during September 2014 and October 2014. This step was conducted in order to verify the names and addresses of the organisation, ask for permission to send a questionnaire, and indicate the most appropriate person to respond to the questionnaire. However, only 320 organisations out of 3,105 registered organisations gave the names of the possible respondents and their position. Some organisations refused to provide the name but they allowed the researcher to send the questionnaire addressed to the respondent's position.

The covering letter (see Appendix A) described the aim of the survey, and it accompanied the questionnaire (Saunders et al., 2012). In this study, the content of the letter, included the letterhead, what the research is about, why it is useful, confidentiality, a token reward for participation, and contact details for queries. The name of a respondent was specified in some organisations from the pre-contact, as mentioned above. Saunders et al. (2012: 446) also referred to the research of Dillman (2009) and others that states "the covering letter will affect the response".

Also, the critical disadvantage of self-administered postal questionnaires is the low response rate (Cooper & Schindler, 1998). Saunders et al. (2012) suggested strategies for raising postal questionnaire response rates. This study adopted an incentive strategy by providing an opportunity to enter the prize draw of £150 as a monetary incentive aimed at maximising the response rate. The current questionnaire is not too long, which may also increase the response rate to very high. In addition, the pre-paid return envelope is attached and a handwritten signature appeared in the covering letter. Pre-contact and follow up are also administered. These strategies are considered as effective methods to enhance the response rate.

Collecting data

Organisations listed among the Thai ISO 9000 register were chosen as the sample frame for this research (see section 3.2.1). There are 3,105 companies across different industries, both manufacturing and non-manufacturing organisations. As previously mentioned, the questionnaire including the cover letter, the approval letter and the prepaid envelope was posted to the Chief Executive Officer, Managing Director or other names (staff in the same position) at 3,105 Thai-ISO-9000 registered firms in the beginning of December 2014. The respondent was given three weeks to return the questionnaires; in total, 189 returned questionnaires were received by December 2014. Two-hundred and seventy-four questionnaires were returned in January 2015 after a reminder letter and further phone call. Finally, a total of 619 questionnaires (or 19.94 per cent) were by 28 February 2015 after two reminder letters and two calls. However, 18 of the 619 returned questionnaires were judged as not valid for the analysis mainly due to missing data. Hence, 601 (or 19.36 percent) were considered usable and were included in the final data analysis. The respondents consist of 601 ISO 9000 organisations; 191 organisations that adopted both ABC and ISO 9000, and 410 organisations that adopted only ISO 9000. There are more than 20 categories (see Appendix H) following the International Standard Industrial Classification of All Economic Activities (ISIC). However, this study widely specifies the type of business as consisting of two types: manufacturing and non-manufacturing.

Table 3.2: Overall response rate

Returned Period	Returned questionnaires	Uncompleted questionnaires	Usable questionnaires
December 2014	189	9	180
January 2015	274	3	271
February 2015	156	6	150
TOTAL	**619**	**18**	**601**

3.3 Data Analysis

There are five subsections of data analysis techniques in this study, as follows.

3.3.1 Preliminary analysis

3.3.2 Descriptive analysis

3.3.3 Factor analysis

3.3.3.1 Exploratory factor analysis (EFA)

3.3.3.2 Confirmatory factor analysis (CFA)

3.3.4 Structural equation modelling (SEM)

3.3.5 Multi-group analysis

Each subsection is discussed in following sections.

3.3.1 Preliminary analysis

Preliminary and descriptive analysis was carried out in order to summarise the data in a meaningful way, such as explaining the basic features of the sample, patterns of data, and testing assumptions underlying the selected statistical methods. This section includes response rate, sample size, tests for non-response bias, screening data (deals with outliers, missing data, normality, linearity, homoscedasticity, and multicollinearity), general characteristics of participators, and descriptive statistics for research variables (central tendency, dispersion, and distribution of score).

3.3.1.1 Response rate and sample size

To test the adequacy of sample size, most of the published sample size recommendations were simplified rules based on experts' experience, such as the absolute numbers. For example, Comrey and Lee (1992) indicated that a sample size of 50 is very poor, 100 is poor, 200 is fair, 300 is good, 500 is very good, and above 1,000 is excellent. A sub sampling study of Costello and Osborne (2005b) indicated that for a sample size as small as 26 cases (2:1), only 10% of the samples recovered the correct factor structure, whereas 70 percent in the largest (20:1 or 260 cases) produced correct results. Additionally, Hair et al. (2006) suggested a sample size of between 100 to 150 would obtain stable maximum likelihood estimation results.

On the one hand, some authors focused on the number of cases per variable (rules of thumb); Nunnally and Bernstein (1994), for instance, suggested 10 cases for each variable to be factor analysed, whereas Hair et al. (2007) recommended five cases for each item as the minimum absolute sample size. However, Brown (2006: 142) indicated that “rules of thumb are very crude and usually do not generalize to the researcher’s data set and model. Thus, sample size requirements should be evaluated in the context of particular data set and model at hand”.

Marsh and Bailey (1991) recommended calculating sample size by the ratio (r) of indicators to latent variables (p/k). Meanwhile, Boomsma (1982) indicated that if r = 12 requires a sample size of at least 50, if r = 4, it requires a sample size of at least 100; if r = 3, it requires at least 200 sample, and for r = 2, it requires a sample size of at least 400. In multi-group analysis, this study considers the 1-Sample Z-test method with regards to an online sample size calculator (Statistical Solution, 2016) which uses the 1-Sample Z-test method.

This study considers the adequacy of sample size by following absolute numbers (Hair et al., 2006), rules of thumb (Nunnally & Bernstein, 1994), ratio (r) of p/k (Marsh & Bailey, 1991),and the 1-Sample Z-test method in order to obtain stable factor analysis and SEM solutions.

3.3.1.2 The tests of non-response bias

In this current study, despite the satisfactory response rate, non-response bias is possible. Hussey and Hussey (1997) indicated that non-response bias occurs when not all the questionnaires are returned and not all the questions in the questionnaires have been completed. It is claimed that non-response bias is a major problem with data collection methods using mailed questionnaire (Mangione, 1995; Chongruksut, 2002) as research findings may be incorrectly reported if respondents' answers differ from those of non-respondents (Mangione, 1995). Armstrong and Overton (1977) described that there are three methods of estimating non-response bias: namely, 1) comparison with known values for population; 2) subjective estimates; and 3) extrapolation. In the first method, if the known values come from a different source instrument, then differences may occur. The second method has a problem in the uncertainty about the use of subjective estimates. Thus, extrapolation method is the more appropriate method to test non-response bias in this study. Measuring the non-response bias is based on the presumption that the late response may be a surrogate of non-respondents (Wallace and Mellor, 1988). The validity of the early and the late responses was evaluated using Levene's test, which is applied to test homogeneity of variance. If it is not significant (p-value > 0.05), this means that no statistically significant differences in the mean scores between early and late respondents (see section 4.1.2).

3.3.1.3 Screening data

Tabachnick and Fidell (2014: 63) suggested "before choosing a technique, you should determine the fit between your data and some very basic assumptions underlying most of the multivariate statistics". Each technique is discussed as follows.

Missing data

"Missing data is one of the most pervasive problems in data analysis" (Tabachnick & Fidell, 2007: 62). Hair et al. (2010: 36) defined missing data as "information not available for a subject (or case) about which other information is available". Missing data may occur due to errors in data entry or on the part of the respondents (Hair et al., 1998). Tabachnick and Fidell (2007) indicate that the number of missing data is less important than the pattern of missing data. In other words, the seriousness is dependent on the pattern of missing data. The patterns of missing data are classified into three levels: namely, missing completely at random (MCAR), missing at random (MAR), and missing not at random (MNAR).

Tabachnick and Fidell (2007) illustrated that if the data set is large and a few random points are missing (say, 5% or less) the problem is less serious. Hair et al. (2010: 48) also recommended that "variables with as little as 15 percent missing data are candidates for the deletion, but higher levels of missing data (20-30 percent) can often be remedied". On the other hand, if a number of data are missing from small to moderate data, the problem is more serious. In this study, if missing data are more than 5%, deleting data is chosen in order to address the problem (see section 4.1.3.1).

Outliers

"Outliers are observations with a unique combination of characteristics identifiable as distinctly different from the other observations" (Hair et al., 2010: 64). Tabachnick and Fidell (2007: 72) also described that "an outlier is a case with such an extreme value on one variable (a univariate outlier) or such a strange combination of scores on two or more variables (multivariate outlier) that it distorts the statistics". Moore et al. (2012: 18) suggested that "you should search for an explanation for any outliers. Sometimes outliers point to errors made in recording the data. In other cases, the outlying observation may be equipment failure or other unusual circumstances".

The presence of an outlier has four reasons: the first is procedure error, namely errors in data collection, recording, or entry; second is failure to identify missing-value codes; third is that the outlier is not a member of the study population; and finally there is the case with more extreme values than a normal distribution. In order to identify the outliers, box plots are used in this study as they are "simpler and literally box in observations that are around the median" (Tabachnick & Fidell, 2007: 74). This means that extreme values are cases that fall far away from the box. After outliers are identified, the researcher needs to discover why the cases are extreme and make a decision for dealing with them (see section 4.1.3.2).

Normality

Hair et al. (2010: 36) defined normality as the "degree to which the distribution of the sample data corresponds to a normal distribution". "Screening continuous variables for normality is an important early step in almost every multivariate analysis, in particular when inference is a goal" (Tabachnick & Fidell, 2007: 79). Regression presumes that variables are normally distributed. Variables with non-normal distribution (skewness or kurtosis) can distort associations and significance tests. Testing for normality may be undertaken in either graphical (such as histogram and normal probability plot) or statistical methods, namely Kolmogorov-Smirnov and Shapiro-Wilk test (Tabachnick & Fidell, 2007; Hair et al., 2010). Amos also reports the output of assessment of normality in terms of critical ratio (C.R.) of skew and kurtosis. Kline (2005) indicated that values of skew index exceeding 3.00 seem to be extreme skew, whereas the values from 8.00 to over 20.0 are considered extreme kurtosis.

In order to test normality, a histogram has been employed in this study because the process location is clearly identifiable (see section 4.1.3.3) as well as considering the C.R. of skew and kurtosis from SEM results (see Section 4.5).

Multivariate normality

The assumption of multivariate normality is the underlying assumption of most multivariate analysis and statistical tests. It assumes that all variables and all combinations of the variables are a normal distribution. “Screening continuous variables for normality is an important early step in almost every multivariate analysis, particular when inference is a goal” (Tabachnick & Fidell, 2007: 79).

In SEM, it regularly assumes that the multivariate distribution is a normal distribution (Kline, 2005). “In applied research, multivariate normality is examined using Mardia’s normalized multivariate kurtosis value” (Khine, 2013: 11). Mardia’s coefficient is computed based on the formula p (p+2) where p is the number of observed variables in the model (Raykov & Marcoulides, 2006). “If the Mardia’s coefficient is lower than the value obtained from the above formula, then the data is deemed as multivariate normal” (Khine, 2013: 11). The Mardia’s coefficient can be also found in most SEM software such as AMOS.

In addition, Byrne (2010) referred to Bentler (2005) suggesting that in practice, the z-statistic of values above 5 are indicative of non-normal distribution. This study tests multivariate normality based on either Mardia’s coefficient or z-statistic through AMOS results (see section 4.5).

Linearity

Hair et al. (2010: 35) explained, “linearity is used to express the concept that the model possesses the properties of additivity and homogeneity”. “The assumption of linearity is that there is a straight-line relationship between variables” (Tabachnick & Fidell, 2014: 117). Linearity can be examined by bivariate scatterplots. If both variables display linearity, the scatter plot is oval-shaped. Conversely, nonlinearity shows as non-oval in scatterplot (Tabachnick & Fidell, 2014). However, using bivariate scatterplots may be burdensome if there are numerous variables (Tabachnick & Fidell, 2014).

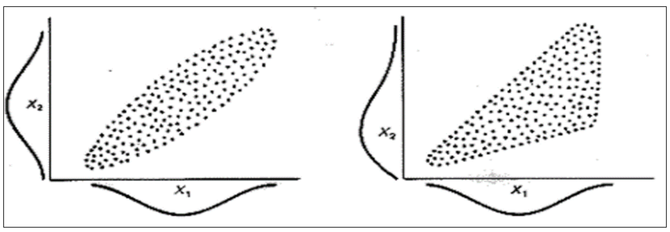
In this study, there are numerous variables; thus, testing deviation from linearity is firstly examined. If the significant value of deviation from linearity is above 0.05, then the relationship between the variables is linear. On the other hand, if there is significant value deviation from linearity below 0.05; it needs further examination by bivariate scatterplots (see section 4.1.3.3).

Homoscedasticity

Hair et al. (2010: 35) described homoscedasticity as "when the variance of errors term appears constant over a range of predictor variables, the data are said to be homoscedastic". On the other hand, "when the error terms have increasing or modulating variance, the data are said to be heteroscedastic" (Hair et al., 2010: 35).

"Homoscedasticity is related to the assumption of normality when the assumption of multivariate normality is met, the relationships between variables are homoscedastic" (Tabachnick & Fidell, 2014: 119). Homoscedasticity can be tested by graphical tests of equal variance dispersion and statistic tests (Hair et al., 2010). In a statistic test, the Levene test is commonly used in assessing the equality of variance (Hair et al., 2010). In contrast, in the graphical test, "the bivariate scatterplots between two variables are of roughly the same width all over with some bulging toward the middle" (Tabachnick & Fidell, 2014: 119), as illustrated in Figure 3.8. Two metric variables are best tested graphically. Cones or diamonds shapes are noticed when there is departure from an equal dispersion. This study tests homoscedasticity by determining scatterplots (see section 4.1.3.3).

Figure 3.8: Bivariate scatterplots under conditions of homoscedasticity and heteroscedasticity



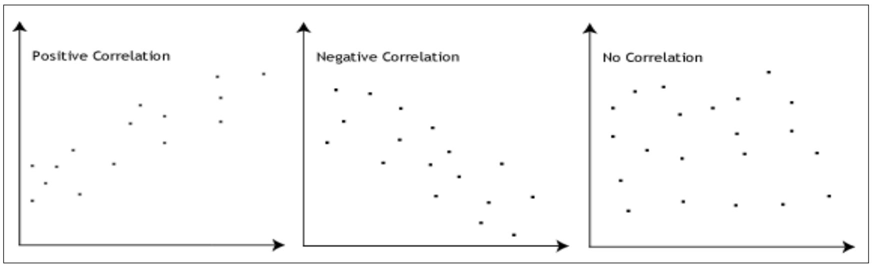
Source: Tabachnick and Fidell (2014: 119)

Multicollinearity

Multicollinearity is a problem with a correlation matrix that occurs when variables have excessively high correlation (Tabachnick & Fidell, 2007). Kline (2005: 56) pointed out “multicollinearity can occur because what appear to be separate variables actually measure the same thing”. Inspecting a correlation matrix is one of methods to assessing multicollinearity. A correlation matrix with values greater than 0.90 is considered as involving multicollinearity (Kline, 2005). Other statistics are tolerance and variance inflation factor (*VIF*). Tolerance comes from 1- R^2 indicating the proportion of total standardised variance that is unique. Variance inflation factor (*VIF*) equals 1/ (1- R^2), the ratio of the total standardised variance. Hair et al. (2010: 204) indicated “a common cut-off threshold is a tolerance value of 0.10, which corresponds to a VIF value of 10”. The values of tolerance less than 0.1 and VIFs exceeding 10 are signs of serious multicollinearity (Hair et al., 2010).

In this study, multicollinearity is examined by using Pearson’s correlation coefficient (see section 4.1.3.4) because it is easy to interpret from considering the direction of the correlation. Pearson’s correlation coefficient measures the strength of a linear relationship between two variables. Its values range from +1 to -1. In Figure 3.9, a value of 0 means that two variables have no association, a value exceeds 0 indicating a positive association, and a value below 0 indicating a negative association (Kline, 2005).

Figure 3.9: The positive correlation, negative correlation and no correlation



Source: https://statistics.laerd.com

3.3.2 Descriptive statistics

Descriptive statistics are examined to report the basic characteristics of the data in this research. These descriptive statistics contain central tendency, dispersion, and distribution of score (see section 4.2). Randolph and Myers (2013) stated that one of the most common ways of analysing and describing data is to compute measures of central tendency.

Central tendency

Central tendency is defined as "an estimation of the centre of a distribution of values" (Faulkner & Faulkner, 2009: 157). Three major types of estimates of central tendency are usually used including mean, median, and mode.

In central tendency, mean is the most frequently used measure (Mann, 2013) for finding the accurate average of data. The mean is the summation of all the values divided by the number of values.

Mean = Sum of all values / Number of values

"The median is the value in the middle of a distribution after all of the values have been ranked in order from smallest to largest" (Randolph & Myers, 2013: 11). Mann (2013: 91) illustrated the calculation of median consisting of two steps: firstly, "rank the data set in increasing order", followed by "find the middle term. The value of this term is the median". In other words, the median is the formal version of the midpoint regarding a specific rule (Moore et al., 2012).

"The mode is simply the value or attribute that occurs most frequently in a distribution of values" (Randolph & Myers, 2013: 13).

Dispersion

Dispersion relates to the spread of the values around the central tendency. The range and the standard deviation commonly measure dispersion. The range equals the highest value minus the lowest value. "The Standard Deviation (S.D.) measures spread by looking at how far the observations are from their mean" (Moore et al., 2012: 39). Researchers frequently use the S.D. method when measuring the dispersion of a set of data to show how the data is spread around.

Distribution of score

Distribution of score is related to the skewness and kurtosis (Tabachnick & Fidell, 2014). Hair et al. (2010: 36) defined "skewness as measure of the symmetry of a distribution, in most instances the comparison is made to a normal distribution". Kurtosis is defined as a "measure of the peakedness or flatness of a distribution when compared with a normal distribution" (Hair et al., 2010: 35). A distribution is symmetric if it appears the same between left and right from the centre point. Data with high kurtosis tends to have a sharp peak and heavy tails. Conversely, data with low kurtosis tends to have a flat top (Tabachnick & Fidell, 2014). In normal distribution, skewness and kurtosis values tend to be zero. Thus, the further the values are far from 0, the more likely it is that the data might not distribute normally.

3.3.3 Factor analysis

This study applies factor analysis (in terms of exploratory factor analysis and confirmatory factor analysis) in order to test the dimensional structure of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance.

Factor analysis (FA) refers to "an interdependent technique whose primary purpose is to define the underlying structure among the variables in the analysis" (Hair et al., 2006: 104). One type of factor analysis is exploratory factor analysis (EFA), indicated as "orderly simplification of interrelated measures". It is assumed that each common factor affects every manifest variable (observed variables) and common factors are either uncorrelated or all correlated. EFA is grounded on a data-driven approach without the constraints of a number of factors. Confirmatory factor analysis (CFA), on the other hand, is theory-driven. It is used to test the hypothesis with regard to the underlying structure of data.

Factor analysis is applied in this study in order to establish underlying dimensions between variables and constructs. Regarding theory, factor analysis allows this current study to confirm or refine theory (Tabachnick & Fidell, 2007; Williams et al., 2012). Looking at the extent of ABC use, Cagwin and Bouwman (2002) considered nine purposes for the unidimensional construct without testing dimensionality. In terms of the extent of ISO 9000 implementation, most previous studies indicated the construct as a single construct without testing the dimensionality.

The organisational performance literature indicated organisational performance as multidimensional. However, based on both ABC and ISO 9000 literature, no study has tested the dimensionality of the organisational performance construct. Because of this, this study conducts EFA in order to explore the factorial structure of organisational performance, as Courtney (2013: 1) suggested that EFA is "particularly appropriate for scale development where little theoretical basis exists for specifying the number and patterns of common factors". CFA is also employed in this study to confirm the results of EFA, and to ascertain the respective dimensions regarding theories and literature. This is an important step to extract a number of factors as this decision directly affects the findings and subsequent theory development. In other words, it is making a decision as to how many factors (constructs) to retain when applying EFA and CFA before testing the effect of initiatives (the extent of ABC use or/and the extent of ISO 9000 implementation) on a performance construct. Indirect effect might occur in the case of considering organisational performance as more than one factor. Similarly, if the extent of ABC use and the extent of ISO 9000 implementation are multidimensional, different dimensions might impact on organisational performance differently.

3.3.3.1 Exploratory factor analysis (EFA)

There are important issues that need to be considered in employing EFA: namely, sample size, factorability of R, the inter-correlation, missing data, outliers, linearity, normality, multicollinearity and homoscedasticity. Most issues (except factorability of R and the inter-correlation) have been discussed in section 3.3.1.

The strength of the relationships and linear relationship can be measured by considering the correlation matrix. It is generally expected to have correlation coefficients greater than 0.30 (Tabachnick & Fidell, 2007). However, using correlation coefficients still have some limitations as it does not indicate the practical meaning of factors' significance as the values are restricted from 0 to 1. Therefore, instead of considering only correlation coefficients, the factorability of R, a complex measure is recommended for evaluating the strength of the relationships and suggesting the factorability of variables.

There are two statistical methods employed to test the factorability of R: 1) Bartlett's test of sphericity; and 2) the Kaiser-Meyer-Olkin (KMO). The guidelines for both are: Bartlett's test of sphericity should be statically significant (p-value ≤ 0.05), whereas a KMO index value of 0.80 or over is meritorious, 0.70 or over is middling, 0.60 or over is mediocre, and below 0.50 is not acceptable (Hair et al., 2006). Based on Kaiser's criterion or eigenvalue rule, only factors with an eigenvalue of 1.0 or above can be retained for further investigation (Pallant, 2007). Furthermore, the level of cumulative percentage of the total variance of 60 is considered as satisfactory in social sciences (Hair et al., 2006). However, 50 percent of the variance explained is the minimally acceptable level (Beavers et al., 2013).

If the data met all the assumptions, this means factor analysis is the appropriate method to apply. Brown (2006: 20) stated that "other procedural aspects of EFA include 1) selection of a specific method to estimate the factor model; 2) selection of the appropriate number of factors; 3) in the case of models that have more than one factor, selection of technique to rotate the initial factor matrix to foster the interpretability of the solution; 4) if desired, selection of the method to compute factor scores".

Factor extraction

There are many methods that can be used to estimate the common factor model, such as maximum likelihood (ML), unweighted least squares, image factoring, principal axis factoring (PAF), generalised least squares, and alpha factoring (Brown, 2006; Hair et al., 2010; Williams et al., 2012). Brown (2006) indicated that ML and PAF are the most commonly used factor extraction methods. Fabrigar et al. (1999) explained that if data are relatively normally distributed, ML is the most appropriate option because "it allows for the computation of a wide range of indexes of the goodness of fit of the model and permits statistical significance testing of factor loadings and correlations among factors and the computation of confidence intervals." (Costello & Osborne, 2005a: 2). On the other hand, if multivariate normality is seriously violated, they recommend employing PAF (Fabrigar et al., 1999).

In this study, ML has been selected to be employed as it can indicate underlying factors that reflect what the variables share in common and how the data of the current study is normally distributed (Hair et al., 2006).

Factor rotation

Once the appropriate number of factors is considered, the extracted factors are related. Rotation maximises high-item loadings whilst minimising low-item loadings, thus developing a more explainable and simplified result (Brown, 2006). Orthogonal technique and oblique technique are two common rotation techniques (Hair et al., 2010). Orthogonal method includes varimax, quartimax, and equamax, whereas oblique method contains direct oblimin, quartimin, and promax. The orthogonal method produces factors that are uncorrelated, while the oblique method allows the factors to relate (Hair et al., 2010). Researchers in the social science area expecting some correlation among factors due to behaviour being seldom partitioned into packaged units that function separately (Costello & Osborne, 2005b).

In fact, there is no broadly favoured method of oblique rotation since all methods tend to produce similar results (Fabrigar et al., 1999). In other words, although there are many alternatives for executing the steps of EFA, the differences between them are insignificant, so it doesn't really matter which methods the researcher selects (Costello & Osborne, 2005a). Finally, this study employs the most commonly used orthogonal approach, particularly varimax, as an appropriate method when the theoretical hypotheses concern unrelated dimensions.

Factor interpretation

A factor loading shows the relationship between the variables and their factor. Hair et al. (2010) assessed the loadings regarding practical significance; factor loadings in the range of ±0.30-0.40 are acceptable as a minimum requirement, ±0.50 or above are of practical significance, and exceeding 0.70 shows a well-defined structure and the goal of any factor analysis. However, factor loadings should be assessed at stricter levels. Hair et al. (2010) also recommended considering factor loadings with different sample sizes by employing a power level of 80 percent, a 0.05 significant level and the proposed inflation of standard errors. The sample size needed for significance is displayed in Table 3.3. In this study, the sample sizes of four models range from 191 to 601, then the current study uses 0.40 as the cut-point value as the minimum level, as Hair et al. (2010) suggested.

In summary, EFA is a data-driven approach. No specifications are indicated regarding the number of factors or the pattern of association between factors and their indicators (Brown, 2006). Therefore, seven indicators are examined in EFA in order to consider the number of factors and the pattern of indicator-factor loadings (see section 4.4.1). This study determines the number of factors to retain in EFA by considering only factors with an eigenvalue (Kaiser's criterion) of 1.0 or above (Pallant, 2007) and factor loadings more than 0.40 (Hair et al., 2010).

Table 3.3: Identifying significant factor loadings based on sample size

Factor Loading	Sample size needed for significance
0.30	350
0.35	250
0.40	200
0.45	150
0.50	120
0.55	100
0.60	85
0.65	70
0.70	60
0.75	50

Source: Hair et al. (2010: 117)

EFA by nature is exploratory without inferential statistics. It is employed as the most appropriate for exploring the data. However, it is not used to test hypotheses or theories (Costello & Osborne, 2005a). Costello and Osborne (2005a) also cautioned researchers against leaping to conclusions regarding exploratory analyses. Confirmatory factor analysis (CFA) is recommended in that it allows researchers to test hypotheses through inferential techniques, providing more substantive analytical options. Because of this, CFA is proposed as a more sophisticated technique for testing the dimensional structure of measures in this study (Byrne, 2010).

3.3.3.2 Confirmatory factor analysis (CFA)

CFA is applied to this study for two main objectives: namely, testing the dimensionality of constructs, and testing validity and reliability of the measurements

(Hair et al., 2006). There are five steps for testing CFA using similar processes as for when examining SEM (see section 3.3.4).

3.3.3.2.1 Testing the dimensional structure of the measurement

In order to test the dimensionality of the measure, alternative models are established in this study as follows: I) all indicators can be tested with only one construct (one factor model); II) all the factors are allowed to be freely related (first-order factors model); and III) all factors may be correlated as a higher order factor model (Byrne, 2010).

Kline (2005: 199) illustrated that "in order for a CFA model with a second-order factor to be identified, there must be at least three first-order factors. Also each first-order factor should have at least two indicators". However, "given the specification of only three first-order factors, the higher order structure will be just-identified" (Byrne, 2010: 132), and lead to an identification problem (Byrne, 2010). Therefore, only first two models (I and II) are examined in the study to find out the dimensional structure of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance (see section 4.4.1).

3.3.3.2.2 Testing the validity and reliability of the measurement

CFA is also employed to assess convergent validity and discriminant validity (Hair et al., 2006), as follows.

Convergent validity

Hair et al. (2010: 709) indicated, "that the items are indicators of a specific construct should converge or share a high proportion of variance in common". In cases of high convergent validity, the minimum of all factor loadings should be 0.5 or above and ideally 0.7 or higher (Hair et al., 2010). Additionally, average variance extracted (AVE) and construct reliability (CR) should be satisfied.

AVE is computed as a summation of standardised factor loadings extracted by a number of items per construct (Hair et al., 2010). AVE should exceed the value of 0.5 or above to indicate adequate convergent validity (Hair et al., 2010).

$$\text{AVE} = \frac{\text{Sum of standardised factor loading}}{\text{Number of items per construct}}$$

CR is computed as the squared sum of factor loadings divided by squared sum of factor loadings and sum of standard errors. Diamantopoulos and Siguaw (2000) suggested that CR should exceed 0.60. However, Nunnally (1978) suggested the generally accepted minimum criterion level of 0.50 (see Section 4.4.2).

$$\text{CR} = \frac{\text{the squared sum of factor loadings}}{\text{(Squared sum of factor loadings + sum of standard errors)}}$$

Discriminant validity

There are two types of discriminant validity coefficients. The first includes the correlations between measures of different traits that are provided by the same measurement method. The second type includes correlations between measures of different traits that are obtained using different methods of measurement (Raykov, 2011). In order to assess discriminant validity, Hair et al. (2006) suggested comparison between the variance extracted estimate (or average AVE) and the squared correlation estimate by CFA. If average AVE exceeds the squared correlation estimate, it means there is evidence of discriminant validity (see Section 4.4.2).

3.3.3.2.3 Common method variance (bias)

The common method variance (CMV) biases might have potential effects on research results (Podasakoff et al., 2003). Then, it is crucial to understand their sources and how to control or minimise CMV. CMV may be a concern when using self-report questionnaires collecting data at the same time from the same respondents (Chang et al., 2010). “Self-report data can build false correlations if the respondents have a propensity to provide consistent answers to survey questions that are otherwise not related” (Chang et al., 2010: 178). Therefore, common methods can cause systematic measurement errors and the actual relationship among theoretical factors (Podasakoff et al., 2003; Chang et al., 2010).

Many statistical remedies are used to detect and control any possible CMV. A *post hoc* Harman one-factor analysis is often employed in order to check whether variance in the data can be largely assigned to a single factor (Chang et al., 2010). However, Podasakoff et al. (2003) indicated that a *post hoc* Harman one-factor analysis is insensitive as there is no given guideline for an acceptable percentage of explained variance of a single-factor model. Therefore, comparing the model fit of two models with CFA is an alternative way to support the result of a *post hoc* Harman one-factor analysis. Consequently, this study examines a *post hoc* Harman one-factor analysis of four models by EFA, followed by comparing model fit of the first model and the second model. Two steps are tested for detecting and controlling CMV (see Section 4.4.2).

3.3.4 Structural equation modelling (SEM)

Byrne (2010: 3) defined structural equation modelling (SEM) as "a statistical methodology that takes a confirmatory approach to the analysis of a structural theory bearing on some phenomenon". Similarly, SEM is defined by Raykov and Marcoulides (2006: 1) as "a statistical methodology used by social, behavioural, and educational scientists as well as biologists, economists, marketing, and medical researchers". "Structural equation modelling also referred to as causal modelling, causal analysis, simultaneous equation modelling, analysis of covariance structures, path analysis, or confirmatory factor analysis" (Tabachnick & Fidell, 2007: 676). "Today, structural equation modelling (SEM) has become a popular and important way of analysing data" (Ghauri & Grønhaug, 2010: 194). In terms of SEM, it expresses "two important aspects of the procedure: (a) that the causal processes under study are represented by a series of structural (i.e., regression) equations, and (b) that these structural equations can be modelled pictorially to enable a clearer conceptualisation of the theory under study" (Byrne, 2010: 3). SEM presents measurement error whereas traditional regression analysis ignores measurement errors (Raykov & Marcoulides, 2006). Additionally, SEM uses both observed and latent variable, while regression analysis examines only observed variables (Byrne, 2010).

SEM has been used in this study because firstly, SEM allows this current study to examine both direct and indirect effects (Raykov & Marcoulides, 2006). Secondly, multi-group analysis in SEM allows this study to test the significant differences between organisations that adopted both ABC and ISO 9000 and organisations that adopted only ISO 9000. In addition, this study can test the moderating impacts on organisational performance.

Generally, there are two sub models for SEM: a measurement model and a structural model. The measurement model relates to manifest variables and construct variables, whereas structural model identifies an association among construct variables (Byrne, 2010). In other words, the measurement model illustrates the connections between the latent variables and their observed variables whereas the structural describes the causal connections among latent variables (Blunch, 2008).

"Latent variable is a central concept in SEM. Latent variables are measures of hidden or unobserved phenomena and theoretical constructs. In social work, latent variables represent complex social and psychological phenomena, such as attitudes, social relationships, or emotions, which are best measured with multiple observed items" (Bowen & Guo, 2012: 1-2). "As latent variables cannot be measured directly, they are measured by indicators (observed variables), usually questions in a questionnaire or some sort of test" (Blunch, 2008: 5).

Rectangles are used to represent observed variables, which may be either indicators of latent variables in the measurement model or independent or dependent variables in the structural model. Ellipses indicating latent variables, independent and dependent variables as well as errors of prediction in the structural model and errors of measurement in the measurement model. Arrows are used to illustrate association and are of two sorts. Straight arrows point in one direction and indicate direction of prediction, from predictor to outcome (Tabachnick & Fidell, 2007; Byrne, 2010).

Individual programs

Kline (2005) indicated eight different SEM computer programs. "They include Amos, the CALIS procedure of SAS/STAT, EQS, LISREL, Mplus, Mx Graph, the RAMONA module of SYSTAT, and the SEOATH module of STATISTICA" (Kline, 2005: 79). The choice of software is dependent on the objective of the SEM analysis and the computing skills of the user (Khine, 2013).

AMOS

AMOS is "actually an acronym for analysis of moment structures or in other words, the analysis of mean and covariance structures" (Byrne, 2010: 17). AMOS is "the Microsoft Windows interface, the program allows you to choose from two completely different methods of model specification" (Byrne, 2001: 15).

Byrne (2010: 17) noted "the choice of which Amos method to use is purely arbitrary and bears solely on how comfortable you feel in working within either a graphical interface or a more traditional programming interface". This study applies AMOS due to it being accessible and provided by the University of Hull.

3.3.4.1 The steps of SEM approach

In structural equation modelling literature, five steps are mentioned for testing SEM models: 1) model specification, 2) identification, 3) estimation, 4) evaluation, and 5) modification (Schumacker & Lomax, 2004; Kline, 2005; Blunch, 2008; Byrne, 2010; Hair et al., 2010; Kline, 2013; Tabachnick & Fidell, 2014).

It is noted that the first two steps have been involved in operationalising constructs as discussed in section 3.2.2 and also indicated in the two previous sections (See section 3.3.2 and 3.3.3)

3.3.4.1.1 Model specification

In this step, a model is stated. "Model specification involves determining every relationship and parameter in the model that is of interest to the researcher" (Schumacker & Lomax, 2004: 62). In other words, the model is specified by hypothesised relationships representing parameters' paths. These relationships can be determined as fixed, free or constrained. Fixed parameters are fixed at zero or one. If a parameter is fixed at zero, this means no relationship between variables and it does not need a path (straight arrows). Free parameters are estimated from the observed data and are assumed by the researcher to be non-zero. Constrained parameters are specified to be equal to a certain value (e.g. 1.0) or equal to another parameter in the model that needs to be estimated.

Kline (2005) indicated that three types of parameters needed to be specified: directional effects, variances, and covariances. Directional effects explain the association between the observed indicators and latent variables, called factor loadings, and relationships between latent variables and other latent variables (called path coefficients). Tabachnick and Fidell (2014) defined directional effects as regression coefficients. “Regression represents the influence of one or more variables on another” (Byrne, 2010). Conversely, covariances are non-directional associations among independent latent variables. Variances are then estimated for indicator error (Kline, 2005).

3.3.4.1.2 Model identification

Blunch (2008) indicated two rules for obtaining identification. Firstly, the three-indicator rule meant that “a confirmatory factor model is identified, if 1) every factor has at least three indicators, 2) no manifest variable is indicator for more than one factor, and 3) the error terms are not correlated” (Blunch, 2008: 129). In the latter, the two-indicator rule has conditions consisting of: 1) every factor has at least two indicators, 2) no manifest variable is indicator for more than one factor, 3) the error terms are not correlated, and 4) the covariance matrix for the latent variables does not contain zeros” (Blunch, 2008: 129). Tabachnick and Fidell (2014: 765) also supported the idea that “if there are only two indicators for a factor, the model may be identified; if there are no correlated errors, each indicator loads on only one factor, and none of the variances or covariances among factors is equal to zero”.

The degrees of freedom in SEM are “equal to the amount of unique information in the sample variance/covariance matrix (variance and covariances) minus the number of parameters in the model to be estimated (regression coeficients and variance and covariances of independent variables)” (Tabachnick & Fidell, 2014: 750). The following formula, $[p(p+1)]/2$, where p represents the number of observed variables, is used to compute the number of variances and covariances (Tabachnick & Fidell, 2014).

Schumacker and Lomax (2010) described that there are three identification types: just-identified, over-identified and under-identified. When the degree of freedom is zero, the model is just-identified. “A model is over-identified when there is more than one way of estimating a parameter (or parameters)” (Schumacker & Lomax, 2004: 64). On the other hand, the last type of identification shows negative degree of freedom, and then the parameter estimation is not possible (Kline, 2013). Kline

(2013) suggested that before continuing to model estimation, the issues relating to sample size (see section 3.3.1.1) and data screening (see section 3.3.1.3) have to be considered.

3.3.4.1.3 Model estimation

"In estimation, the goal is to produce Σ (θ) (estimated model-implied covariance matrix) that resembles S (estimated sample covariance matrix) of the observed indicators, with the residual matrix (S – Σ (θ)) being as little as possible. When S - $\Sigma(\theta) = 0$, then $\chi 2$ becomes zero, and a perfect model is obtained for the data" (Khine, 2013: 11). There are various estimation techniques: namely, maximum likelihood estimation (MLE), unweighted least squares (ULS), generalised least squares (GLS), weighted least squares (WLS), and asymptotic distribution free (ADF) methods (Tabachnick & Fidell, 2014).

This study uses maximum likelihood (ML). Nachtigall et al. (2003: 7) stated that "the most common type of estimating parameters and computing model fit is the maximum likelihood method (ML) requiring multivariate, normally distributed continuous variables". Furthermore, MLE "is currently the most frequently used estimation method in SEM" (Tabachnick & Fidell, 2014: 770). Raykov and Marcoulides (2006: 30) also supported the idea that "ML method can also be employed with minor deviations from normality".

3.3.4.1.4 Model evaluation

"Once the parameter estimates are obtained for a specified SEM model, they should determine how well the data fit the model" (Schumacker & Lomax, 2004: 69). Schumacker and Lomax (2004: 69) indicated two ways to think about model fit: 1) considering "some global-type omnibus test of the fit of the entire model"; and 2) examining "the fit of individual parameters of the model" (Schumacker & Lomax, 2004: 70). In the parameter estimates, Byrne (2010: 67) stated that "examples of parameters exhibiting unreasonable estimates are correlations > 1.00, negative variances, and covariance or correlation matrices that are not positive definite".

First, the SEM literature reported various statistical indices of overall model fit. It should be noted that each fit index has a few problems (Kline, 2005). Kline (2005) described basic limitations of all fit indexes in SEM as: 1) values of fit indices present only the overall fit of the model, not each part of the model. This means that even when the overall fit of the model appears a perfect fit, some parts might be a poor fit; 2) no single index indicates a gold standard for all models, so models should be assessed based on more than one index; 3) fit indices did not mean that the results are theoretically meaningful; and 4) value of fit indexes indicates sufficient fit but does not mean the model has high power. Finally, the sampling distributions of several fit indexes applied in SEM are unknown (except RMSEA).

Second, there are three main features of individual parameters for consideration. Firstly, "whether a free parameter is significantly different from zero (critical value exceeds 1.96 for a two-tailed test at the 0.05 level)". Secondly, "whether the sign of the parameter agrees with what is expected from the theoretical model". Lastly, "parameter estimates should be within an expected range of values" (Schumacker & Lomax, 2004: 70). This section discusses the various goodness-of-fit indices available in SEM software.

Schumacker and Lomax (2004: 81) stated, "finding a statistically significant theoretical model that also has practical and substantive meaning is the primary goal of using structural equation modeling to test theories". There are three types of model fit criteria as Schumacker and Lomax (2004) illustrated. The first is the non-statistical significance of chi-square and root-mean-square error of approximation (RMSEA). Next is the statistical significance of individual parameter estimates for the paths in the model. Last is the magnitude and the direction of parameter estimates.

Absolute fit indices

"Absolute fit indices are a direct measure of how well the model specified by the researcher reproduces the observed data" (Hair et al., 2010). The most commonly applied are chi-square (χ^2), goodness-of-fit statistic (GFI), the root mean square error of approximation (RMSEA), and the root mean square residual (RMR) (Schumacker & Lomax, 2004; Hair et al., 2010). "These criteria are based on differences between the observed (Original, S) and model-implied (reproduced, Σ) variance-covariance matrices" (Schumacker & Lomax, 2010: 85).

Chi-square (χ^2)

Chi-square, also known as the generalised likelihood ratio (Byrne, 2010), shows the differences between observed and implied covariance matrices. The value close to zero means there is a small difference between the expected and observed covariance matrices (Schumacker & Lomax, 2004). In addition, when the p-value ≤ 0.05 the chi-square is close to zero. In other words "a nonsignificant χ^2 value indicates that the two matrices are similar, indicating that the implied theoretical model significantly reproduces the sample variance-covariance relationships in the matrix" (Schumacker & Lomax, 2004: 100).

However, this fit statistic is likely to be implausible regarding the size of correlations. For instance, higher correlations contribute to bigger values of chi-square. Additionally, chi-square is affected by sample size, particular in the larger size and non-normal distribution. Both can lead to rejection of the model (Kline, 2005). Due to the restrictiveness of chi-square, it is seldom that a chi-square only is used in applied research (Brown, 2006).

As mentioned, using only a single statistical significance cannot identify a correct model; thus, researchers normally employ several criteria when considering and evaluating model fit (Schweizer et al., 2003; Schumacker & Lomax, 2004; Hair et al., 2010): for example, the comparative fit index (*CFI*), the root mean square error of approximation (*RMSEA*), and the comparative fit index (*CFI*). This broad range of fit indices is applied in the study to evaluate the measurement models and the structural models.

Goodness-of-fit statistic (GFI)

GFI was produced by Jöreskog and Sorbom as an optional to the χ^2 test (Tabachnick & Fidell, 2014). It is based on "the ratio of the sum of the squared differences between the observed and reproduced matrices to the observed variances, thus allowing for scale" (Schumacker & Lomax, 2004: 101). Values for GFI range from 0.00 to 1.00. Hair et al. (2010) indicated the cut-off point of 0.90.

The root mean square error of approximation (RMSEA)

RMSEA indicates the amount of unexplained variance: "RMSEA estimates the amount of error of approximation per model degree of freedom and takes sample size into account" (Kline, 2005: 139). "It has become regarded as one of the most informative fit indices" (Diamantopoulos & Siguaw, 2000: 85). The values range from 0 to 1, a smaller RMSEA value implying a better model fit. An RMSEA value between 0.08 and 0.10 presents a mediocre fit and under 0.08 indicates a good fit (MacCallum et al., 1996).

The root mean square residual (RMR)

RMR represents "the average residual value derived from the fitting of the variance-covariance matrix for the hypothesised model to the variance-covariance matrix of the sample data" (Byrne, 2001: 82). The values range from 0 to 1.00, an RMR value below 0.05 is viewed as a well-fitting model (Byrne, 2001). However, values less than 0.08 are considered as acceptable (Hooper et al., 2008).

Incremental fit indices

"Incremental fit indices differ from absolute fit indices in that they assess how well the estimated model fits relative to some alternative baseline model" (Hair et al., 2010: 668). Schumacker and Lomax (2004) called the criteria a model comparison. "They typically compare a proposed model with a null model" (Schumacker & Lomax, 2004: 103).

Normed fit index (NFI)

Hair et al. (2010: 668) indicated that NFI is "one of original incremental fit indices". "This statistic assesses the model by comparing the $\chi 2$ value of the model to the $\chi 2$ of the null model. Values for this statistic range between 0 and 1 with Bentler and Bonnet (1980) recommending values greater than 0.90 indicating a good fit" (Hooper et al., 2008: 55).

Comparative fit index (CFI)

The comparative fit index (CFI) is an improvement on the NFI (Hair et al., 2010). Values for CFI range from 0.00 to 1.00 (Schumacker & Lomax, 2004): the values closer to 1.0 indicating a good model fit (Brown, 2006). CFI values exceeding 0.95 imply the good-fitting model (Tabachnick & Fidell, 2007). Hair et al. (2010: 669) stated, “CFI values above 0.90 are usually associated with a model that fits well”.

Tucker-Lewis index (TLI)

The Tucker-Lewis index or Bentler-Bonnet NNFI (non-normed fit index) is used for comparing the proposed model to the null model (Kline, 2005). “The measure can be used to compare alternative models or to compare a proposed model against a null model” (Schumacker & Lomax, 2010: 88). “TLI is not normed and thus its values can fall below 0 or above 1. Typically though, models with good fit have values that approach 1, and a model with a higher value of 0.90 suggests a better fit than a model with lower value” (Hair et al., 2010: 668).

Parsimony fit indices

The parsimony fit index “is improved either by better fit or by a simpler model” (Hair et al., 2010: 669). “Parsimony refers to the number of estimated parameters required to achieve a specific level of fit” (Schumacker & Lomax, 2004: 104). This includes the adjusted goodness-of-fit statistic (AGFI) and normed chi-square (NC).

The adjusted goodness-of-fit statistic (AGFI)

GFI was adjusted as AGFI, the values are “typically lower than GFI values in proportion to model complexity” (Hair et al., 2010: 669). AGFI ranges between 0 and 1. The value of 0.85 is considered as acceptable (Hair et al., 2006) and above 0.90 considered as well-fitting model (Hooper et al., 2008).

Normed chi-square (NC; Chi-square /df)

This index is considered as reducing the sensitivity of chi-square. The small ratio value (chi-square/df) of 2 indicates a good fit, and of between 2 and 3 indicates an acceptable fit (Schweizer et al., 2003). Generally, “chi-square /df ratios on the order of 3:1 or less are associated with better-fitting models, except in circumstances with larger samples (greater than 750) or other extenuating circumstances, such as a high degree of model complexity” (Hair et al., 2010: 668). Hooper et al. (2008: 54) concluded that “Although there is no consensus regarding an acceptable ratio for this statistic, recommendations range from as high as 5.0 (Wheaton et al, 1977) to as low as 2.0 (Tabachnick & Fidell, 2007)".

As discussed above, the chosen indices of the three types of model fit in this study are shown in Tables 3.4-3.6.

Table 3.4: Absolute fit indices

Measures	Recommendation
GFI	Above 0.90 (Hair et al., 2010)
RMSEA	Below 0.08 (MacCallum et al., 1996)
RMR	Below 0.08 (Hooper et al., 2008)

Table 3.5: Incremental fit indices

Measures	Recommendation
NFI	Above 0.90 (Hooper et al., 2008)
CFI	Above 0.90 (Bentler, 1992)
TLI	Above 0.90 (Hair et al., 2010)

Table 3.6: Parsimony fit indices

Measures	Recommendation
AGFI	Above 0.85 (Hair et al., 2006)
Chi-square /df	Below 5.00 (Wheaton et al., 1977)

3.3.4.1.5 Model modification

Schumacker and Lomax (2010: 173) indicated that "a final step in structural equation modelling is to consider changes to a specified model that has poor model-fit indices, that is model modification". Tabachnick and Fidell (2014: 776) stated that "there are at least two reasons for modifying a SEM model: to improve fit and to test hypotheses". "The modification of a specified model with the aim of improving fit has been termed a specification search. Accordingly, a specification search is conducted with the intent to detect and correct specification errors in a proposed model" (Raykov & Marcoulides, 2006: 49). In this process, "a researcher either adds or removes parameters to improve the fit. Additionally, parameters could be changed from fixed to free or from free to fix” (Khine, 2013: 16).

Model validation

Firstly, a model is satisfied with the final best-fitting model. Next, there is model validation by replication. In other words, the model should be tested by using different samples. Regarding limited resources, this study could not replicate the model with different data. However, the current study data was already tested in different groups: namely, organisations with ABC and ISO 9000; organisations with only ISO 9000; and organisations with different types of firm, sizes, time using ABC or ISO 9000, and frequency of using ABC.

In addition, this study applies two techniques in order to provide evidence of model validity. The first is three indices: namely, expected cross validation index (ECVI), Bayesian information criterion (BIC), and Akaike information criterion (AIC). The model with the lowest values of ECVI, BIC, and AIC is considered as the most stable in the population.

The latter is Bootstrap; it treats a random sample of data as a substitute for the population and re-samples in order to create sample bootstrap estimates and standard error (Schumacker & Lomax, 2010). It needs to compare the results and the bias between bootstrap and ML. Indifferent results or small differences are required to determine model validation. In this study, bootstrap is operated at 1000 bootstrap samples with 95-percentile confidence interval (see Section 4.5).

Testing hypotheses

Path models are the logical extension of multiple regression models (Schumacker & Lomax, 2010). The individual path in a structural model represents a particular hypothesis. Null hypothesis indicates there is no relationship between constructs. This null hypothesis can be rejected when p-value $\leq$ 0.05. The current study considers p-value $\leq$ 0.05 as an acceptable significance level, p-value $\leq$ 0.01 is viewed as strong significance level, and p-value $\leq$ 0.001 is viewed as a highly significant level.

3.3.5 Multi group analysis

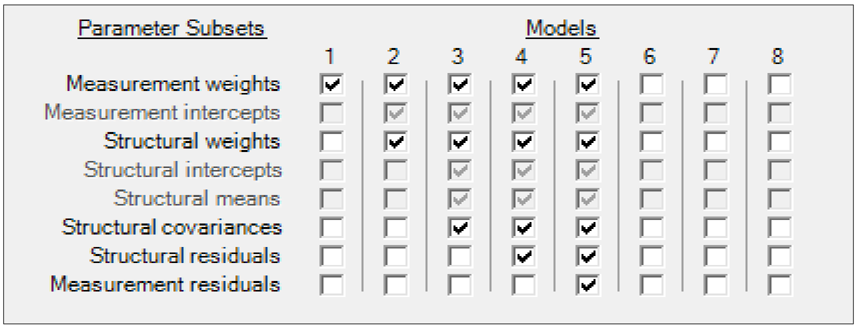
The previous section discussed the analysis based on a single sample. This section focuses on an application that analyses more than one sample. The research objectives are: to examine the differences between two groups of organisations that adopted both ABC and ISO 9000 and organisations that adopted only ISO 9000; and to test the moderating impacts (type of business, size of business, age of initiatives and frequency of ABC use) of ABC and ISO 9000 on organisational performance. Baron and Kenny (1986) recommended using multi-group analysis to model moderating variables effects in a structural model context. Sauer and Dick (1993: 636) stated that "tests of discrete (categorical) moderator variable effects can be performed by utilizing the moderator to divide the sample into groups and performing a chi-square test of the significance of the difference between designated structural parameters across groups"

AMOS can provide evidence of multiple group equivalence regarding the covariance structures analysis (COVS). The initial step examines the null hypothesis (H_{null}), $\Sigma_1 = \Sigma_2$ where Σ_1 is the population variance-covariance matrix of organisations that adopted ABC and ISO 9000 and Σ_2 is the population variance-covariance matrix of organisation adopted ISO 9000. In types of business, $\Sigma_1 = \Sigma_2$ where Σ_1 is the population variance-covariance matrix of manufacturing and Σ_2 is the population variance-covariance matrix of non-manufacturing. If H_{null} cannot be rejected, then two groups are viewed to have equivalent covariance structures; therefore, tests for invariance are not required (Byrne, 2010). Similarly, for size of business, null hypothesis (H_{null}), $\Sigma_1 = \Sigma_2$ where Σ_1 is the population variance-covariance matrix of small and medium organisations and Σ_2 is the population variance-covariance matrix of large organisations.

Age of ABC and age of ISO 9000 are classified into two groups: adopted ABC or implemented ISO 9000 for less than average number of years; and adopted ABC or implemented ISO 9000 greater than or equal to the average number of years. Lastly, frequency of ABC use is classified by average frequency use, null hypothesis (H_{null}), $\Sigma_1 = \Sigma_2$ where Σ_1 is below average frequency use of ABC, Σ_2 is the population variance-covariance matrix of above or equal to average frequency use of ABC.

Before testing hypotheses, it is important to examine the model fit, as parameters are estimated for interested groups at the same time. This multi-group analysis provides a set of fit statistics for overall model fit (Byrne, 2004). If they meet the model fit, it then proceeds to the hypothesis test.

Figure 3.10: Multiple group dialogue box



With the automated multiple-group approach, five models are generated as depicted in the multiple group dialogue box (see Figure 3.10). Unconstrained (no equality constraints) is compared with other models with particular parameters equally constraint (presented into five models). Model A generates a model with measurement weights that are constant across the groups. Model B's measurement weights and structural weight (the regression weight for predicting financial performance construct, operational performance construct and paths from each indicator to an independent construct) are constant across the groups. With Model C, the measurement weights, structural weight, and structural covariances (factor variances and covariances) are constant across the groups. With Model D, measurement weights, structural weight, structural covariances and structural residuals (the variance of constructs) are constant across the groups. Lastly, Model E has all its parameters (measurement weights, structural weight, structural covariances, structural residuals and measurement residual) constant across the groups. However, the objective of the current study was to examine the significant difference in path coefficients; therefore, only measurement weights (Model A) and structural weights (Model B) are compared to the unconstrained model in order to find out which parameters contribute to these noninvariant results.

This $\chi 2$ difference and ΔCFI value are used to determine difference across the groups. $\chi 2$ difference value (between a configural model and Model A or Model B) is significant when p-value ≤ 0.05. It means one or more of factor loadings or structural paths are not identifying equivalently across the groups (Byrne, 2010). In addition, if the ΔCFI value (a configural model and Model A or Model B) yields a different value of less than -0.01, it is the evidence of non-invariance (Cheung & Rensvold, 2002).

3.4 Summary

This chapter briefly explains the methodology or procedures to address research problems in order to achieve research objectives. The chapter started with the research design, which is a plan for collecting and analysing data. This can be accomplished by employing a positivist paradigm. The deductive approach is chosen, as it is the most common perspective for the relationship between theory and the study. Quantitative data is collected to examine hypotheses and interpret results. The research strategy is a survey based on a questionnaire. The questionnaire design is discussed including the target population, operationalisation of constructs, question types, pre-test study, and the questionnaire. The chapter considers the reliability and validity of variables. Data analysis techniques are explained including preliminary analysis, descriptive analysis, EFA, CFA, and SEM. Figures 3.11 and 3.12 show the analysis process in relation to research results referring to the section numbers in Chapter 4.

Figure 3.11: The analysis process diagram (1)

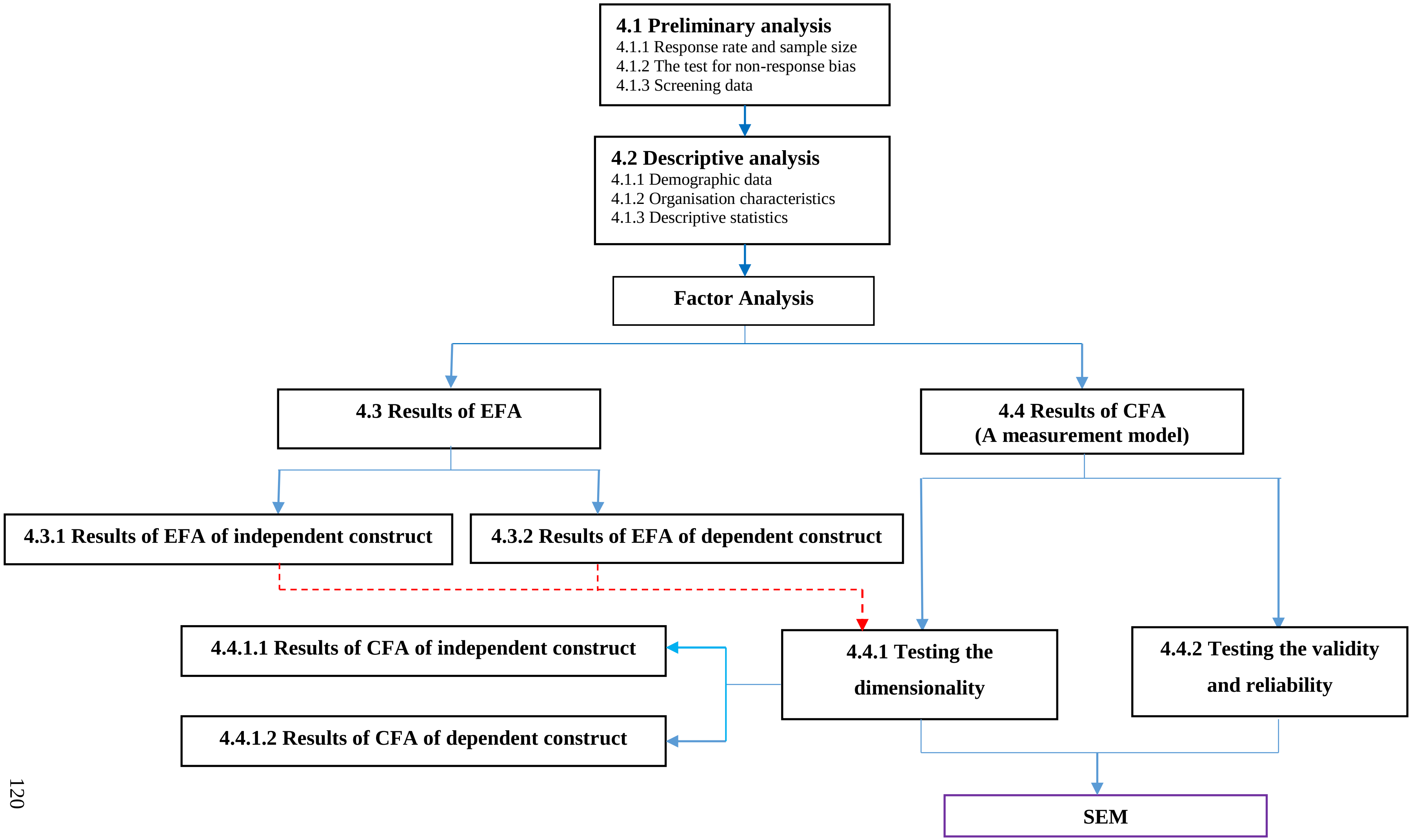
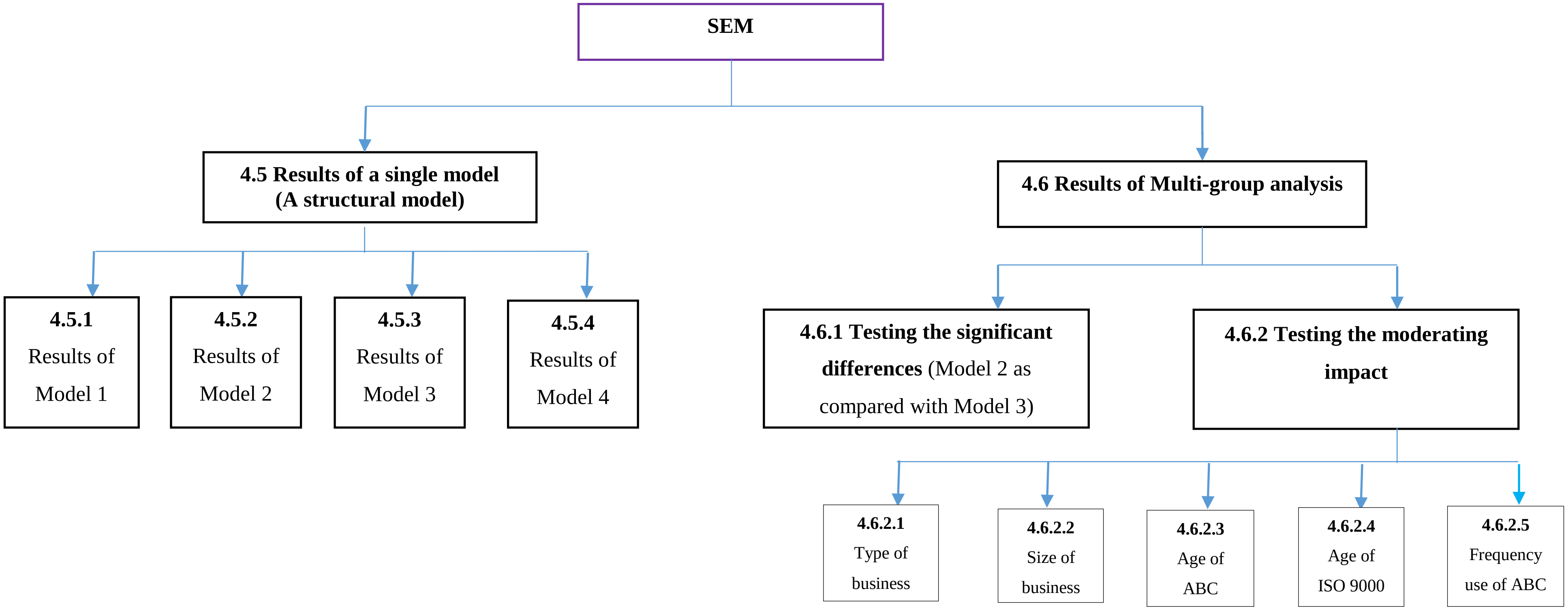


Figure 3.12: The analysis process diagram (2)



Chapter 4: Research Results

Introduction

This chapter reports the results of the study. The data collected by questionnaires are analysed following the procedures discussed in Section 3.3. The first section of this chapter starts with preliminary analysis: namely, response rate and sample size, test of non-response bias, and screening data (missing data, outliers, normality, multicollinearity, linearity, and homoscedasticity). Descriptive analysis is presented in Section 4.2, including demographic data and organisation characteristics including central tendency, dispersion, and distribution of score. Sections 4.3 and 4.4 report the results of exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), respectively. The results of structural equation modelling (SEM) are shown in Section 4.5, and the results of multi-group analysis are presented in the last section.

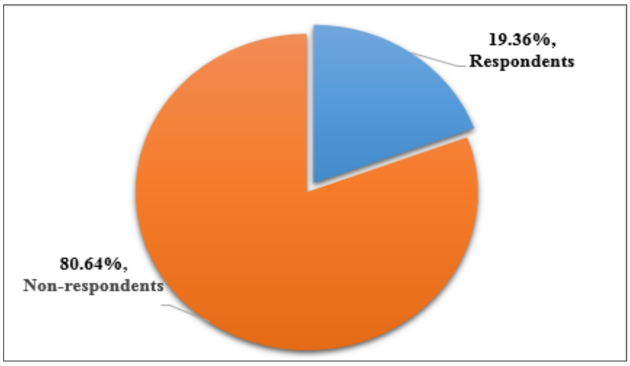
4.1 Preliminary analysis

4.1.1 Response rate and sample size

Response rate

For the results from data collection (see Appendix H), 619 returned questionnaires out of 3,105 ISO-9001-registered organisations were received (or 19.94 percent), and 601 (or 19.36 percent) were considered as completed questionnaires, as shown in Figure 4.1.

Figure 4.1: Overall response rates



Adequacy of sample size

All organisations can be classified into two groups: 1) organisations that adopted both ABC and ISO 9000 (191 cases); and 2) organisations that adopted only ISO 9000 (410 cases). The data from the first group examines the impact of the extent of ABC use on organisational performance (Model 1: 191 cases), and also investigates the impact of the extent of ISO 9000 implementation on organisational performance (Model 2: 191 cases). Additionally, the study employs the data from the second group to test the impact of the extent of ISO 9000 implementation on organisational performance (Model 3: 410 cases). Finally, Model 4 combines data from both groups, examining the extent of ISO 9000 implementation overall (601 cases).

In Model 1 (ABC firms) with 18 indicators, the sample size (191) exceeds the required sample size of 180 cases that Nunnally and Bernstein (1994) recommended and is adequate (100-150 cases) (Hair et al., 2006) to obtain stable maximum likelihood estimation results. In addition, regarding the three constructs and 18 indicators in Model 1, the ratio (r) is 6 (18/3), which suggests this study sample size (191) is acceptable as per Marsh and Bailey (1991).

Models 2, 3, and 4 (ISO results) with 16 variables show sample sizes (191, 410, and 601 cases) exceeding the required sample size (160) as per Nunnally and Bernstein (1994) and Hair et al. (2006). The ratio (r) is 5.33 (16/3) which means this study sample size (191, 410, and 601 cases) is acceptable as per Marsh and Bailey (1991).

According to the online sample size calculator (Statistical Solution, 2016), which uses the 1-Sample Z-test method, the known mean values of the four models are 4.89, 5.09, 4.83, and 4.91, whereas the expected mean value of all models is 4. The known standard deviation values are 1.12, 1.01, 1.14, and 1.13, respectively. With alpha 0.05 and power 0.80, the required sample sizes of the four models are 13, 8, 15, and 13 respectively. The actual sample sizes (see Table 4.1) exceed these required sample sizes. Therefore, the study considers all the moderating variables as adequate for using multi-group analysis because they met the minimum requirement of the 1-Sample Z-test method.

Table 4.1: Conclusion sample size of each moderating variable

Moderating variables		ABC--->OP (Adopted ABC&ISO)	ISO--->OP (Adopted ABC&ISO)	ISO --->OP (Adopted only ISO)	ISO --->OP (the whole sample)
Type	Manu	152	152	176	328
	Non-Manu	39	39	234	273
Size	Small and Med	145	145	345	494
	Large	46	46	65	107
Age of ABC	Less than Aver.	99	99	N/A	N/A
	Above & Equal Aver.	92	92	N/A	N/A
Age of ISO	Less than Aver.	106	106	253	356
	Above & Equal Aver.	85	85	157	245
Frequency of ABC use	Less than Aver.	66	66	N/A	N/A
	Above & Equal Aver.	125	125	N/A	N/A

4.1.2 The test for non-response bias

Regarding the test for non-response bias, all variables are chosen and tested: namely, the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance indicators.

As discussed in Section 3.3.1.2, Levene's test is used to measure the homogeneity of variance. As shown in Appendix B, it is not significant (P>0.05). This means that there are no statistically significant differences in the mean scores between early and late respondents. In other words, the answers of early and late respondents are not different. Therefore, non-response bias is not considered a problem in this current study.

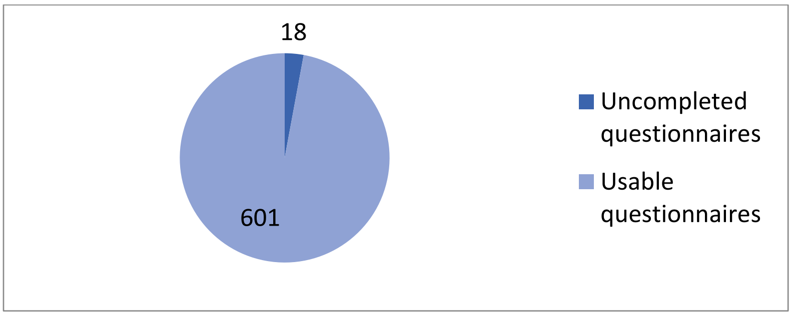
4.1.3 Screening data

This sector deals with data screening: namely, missing data, outliers, normality, linearity, homoscedasticity, and multicollinearity. These tasks must be accomplished prior to the main data analysis. All are discussed in the subsections, as follows.

4.1.3.1 Missing data

There are 18 uncompleted questionnaires. In other words, the missing values are 2.91 percent (18 out of 619). Deleting cases is one procedure for handing missing data and cause of action is adopted because missing data accounts for more than 5% (Tabachnick & Fidell, 2007).

Figure 4.2: Missing values



4.1.3.2 Outliers

Regarding the box plots shown in Appendices C1-C4 for Models 1, 2, 3 and 4, respectively, the outliers in the study are unique in their combinations of values across variables. In other words, these outliers are expected to occur as the questionnaire allows respondents to specify the number of years the organisation has implemented ISO 9001, the number of years the organisation has used ABC, the number of employees, the total revenues, et cetera. On the other hand, for questions 2, 3, 5, and 6, the respondents were asked to select the values for 1-to-7-point-scale questions. All of the values are occur within the normal range of values, as indicated. Furthermore, there were no errors (data entry) or failure to specify missing-value. Because of this, all resultant outliers remain in the analysis.

4.1.3.3 Normality, linearity, and homoscedasticity

Normality is checked using the histograms shown in Appendices D1-D4 for Models 1, 2, 3 and 4, respectively. The shapes of the distribution are inspected for normality. Similarly, the results of skewness and kurtosis as shown in Tables 4.13-4.16 indicated that the data did not seriously depart from the normality assumption. Therefore, it can be concluded that the data comes from a normal distribution. Further results of multivariate normality are presented in section 4.5 (results of SEM).

Results presented in Appendices E1-E4 for Models 1, 2, 3 and 4, respectively, show that pairs of variables have insignificant deviation from linearity ($P>0.05$), and are therefore considered linear. However, in Model 1 (see Appendix E1), there are four pairs showing significant deviation from linearity ($P<0.05$, non-linear). Models 2, 3, and 4 depicted two, three and four pairs (see Appendix E2-E4), respectively, with significant deviation from linearity ($P<0.05$, non-linear).

It is noted that only 13 out of 231 pairs have significant deviation from linearity ($P<0.05$, non-linear); therefore, these pairs are further tested in scatterplot as displayed in Appendices F1-F4. Scatterplots showed that these variables are normally distributed in an oval. Consequently, it can be concluded that all the pairs possess the quality of linearity.

Homoscedasticity was examined by scatterplot, as displayed in Appendices G1-G4. The results displayed in an oval, which means the relationships between variables are homoscedastic (constancy of the variance).

4.1.3.4 Multicollinearity

Multicollinearity is examined using Pearson's correlation coefficient (R^2). As depicted in Tables 4.2- 4.5, the values of correlation coefficients that are less than 0.90 should demonstrate that no problem exists with multicollinearity (Kline, 2005). In Model 1, the values of R^2 range from 0.047 to 0.695. The values of R^2 of Model 2 are between 0.030 and 0.579. In Model 3 and 4, the values of R^2 range from 0.002 to 0.837, and from 0.050 to 0.702, respectively.

Table 4.2 Pearson's correlation coefficient (Model 1)

	ABC-X1	ABC-X2	ABC-X3	ABC-X4	ABC-X5	ABC-X6	ABC-X7	ABC-X8	ABC-X9	ABC-Y1	ABC-Y2	ABC-Y3	ABC-Y4	ABC-Y5	ABC-Y6	ABC-Y7
ABC-X1	1.000															
ABC-X2	.614	1.000														
ABC-X3	.304	.301	1.000													
ABC-X4	.330	.402	.598	1.000												
ABC-X5	.332	.376	.695	.506	1.000											
ABC-X6	.277	.299	.344	.295	.309	1.000										
ABC-X7	.349	.337	.309	.491	.345	.358	1.000									
ABC-X8	.270	.273	.712	.537	.560	.389	.330	1.000								
ABC-X9	.327	.359	.375	.348	.356	.626	.337	.326	1.000							
ABC-Y1	.340	.364	.307	.338	.372	.258	.384	.220	.325	1.000						
ABC-Y2	.238	.281	.305	.262	.398	.198	.436	.281	.263	.649	1.000					
ABC-Y3	.256	.341	.342	.462	.358	.308	.470	.267	.369	.551	.438	1.000				
ABC-Y4	.322	.263	.331	.430	.313	.237	.445	.339	.283	.527	.474	.637	1.000			
ABC-Y5	.165	.284	.202	.243	.198	.143	.106	.203	.259	.346	.240	.463	.291	1.000		
ABC-Y6	.285	.303	.213	.331	.252	.047	.332	.272	.159	.289	.272	.298	.317	.390	1.000	
ABC-Y7	.256	.284	.197	.162	.278	.190	.349	.143	.281	.461	.359	.434	.409	.319	.238	1.000

Note ** significant at the 0.01, * significant at the 0.05

Table 4.3: Pearson's correlation coefficient (Model 2)

	ISO-X1	ISO-X2	ISO-X3	ISO-X4	ISO-X5	ISO-X6	ISO-X7	ISO-X8	ISO-Y1	ISO-Y2	ISO-Y3	ISO-Y4	ISO-Y5	ISO-Y6	ISO-Y7
ISO-X1	1.000														
ISO-X2	.299	1.000													
ISO-X3	.314	.456	1.000												
ISO-X4	.579	.243	.264	1.000											
ISO-X5	.469	.279	.413	.353	1.000										
ISO-X6	.458	.332	.296	.433	.516	1.000									
ISO-X7	.490	.297	.291	.325	.410	.542	1.000								
ISO-X8	.428	.422	.569	.418	.369	.394	.467	1.000							
ISO-Y1	.282	.158	.171	.321	.214	.125	.163	.210	1.000						
ISO-Y2	.284	.279	.268	.304	.327	.378	.370	.321	.515	1.000					
ISO-Y3	.169	.251	.129	.173	.200	.307	.095	.139	.333	.173	1.000				
ISO-Y4	.159	.131	.030	.098	.156	.199	.109	.168	.218	.248	.393	1.000			
ISO-Y5	.208	.212	.124	.204	.249	.235	.134	.214	.318	.260	.366	.419	1.000		
ISO-Y6	.236	.172	.154	.341	.221	.237	.083	.252	.367	.295	.328	.246	.474	1.000	
ISO-Y7	.144	.232	.041	.142	.171	.192	.147	.127	.210	.128	.370	.278	.477	.328	1.000

Note ** significant at the 0.01, * significant at the 0.05

Table 4.4: Pearson's correlation coefficient (Model 3)

	ISO-X1	ISO-X2	ISO-X3	ISO-X4	ISO-X5	ISO-X6	ISO-X7	ISO-X8	ISO-Y1	ISO-Y2	ISO-Y3	ISO-Y4	ISO-Y5	ISO-Y6	ISO-Y7
ISO-X1	1.000														
ISO-X2	.329	1.000													
ISO-X3	.414	.548	1.000												
ISO-X4	.527	.352	.510	1.000											
ISO-X5	.407	.278	.349	.492	1.000										
ISO-X6	.471	.354	.511	.837	.515	1.000									
ISO-X7	.390	.252	.336	.525	.430	.518	1.000								
ISO-X8	.360	.477	.731	.361	.381	.430	.264	1.000							
ISO-Y1	.109	.082	.153	.054	.070	.128	.079	.180	1.000						
ISO-Y2	.073	.092	.111	.093	.042	.103	.107	.097	.373	1.000					
ISO-Y3	.109	.165	.158	.201	.095	.155	.197	.118	.096	.150	1.000				
ISO-Y4	.049	.127	.067	.113	.104	.096	.103	.079	.109	.167	.779	1.000			
ISO-Y5	.157	.203	.193	.198	.106	.159	.141	.195	.189	.211	.788	.773	1.000		
ISO-Y6	.112	.002	.128	.060	.061	.080	.027	.148	.024	.011	.259	.182	.264	1.000	
ISO-Y7	.057	.110	.069	.093	.040	.075	.038	.080	.102	.126	.476	.565	.639	.055	1.000

Note ** significant at the 0.01, * significant at the 0.05

Table 4.5: Pearson's correlation coefficient (Model 4)

	ISO-X1	ISO-X2	ISO-X3	ISO-X4	ISO-X5	ISO-X6	ISO-X7	ISO-X8	ISO-Y1	ISO-Y2	ISO-Y3	ISO-Y4	ISO-Y5	ISO-Y6	ISO-Y7
ISO-X1	1.000														
ISO-X2	.341	1.000													
ISO-X3	.399	.528	1.000												
ISO-X4	.587	.339	.441	1.000											
ISO-X5	.466	.298	.380	.492	1.000										
ISO-X6	.479	.357	.450	.698	.526	1.000									
ISO-X7	.420	.272	.328	.458	.429	.530	1.000								
ISO-X8	.327	.442	.664	.323	.340	.400	.318	1.000							
ISO-Y1	.112	.088	.143	.091	.078	.110	.095	.199	1.000						
ISO-Y2	.147	.152	.163	.174	.136	.197	.192	.155	.402	1.000					
ISO-Y3	.113	.182	.148	.176	.113	.191	.167	.123	.156	.154	1.000				
ISO-Y4	.123	.146	.074	.156	.152	.143	.116	.084	.114	.197	.681	1.000			
ISO-Y5	.203	.219	.188	.232	.169	.193	.147	.181	.200	.230	.690	.702	1.000		
ISO-Y6	.169	.057	.145	.166	.124	.135	.050	.161	.097	.090	.271	.212	.321	1.000	
ISO-Y7	.086	.146	.065	.112	.081	.114	.073	.090	.128	.129	.449	.491	.598	.124	1.000

Note ** significant at the 0.01, * significant at the 0.05

4.2 Descriptive analysis

4.2.1 Demographic data

Demographic data were contained in the last section of questionnaire. It included the respondents' positions, the length of time in the organisation, the length of time in their present position, the length of time involved in ISO 9000, and the length of time involved in ABC, as analysed below.

4.2.1.1 Respondent position

In this study, respondents' positions include Chief Executive Officer (CEO), Managing Director, and others. More than half of the respondents (71.7 percent) are within the other category. This means respondents in this study are not only Chief Executive Officers (CEO) and Managing Directors, but also people in similar status as a Chief Executive Officer (CEO) or Managing Director who have the ability and knowledge to answer the questionnaire. In the returned questionnaires, other positions included General Manager, Senior Manager, Accounting and Finance Manager, Project Manager, Production Manager and Quality Manager. As shown in Table 4.6, the remaining 28.3 percent came from top management teams, consisting of Chief Executive Officer (9.3%) and Managing Director (19%).

Table 4.6: Respondents' position

Position	Frequency	Percent	Valid Percent	Cumulative Percent
Chief Executive Officer	56	9.3	9.3	9.3
Managing Director	114	19.0	19.0	28.3
Other, specify.....	431	71.7	71.7	100.0
Total	601	100.0	100.0	

4.2.1.2 Length of time in the organisation, in their present position, involved in ISO 9000, and involved in ABC

Table 4.7 shows the average number of years for which the respondents have worked in the current organisation. The number of years ranged from 2 years to 17 years with an average of 8 years.

Table 4.7: Descriptive analysis of demographic data

	N	Minimum	Maximum	Mean	Std. Deviation
The length in organisation	601	2	17	8	2.79
The length in the present position	601	2	15	7	3.14
Years of involvement in ISO 9001	601	2	15	6	2.37
Years of involvement in ABC	191	2	12	7	2.14

The analyses of the number of years respondents have occupied their current position are presented in Table 4.7; years in the current position range from 2 years to 15 years (average 7 years).

Table 4.7 presents the different number of years of involvement in ISO 9001 certification. Respondents have been involved in ISO 9001 certification for a range of between 2 years and 15 years. The average number of years involved in ISO 9001 certification is 6 years.

Four hundred respondents have not been involved in ABC, whereas 201 respondents have been involved (even if their organisations have not adopted ABC). In other words, ABC has been implemented by 191 organisations, whereas 10 additional respondents had experience in ABC.

Table 4.8 shows 191 respondents (31.8 percent) whose companies adopted both ABC and ISO 9000, while 68.2 percent have not adopted ABC (410 cases). Additionally, the majority of ABC-adopting organisations are in manufacturing (152 cases, 79.6 percent). The remaining 39 organisations (20.4 percent) come from non-manufacturing. ABC-adopting organisations have been involved in ABC from 2 to 12 years with an average of 7 years (see Table 4.7).

Table 4.8: The number of ABC-adopting organisations

	Frequency	Percent	Valid Percent	Cumulative Percent
ABC	191	31.8	31.8	31.8
Non-ABC	410	68.2	68.2	100.0
Total	601	100.0	100.0	

4.2.2 Organisation characteristics

Organisation characteristics were contained in section C of the questionnaire. This contains type of business, number of employees (full-time equivalent), and the total annual revenues of the organisation.

4.2.2.1 Type of business

Even though all ISO-9000-registered organisations are classified by the International Standard Industrial Classification of All Economic Activities (ISIC) (Thai Industrial Standard Institue, 2014), as shown in Appendix H, in this study, the classification of all types can be divided traditionally into two types; namely, manufacturing and non-manufacturing. As illustrated in Table 4.9, the highest number of responses comes from manufacturing (54.6 percent), while the remaining 45.4 percent is non-manufacturing.

Table 4.9: Type of business

	Frequency	Percent	Valid Percent	Cumulative Percent
Manufacturing	328	54.6	54.6	54.6
Non-Manufacturing	273	45.4	45.4	100.0
Total	601	100.0	100.0	

4.2.2.2 Number of employees (full-time equivalent)

With regard to the size of Thai firms, the measure regulated by the Ministry of Industry of Thailand (*http://www.sme.go.th/Pages/Define.aspx*) is that firms consisting of less than 50 employees are considered small, while those composed of 50 to 200 employees are medium-size firms. Thai firms with more than 200 employees are determined as large firms.

Table 4.10 showed that 22.1 percent of the 601 participating firms had less than 50 employees. These firms are considered small. The majority of respondent firms are medium size (60.1 percent), whereas there are 107 large firms included (17.8 percent).

Table 4.10: Number of employees

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 50	133	22.1	22.1	22.1
50-200	361	60.1	60.1	82.2
More than 200	107	17.8	17.8	100
Total	601	100.0	100.0	

4.2.2.3 Total annual revenues of the organisation

The size of the organisation has been measured by both the number of employees and the annual revenues. The respondents were also asked to indicate these annual revenues. The revenue department of Thailand identifies the size of organisations by the annual revenues: companies with revenues less than 30 million baht are classified as small and medium enterprises (SME) (*http://www.rd.go.th/publish/38056.0.html*). Therefore, in this study, organisation revenues ranged from less than 30 million baht, meaning they were classified as small and medium firms (SME). Organisations with revenues more than or equal to 30 million baht are categorised in the large group. In the survey, all revenues were specified, ranging from 0.20 million baht to 52,000 million baht with an average at 766.60 million baht. As demonstrated in Table 4.11, the highest number of responses came from large organisations (86.7 percent), while the remaining 13.3 percent were small and medium organisations.

Table 4.11: Classifying size of firm by the total annual revenues of organisations

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 30 million baht (SME)	80	13.3	13.3	13.3
More than or equal to 30 million baht	521	86.7	86.7	100
Total	601	100.0	100.0	

4.2.2.4 Descriptive statistics for moderating variables

Age of ISO 9001, age of ABC, and frequency of ABC use variables are presented in Table 4.12. The years their organisations have implemented ISO 9001 range from 2 years to 12 years with the average number of years of implementing ISO 9001 certification at 6 years. Organisations have used ABC for a range from 3 years to 10 years, with the average number of years ABC being 6 years. The scale of frequency of ABC use ranged from 1 to 7 with average of frequency of use of 5.

Table 4.12: Descriptive analysis of demographic data

	N	Minimum	Maximum	Mean	Std. Deviation
Age of ISO 9001	601	2	12	6	2.18
Age of ABC	191	3	10	6	1.67
Frequency use of ABC	191	2	7	5	1.10

4.2.3 Descriptive statistics

The independent constructs and dependent construct related to Models 1, 2, 3, and 4 are described next.

In Model 1, as shown in Table 4.13, variables ABC-X1 to ABC-X9 measuring the extent of ABC use showed mean values with a range of between 4.39 and 5.26, whereas the mean values of organisational performance are between 4.40 and 5.57. The standard error of mean values is between 0.066 and 0.094, which explains how exactly the mean of the sample estimates the population mean. Small values (0.066-0.094), indicate more precise estimates of the population mean. The median values of all variables (ABC-X1 to ABC-X9 and ABC-Y1 to ABC-Y7) are 4, 5 and 6 and mode variables are also between 4 and 6. Standard deviation (S.D.) values of all variables are between 0.909 and 1.298, which measures the dispersion. In this model, S.D. results indicated that the data demonstrated normal distribution. This is also supported by the results of the histogram shapes, as shown in Appendices D1-D4. Furthermore, variance values are between 0.826 and 1.685**,** which also indicates a spread-out distribution with low concentration.

Most skewness values (except variables ABC-X4, ABC-Y3, ABC-Y4, and ABC-Y6) are negative and close to zero (between -0.040 and -0.416), presenting a very slight skew to the right hand side. In addition, all the kurtosis values are negative (except variables ABC-X1) and relatively close to zero (between -0.213 and -0.887) which depicts very slight flat shape and of no concern. The standard error of skewness and the standard error of kurtosis are 0.176 and 0.350 respectively; they are roughly close to zero, showing small deviation of the underlying distribution of the sample from a symmetric distribution. This is also supported with a histogram for testing normality (see section 4.1.3.3) as all data are reasonably normally distributed and critical ratio (CR) values are in the SEM results (see section 4.5.1).

Model 2, as presented in Table 4.14, ISO-X1 to ISO-X8 variables measuring the extent of ISO 9000 implementation showed mean values with a range between 4.72 and 5.46, whereas the mean values of organisational performance are between 4.86 and 5.34. The standard error of mean values explains how precisely the mean of the sample estimates the population mean. Small values between 0.067 and 0.091indicate more precise estimates of the population mean. The median values of all variables (ISO-X1 to ISO 9000-X8 and ISO-Y1 to ISO-Y7) are 5-6 as well as the mode variables, which are also 5-6. Standard deviation (S.D.) values are between 0.923 and 0.1254, which reflects the dispersion. The results indicated that the data are normal distribution. Furthermore, variance values are between 0.853 and 1.572, which indicate a spread-out distribution with low concentration.

All skewness values are negative (except variables ISO-Y3 and ISO-Y5) and close to zero (between -0.018 and -0.388), presenting a very slight skew to the right hand side. In addition, most the kurtosis values (except variables ISO-Y3) are negative and relatively close to zero (between -0.079 and -0.714), which presents a very slight flat shape and of no concern. The standard error of skewness and the standard error of kurtosis are 0.176 and 0.350, respectively; they are roughly close to zero, showing small deviation of the underlying distribution of the sample from a symmetric distribution. This is also supported in the histogram for testing normality (see section 4.1.4.3) and critical ratio (CR) values are in the SEM results (see section 4.5.2).

Model 3 (see Table 4.15), ISO-X1 to ISO-X8 measuring the extent of ISO 9000 implementation, showed mean values with a range between 4.33 and 5.12, whereas the mean values of organisational performance are between 4.53 and 5.29. The standard error of mean values, which explains how exactly the mean of the sample is estimated, has the population mean showing the small values (between 0.048 and 0.065) indicate more precise estimates of the population mean. The median values of all variables (ISO-X1 to ISO-X8 and ISO-Y1 to ISO-Y7) are 4-5 while the mode variables, which are 4-6. Standard deviation (S.D.) values are between 0.968 and 1.323, which measured the dispersion to indicate that the data are normally distributed. Furthermore, variance values are between 0.936 and 1.750, which indicates a spread-out distribution with low concentration.

Most skewness values (except variables ISO-X4, ISO-X5 and ISO-Y5) are negative and close to zero (between -0.016 and -0.358), presenting a very slight skew to the right hand side. In addition, all the kurtosis values are negative and relatively close to zero (between -0.189 and -0.824), which depicts a very slightly flat shape and of no concern. The standard error of skewness and the standard error of kurtosis are 0.121 and 0.240, respectively; they are roughly close to zero showing small deviation in the underlying distribution of the sample from a symmetrical distribution. This is also supported in the histogram for testing normality (see section 4.1.3.3) and critical ratio (CR) values are in the SEM results (see section 4.5.3).

Model 4, as shown in Table 4.16, the mean values of ISO-X1 to ISO-X8 showed mean values with a range between 4.64 and 5.07, whereas the mean values of organisational performance are between 4.81 and 5.21. The standard error of mean values is between 0.039 and 0.051, indicating more precise estimates of the population mean. The median values of all variables (ISO-X1 to ISO-X8 and ISO-Y1 to ISO-Y7) are 5 and the mode variables are 5 and 6. Standard deviation (S.D.) values are between 0.965 and 1.250, which indicates that the data are in normal distribution. Similarly, variance values are between 0.932 and 1.550, which presents small values in a spread-out distribution with low concentration.

Most skewness values (except variables ISO-X4 and ISO-Y5) are negative and close to zero (between -0.067 and -0.348), presenting a very slight skew to the right hand side. In addition, all the kurtosis values are negative and relatively close to zero (between -0.113 and -0.727), which depicts a very slightly flat shape and of no concern. The standard error of skewness and the standard error of kurtosis are 0.100 and 0.199, respectively; they are roughly close to zero showing a small deviation in the underlying distribution of the sample from a symmetrical distribution. This is also supported in the histogram for testing normality (see section 4.1.3.3) and critical ratio (CR) values in SEM results (see section 4.5.4).

Table 4.13: Descriptive statistics (Model 1)

		ABC-X1	ABC-X2	ABC-X3	ABC-X4	ABC-X5	ABC-X6	ABC-X7	ABC-X8	ABC-X9	ABC-Y1	ABC-Y2	ABC-Y3	ABC-Y4	ABC-Y5	ABC-Y6	ABC-Y7
N	Valid	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean		5.26	5.08	4.63	4.39	4.98	5.02	5.10	4.67	4.74	5.56	5.57	4.60	4.63	4.86	4.98	4.40
Std. Error of Mean		.066	.073	.083	.086	.085	.088	.074	.094	.082	.075	.068	.085	.085	.076	.068	.085
Median		5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	5.00	5.00	5.00	5.00	4.00
Mode		5	5	5	4	5	5	5	4	5	6	6	4	4	5	5	5
Std. Deviation		.909	1.010	1.153	1.182	1.181	1.214	1.026	1.298	1.130	1.039	.937	1.179	1.180	1.047	.934	1.174
Variance		.826	1.020	1.330	1.398	1.394	1.473	1.052	1.685	1.276	1.079	.878	1.389	1.393	1.097	.873	1.379
Skewness		-.416	-.190	-.297	.144	-.299	-.040	-.064	-.154	-.211	-.290	-.324	.145	.058	-.085	.198	-.179
Std. Error of Skewness		.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176
Kurtosis		.281	-.441	-.249	-.349	-.213	-.664	-.623	-.619	-.273	-.655	-.277	-.828	-.565	-.346	-.654	-.887
Std. Error of Kurtosis		.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350
Range		5	4	5	5	5	5	4	5	5	4	4	5	5	5	4	5
Minimum		2	3	2	2	2	2	3	2	2	3	3	2	2	2	3	2
Maximum		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Sum		1005	970	884	839	952	959	975	892	906	1062	1064	878	884	929	951	841

Note: Product costing (ABC-X1), cost management (ABC-X2), pricing decisions (ABC-X3), product mix decisions (ABC-X4), determine customer profitability (ABC-X5), budgeting (ABC-X6), as an off-line analytic tool (ABC-X7), outsourcing decisions (ABC-X8), performance measurement (ABC-X9), sales (ABC-Y1), ROA (ABC -Y2), total reduced costs (ABC -Y3), product/service quality (ABC -Y4), delivery reliability (ABC -Y5), process efficiency (ABC -Y6), and process effectiveness (ABC -Y7)

Table 4.14: Descriptive statistics (Model 2)

		ISO-X1	ISO-X2	ISO-X3	ISO-X4	ISO-X5	ISO-X6	ISO-X7	ISO-X8	ISO-Y1	ISO-Y2	ISO-Y3	ISO-Y4	ISO-Y5	ISO-Y6	ISO-Y7
N	Valid	191	191	191	191	191	191	191	191	191	191	191	191	191	191	191
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean		5.46	5.26	4.92	5.18	5.31	5.19	4.72	4.85	5.05	5.30	5.00	5.34	4.88	5.19	4.86
Std. Error of Mean		.073	.071	.080	.084	.070	.082	.091	.089	.068	.067	.067	.072	.068	.074	.074
Median		6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Mode		6	5	5	6	5	6	5	5	5	5	5	5	5	5	5
Std. Deviation		1.009	.976	1.102	1.156	.971	1.131	1.254	1.231	.942	.924	.923	1.001	.933	1.024	1.017
Variance		1.018	.952	1.214	1.337	.943	1.280	1.572	1.515	.887	.855	.853	1.003	.871	1.048	1.034
Skewness		-.342	-.238	-.381	-.353	-.388	-.311	-.179	-.299	-.018	-.076	.000	-.078	.075	-.059	.095
Std. Error of Skewness		.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176
Kurtosis		-.508	-.135	-.357	-.504	-.079	-.390	-.599	-.490	-.569	-.146	.314	-.688	-.354	-.714	-.262
Std. Error of Kurtosis		.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350	.350
Range		4	5	5	5	4	5	5	5	4	4	5	4	4	4	5
Minimum		3	2	2	2	3	2	2	2	3	3	2	3	3	3	2
Maximum		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Sum		1043	1005	939	989	1015	991	901	927	964	1013	955	1019	933	991	929

Note: Customer focus (ISO-X1), leadership (ISO-X2), involvement of people (ISO-X3), process approach (ISO-X4), system approach to management (ISO-X5), continual improvement (ISO-X6), factual approach to decision-making (ISO-X7) and mutually beneficial supplier relationships (ISO-X8), sales (ISO-Y1), ROA (ISO-Y2), total costs (ISO-Y3), product/service quality (ISO-Y4), delivery reliability (ISO-Y5), process efficiency (ISO-Y6), and process effectiveness (ISO-Y7)

Table 4.15: Descriptive statistics (Model 3)

		ISO-X1	ISO-X2	ISO-X3	ISO-X4	ISO-X5	ISO-X6	ISO-X7	ISO-X8	ISO-Y1	ISO-Y2	ISO-Y3	ISO-Y4	ISO-Y5	ISO-Y6	ISO-Y7
N	Valid	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean		4.68	4.98	4.65	4.33	4.75	4.88	4.51	5.12	5.29	5.14	5.03	4.91	4.53	4.88	4.78
Std. Error of Mean		.057	.054	.057	.055	.054	.053	.061	.061	.048	.049	.060	.062	.061	.065	.057
Median		5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00
Mode		5	5	5	4	4	5	5	5	6	5	5	5	4	5	5
Std. Deviation		1.160	1.092	1.161	1.110	1.096	1.068	1.244	1.244	.968	.996	1.209	1.253	1.239	1.323	1.144
Variance		1.347	1.193	1.348	1.233	1.202	1.140	1.546	1.548	.936	.992	1.461	1.569	1.536	1.750	1.310
Skewness		-.030	-.346	-.134	.221	.069	-.092	-.019	-.358	-.273	-.317	-.158	-.016	.120	-.163	-.177
Std. Error of Skewness		.121	.121	.121	.121	.121	.121	.121	.121	.121	.121	.121	.121	.121	.121	.121
Kurtosis		-.555	-.189	-.669	-.320	-.790	-.610	-.649	-.625	-.475	-.287	-.542	-.824	-.666	-.713	-.527
Std. Error of Kurtosis		.240	.240	.240	.240	.240	.240	.240	.240	.240	.240	.240	.240	.240	.240	.240
Range		5	5	5	5	5	5	5	5	4	5	5	5	5	6	5
Minimum		2	2	2	2	2	2	2	2	3	2	2	2	2	1	2
Maximum		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Sum		1920	2042	1906	1774	1946	2002	1849	2099	2170	2108	2064	2013	1856	2000	1961

Note: Customer focus (ISO-X1), leadership (ISO-X2), involvement of people (ISO-X3), process approach (ISO-X4), system approach to management (ISO-X5), continual improvement (ISO-X6), factual approach to decision-making (ISO-X7) and mutually beneficial supplier relationships (ISO-X8), sales (ISO-Y1), ROA (ISO-Y2), total costs (ISO-Y3), product/service quality (ISO-Y4), delivery reliability (ISO-Y5), process efficiency (ISO-Y6), and process effectiveness (ISO-Y7)

Table 4.16: Descriptive statistics (Model 4)

		ISO-X1	ISO-X2	ISO-X3	ISO-X4	ISO-X5	ISO-X6	ISO-X7	ISO-X8	ISO-Y1	ISO-Y2	ISO-Y3	ISO-Y4	ISO-Y5	ISO-Y6	ISO-Y7
N	Valid	601	601	601	601	601	601	601	601	601	601	601	601	601	601	601
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean		4.93	5.07	4.73	4.60	4.93	4.98	4.58	5.03	5.21	5.19	5.02	5.04	4.64	4.98	4.81
Std. Error of Mean		.048	.043	.047	.049	.044	.045	.051	.051	.039	.040	.046	.049	.047	.051	.045
Median		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Mode		5	5	5	5	5	5	5	5	6	5	5	5	5	5	5
Std. Deviation		1.171	1.064	1.148	1.192	1.090	1.097	1.250	1.245	.965	.976	1.125	1.194	1.162	1.243	1.105
Variance		1.372	1.132	1.319	1.421	1.188	1.203	1.561	1.550	.932	.953	1.266	1.426	1.351	1.546	1.222
Skewness		-.170	-.348	-.215	.082	-.102	-.143	-.067	-.331	-.184	-.265	-.123	-.116	.015	-.217	-.121
Std. Error of Skewness		.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100
Kurtosis		-.589	-.113	-.612	-.615	-.727	-.568	-.653	-.591	-.550	-.205	-.306	-.718	-.529	-.572	-.427
Std. Error of Kurtosis		.199	.199	.199	.199	.199	.199	.199	.199	.199	.199	.199	.199	.199	.199	.199
Range		5	5	5	5	5	5	5	5	4	5	5	5	5	6	5
Minimum		2	2	2	2	2	2	2	2	3	2	2	2	2	1	2
Maximum		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Sum		2963	3047	2845	2763	2961	2993	2750	3026	3134	3121	3019	3032	2789	2991	2890

Note: Customer focus (ISO-X1), leadership (ISO-X2), involvement of people (ISO-X3), process approach (ISO-X4), system approach to management (ISO-X5), continual improvement (ISO-X6), factual approach to decision-making (ISO-X7) and mutually beneficial supplier relationships (ISO-X8), sales (ISO-Y1), ROA (ISO-Y2), total costs (ISO-Y3), product/service quality (ISO-Y4), delivery reliability (ISO-Y5), process efficiency (ISO-Y6), and process effectiveness (ISO-Y7)

4.3 Results of exploratory factor analysis (EFA)

The study aims to test the dimensionality of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance. Therefore, EFA is conducted in order to explore the factorial structure of all relevant items. All indicators are first tested by EFA. The set of variables is tested for reliability by Cronbach's alpha (see sections 4.3.1 and 4.3.2). The results of CFA are reported in section 4.4.1. These results are presented in the following constructs: independent constructs, and dependent constructs. Testing validity and reliability such as convergent validity and discriminate validity by CFA are shown in section 4.4.2, including testing for common method variance (bias).

4.3.1 Results of EFA of the independent constructs (the extent of ABC use and the extent of ISO 9000 implementation)

Model 1

The strength of the inter-correlations among the nine indicators in measuring the extent of the ABC use construct that has been presented in Table 4.2 (see section 4.1.3.4); most pairs have correlation coefficients of more than 0.30. Some values are smaller than 0.30 (between 0.270 and 0.299), however this is not enough to conclude that factor analysis is not feasible. This needs to consider Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) statistic, as shown in Table 4.17. Bartlett's test of sphericity is significant (p-value < 0.05) with the KMO index at 0.821, this is considered as meritorious. The data also met all requirements of sample size, missing data, outlier, linearity, normality, multicollinearity and homoscedasticity as reported in section 4.1. As a result, nine indicators have been tested with EFA as they met all the assumptions for EFA.

Table 4.17: KMO and Bartlett's Test of nine indicators (Model 1)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.821
Bartlett's Test of Sphericity	Approx. Chi-Square	714.405
	Df	36
	Sig.	.000

Regarding Kaiser's criterion or eigenvalue rule (1 or more than 1), there are three factors with an eigenvalue of 1 or greater (see Table 4.18). The cumulative percentage of variance (criterion) is more than the 60 percent which is declared as satisfactory in the social sciences (Hair et al., 2006).

Table 4.18: Total variance explained of nine indicators (Model 1)

Factor	Eigenvalues	Percentage of variance	Accumulative percentage
1	4.207	46.749	46.749
2	1.204	13.375	60.125
3	1.005	11.169	71.294
4	.747		
5	.464		
6	.454		
7	.379		
8	.313		
9	.227		

The results of rotation method (orthogonal, particularly varimax) as shown in Table 4.19, reveal factor loadings ranging from 0.363 to 0.973. Conceptually interpreted, factor 1 (the first construct) can explain 0.897, 0.595, 0.695, and 0.727 of the variance associated with the responses in indicators 3, 4, 5 and 8, respectively. On the other hand, factor 2 can explain 0.691, 0.789 and 0.363 of the variance associated with the responses in indicators 1, 2 and 7, respectively. The third factor can explain 0.973 and 0.552 of the variance associated with the responses in indicators 6 and 9, respectively.

Table 4.19: Rotated factor matrix of nine indicators (Model 1)

Indicator	Factor		
	1	**2**	**3**
ABC-X1	.192	**.691**	.147
ABC-X2	.181	**.789**	.157
ABC-X3	**.897**	.142	.167
ABC-X4	**.595**	.345	.143
ABC-X5	**.695**	.276	.148
ABC-X6	.179	.144	**.973**
ABC-X7	.279	***.363***	.262
ABC-X8	**.727**	.131	.246
ABC-X9	.263	.290	**.552**

Regarding the use of a value of 0.40 as a minimum level of satisfaction (Hair et al., 2010), indicator 7 with the value of 0.363 is removed from the construct. In summary, EFA suggests the dimensionality of “the extent of ABC use construct” as consisting of three constructs (factors). Each construct has been arranged by subsequent indicators. Indicators 1 and 2 are grouped in the first construct (factor 1); indicators 3, 4, 5 and 8 are incorporated in factor 2, and indicators 6 and 9 are categorised in the third factor. Factor 1 is related to analysis of cost by employing ABC, so it was named **cost analysis.** Factor 2 is relevant to strategy, so it was called **cost strategy.** Factor 3 is concerned with evaluation; therefore, it was named as **cost evaluation**.

Table 4.20 reports mean, standard deviation (S.D.), the corrected item-total correlation (CITC), and Cronbach's alpha. CITC values ranged from 0.61 to 0.81 which exceeds the value of 0.40 a satisfactory level (Nunnally & Bernstein, 1994). Reliability scores of the overall three constructs are 0.76, 0.86, and 0.77, which are more than the 0.60 recommended by Nunnally (1978). Regarding the results in the last column, removal of any indicator would result in a lower Cronbach's alpha or equivalent value. Therefore, all indicators are kept for further investigation.

Table 4.20: Descriptive statistics and reliability analysis of independent constructs (Model 1)

Factors and variables	**Descriptive statistic**		**Reliability**	
	Mean	**S.D.**	**CITC**	**Cronbach’ s alpha**
Cost analysis				**0.76**
Product costing (ABC-X1)	5.26	0.909	0.61	n/a
Cost management (ABC-X2)	5.08	1.010	0.61	n/a
Cost strategy				**0.86**
Pricing decisions (ABC-X3)	4.63	1.153	0.81	0.77
Product mix decisions (ABC-X4)	4.39	1.182	0.62	0.85
Determine customer profitability (ABC-X5)	4.98	1.181	0.68	0.83
Outsourcing decisions (ABC-X8)	4.67	1.298	0.70	0.82
Cost evaluation				**0.77**
Budgeting (ABC-X6)	5.02	1.214	0.63	n/a
Performance measurement (ABC-X9)	4.17	1.130	0.63	n/a

Model 2

The strength of the inter-correlations among the eight indicators in measuring the extent of the ISO 9000 implementation construct has been presented in Table 4.3 (see section 4.1.3.4); most pairs have correlation coefficients of more than 0.30. Although some values are smaller than 0.30 (between 0.243 and 0.299), this is not enough to conclude that factor analysis is not feasible, as mentioned earlier. In Table 4.21, Bartlett's test of sphericity is significant ($P<0.05$) with a KMO index of 0.829, which is considered as meritorious. All indicators also met requirements of EFA such as sample size, missing data, outlier, linearity, normality, multicollinearity, and homoscedasticity (see Section 4.1). Thus, eight indicators have been input into EFA.

Table 4.21: KMO and Bartlett's test of eight indicators (Model 2)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.829
Bartlett's Test of Sphericity	Approx. Chi-Square	513.411
	Df	28
	Sig.	.000

Regarding the Kaiser's criterion or eigenvalue rule (1 or more than 1), there are two factors with an eigenvalue of 1 or above (see Table 4.22). Cumulative percentage of variance (criterion) is more than the 60 percent which is determined as satisfactory in the social sciences (Hair et al., 2006).

Table 4.22: Total variance explained of eight indicators (Model 2)

Factor	Eigenvalues	Percentage of variance	Accumulative percentage
1	3.800	47.502	47.502
2	1.044	13.045	60.547
3	.747		
4	.648		
5	.605		
6	.475		
7	.357		
8	.323		

The results of the rotation method in Table 4.23 show values of factor loadings ranging from 0.415 to 0.704 which are above the value of 0.40 as a minimum level of satisfaction (Hair et al., 2010). Conceptually interpreted, factor 1 (the first construct) can explain that 0.704, 0.610, 0.545, 0.683 and 0.647 of the variance are associated with the responses in indicators 1, 4, 5, 6 and 7, respectively. On the other hand, factor 2 can explain 0.415, 0.989 and 0.508 of the variance associated with the responses in indicators 2, 3 and 8, respectively.

Factor 1 is related to operational management for employing ISO 9000, so it was named **management principle.** Factor 2 is relevant to operational cooperation, so it was called **cooperation principle.**

Table 4.23: Rotated factor matrix of eight indicators (Model 2)

Indicator	Factor	
	1	2
ISO-X1	**.704**	.218
ISO-X2	.323	**.415**
ISO-X3	.140	**.989**
ISO-X4	**.610**	.180
ISO-X5	**.545**	.340
ISO-X6	**.683**	.202
ISO-X7	**.647**	.203
ISO-X8	.475	**.508**

In Table 4.24, the values of the corrected item-total correlation (CITC) range from 0.50 to 0.66, which are above the value at 0.40 a satisfactory level (Nunnally & Bernstein, 1994). The reliability scores of the two constructs overall are 0.80 and 0.74, which are more than the 0.60 needed, as recommended by Nunnally (1978). Regarding the results in the last column, removal of any indicator would result in a lower Cronbach's alpha or equivalent value. Therefore, all indicators are retained for further investigation.

Table 4.24: Descriptive statistics and reliability analysis of independent construct (Model 2)

Factors and variables	Descriptive statistic		Reliability	
	Mean	S.D.	CITC	Cronbach' s alpha
Management principle				**0.80**
customer focus (ISO-X1)	5.46	1.009	0.66	0.75
process approach (ISO-X4)	5.18	1.156	0.53	0.78
system approach to management (ISO-X5)	5.31	.971	0.56	0.78
continual improvement (ISO-X6)	5.19	1.131	0.64	0.75
factual approach to decision making (ISO-X7)	4.72	1.254	0.57	0.78
Cooperation principle				**0.74**
leadership (ISO-X2)	5.26	.976	0.50	0.72
involvement of people (ISO-X3)	4.92	1.102	0.61	0.58
supplier relationships (ISO-X8)	4.85	1.231	0.59	0.62

Model 3

The strength of the inter-correlations among the eight indicators in measuring the extent of ISO 9000 implementation construct has been presented in Table 4.4 (see section 4.1.3.4); most pairs have correlation coefficients of more than 0.30, whereas some values are smaller than 0.30 (between 0.252 and 0.278). In Table 4.25, Bartlett's test of sphericity is significant (p-value < 0.05) with a KMO index of 0.826, which is considered meritorious. These indicators also met all the assumptions for EFA and as a result, eight indicators have been entered into EFA.

Table 4.25: KMO and Bartlett's Test of eight indicators (Model 3)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.826
Bartlett's Test of Sphericity	Approx. Chi-Square	1588.672
	df	28
	Sig.	.000

Regarding Kaiser's criterion or eigenvalue rule (1 or more than 1), there are two factors with an eigenvalue of 1 or above (see Table 4.26). Cumulative percentage of variance (criterion) is more than the 60 percent considered as satisfactory in the social sciences (Hair et al., 2006).

Table 4.26: Total variances explained of eight indicators (Model 3)

Factor	Eigenvalues	Percentage of variance	Accumulative percentage
1	4.129	51.612	51.612
2	1.147	14.340	65.951
3	.616		
4	.606		
5	.579		
6	.526		
7	.248		
8	.149		

The results of the rotation method are shown in Table 4.27, values of factor loadings range from 0.493 to 0.909, which exceed the value of 0.40 regarded as a minimum level of satisfaction (Hair et al., 2010). Conceptually interpreted, factor 1 (the first construct) can explain 0.493, 0.909, 0.495, 0.846 and 0.546 of the variance associated with the responses in indicators 1, 4, 5, 6 and 7, respectively. On the other hand, factor 2 can explain 0.548, 0.799 and 0.824 of the variance associated with the responses in indicators 2, 3 and 8, respectively. As mentioned earlier in Model 2, the first factor was named **management principle,** whereas Factor 2 was called **cooperation principle.**

Table 4.27: Rotated factor matrix of eight indicators (Model 3)

Indicator	Factor	
	1	2
ISO-X1	**.493**	.315
ISO-X2	.250	**.548**
ISO-X3	.349	**.799**
ISO-X4	**.909**	.226
ISO-X5	**.495**	.285
ISO-X6	**.846**	.286
ISO-X7	**.546**	.193
ISO-X8	.207	**.824**

In Table 4.28, the values of the corrected item-total correlation (CITC) range from 0.55 to 0.77, which are above the value of 0.40 as considered satisfactory (Nunnally & Bernstein, 1994). The reliability scores of the two constructs are 0.84 and 0.81 which are more than 0.60, as recommended by Nunnally (1978). Regarding the results in the last column, removal of any indicators would result in a lower Cronbach's alpha or equivalent value. Therefore, all indicators are kept in further investigation.

Table 4.28: Descriptive statistics and reliability analysis of independent construct (Model 3)

Factors and variables	**Descriptive statistic**		**Reliability**	
	Mean	**S.D.**	**CITC**	**Cronbach' s alpha**
Management principle				**0.84**
customer focus (ISO-X1)	4.68	1.160	0.55	0.83
process approach (ISO-X4)	4.33	1.110	0.77	0.77
system approach to management (ISO-X5)	4.75	1.096	0.57	0.82
continual improvement (ISO-X6)	4.88	1.068	0.75	0.77
factual approach to decision making (ISO-X7)	4.51	1.244	0.58	0.82
Cooperation principle				**0.81**
leadership (ISO-X2)	4.98	1.092	0.55	0.74
involvement of people (ISO-X3)	4.65	1.161	0.75	0.64
supplier relationships (ISO-X8)	5.12	1.244	0.69	0.71

Model 4

The strength of the inter-correlations among the eight indicators in measuring the extent of ISO 9000 implementation construct has been presented in Table 4.5 (see Section 4.1.3.4); most pairs have correlation coefficients of more than 0.30, while some values are smaller than 0.30 (between 0.272 and 0.298). In Table 4.29, Bartlett's test of sphericity is significant ($P<0.05$) with KMO index of 0.854, which is considered as meritorious. All indicators also met requirements of sample size, missing data, outlier, linearity, normality, multicollinearity and homoscedasticity, as reported in Section 4.1. As a result, eight indicators have been input into EFA.

Table 4.29: KMO and Bartlett's Test of eight indicators (Model 4)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.854
Bartlett's Test of Sphericity	Approx. Chi-Square	1938.664
	Df	28
	Sig.	.000

Regarding with Kaiser's criterion or eigenvalue rule (1 or more than 1), there are two factors with an eigenvalue of 1 or above (see Table 4.30). The cumulative percentage of variance (criterion) shows 64.330 which is more than 60 percent suggested as satisfactory in the social sciences (Hair et al., 2006).

Table 4.30: Total variances explained of eight indicators (Model 4)

Factor	Eigenvalues	Percentage of variance	Accumulative percentage
1	4.031	50.381	50.381
2	1.116	13.949	64.330
3	.631		
4	.577		
5	.546		
6	.516		
7	.324		
8	.259		

The results of the rotation method are shown in Table 4.31, values of factor loadings range from 0.540 to 0.819 which exceeds the value of 0.40 as the minimum level of satisfaction (Hair et al., 2010). Conceptually interpreted, factor 1 (the first construct) can explain 0.610, 0.803, 0.578, 0.770 and 0.566 of the variance associated with the responses in indicators 1, 4, 5, 6 and 7, respectively. On the other hand, factor 2 can explain 0.540, 0.819 and 0.728 of the variance associated with the responses in indicators 2, 3 and 8, respectively. As mentioned before, the first factor was named **management principle;** whereas Factor 2 was called **cooperation principle.**

Table 4.31: Rotated factor matrix of eight indicators (Model 4)

Indicator	Factor	
	1	2
ISO-X1	**.610**	.270
ISO-X2	.273	**.540**
ISO-X3	.294	**.819**
ISO-X4	**.803**	.231
ISO-X5	**.578**	.268
ISO-X6	**.770**	.280
ISO-X7	**.566**	.221
ISO-X8	.227	**.728**

In Table 4.32, the values of the corrected item-total correlation (CITC) range from 0.53 to 0.72, which are above the value of 0.40 suggested as satisfactory level (Nunnally & Bernstein, 1994). The reliability scores of these two constructs are 0.84 and 0.78, which is more than the 0.60 as recommended by Nunnally (1978). Regarding the results in the last column, removal of any indicator would result in a lower Cronbach's alpha or equivalent value. Therefore, all indicators are kept in for further investigation.

Table 4.32: Descriptive statistics and reliability analysis of independent construct (Model 4)

Factors and variables	**Descriptive statistic**		**Reliability**	
	Mean	**S.D.**	**CITC**	**Cronbach' s alpha**
Management principle				**0.84**
customer focus (ISO-X1)	4.93	1.171	0.61	0.81
process approach (ISO-X4)	4.60	1.192	0.71	0.78
system approach to management (ISO-X5)	4.93	1.090	0.59	0.82
continual improvement (ISO-X6)	4.98	1.097	0.72	0.78
factual approach to decision making (ISO-X7)	4.58	1.250	0.57	0.83
Cooperation principle				**0.78**
Leadership (ISO-X2)	5.07	1.064	0.53	0.70
involvement of people (ISO-X3)	4.73	1.148	0.71	0.61
supplier relationships (ISO-X8)	5.03	1.245	0.64	0.69

4.3.2 Results of EFA of the dependent construct (organisational performance)

Model 1

The strength of the inter-correlations among the seven indicators in measuring the organisational performance construct has been presented in Table 4.2 (see section 4.1.3.4); most pairs have correlation coefficients of more than 0.30. Although some values are smaller than 0.30 (between 0.238 and 0.298), Bartlett's test of sphericity is significant (p-value < 0.05) with KMO index of 0.822, as shown in Table 4.33, which is considered as meritorious. These indicators also met requirements of sample size, missing data, outlier, linearity, normality, multicollinearity and homoscedasticity (see section 4.1). As a result, seven indicators have been further tested with EFA.

Table 4.33: KMO and Bartlett’s test of seven indicators (Model 1)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.822
Bartlett's Test of Sphericity	Approx. Chi-Square	443.425
	Df	21
	Sig.	.000

Regarding Kaiser’s criterion or eigenvalue rule (1 or more than 1), there is only one factor with an eigenvalue of 3.452 (see Table 4.34). The cumulative percentage of variance (criterion) is less than 60 per cent, thought satisfactory in social sciences (Hair et al., 2006). Then, considering factor 2 which shows an eigenvalue of 0.958, which is close to 1, Ledesma and Valero-Mora (2007) indicated that using 1.00 as an eigenvalue rule might lead to arbitrary decisions. Then, applying an eigenvalue rule of 0.958 (close to 1) is considered as reasonable and the second factor in this model is shown in Table 4.35.

Table 4.34: Total variances explained of seven indicators (Model 1)

Factor	Eigenvalues	Percentage of variance	Accumulative percentage
1	3.452	49.311	49.311
2	.958		
3	.715		
4	.636		
5	.592		
6	.337		
7	.311		

Table 4.35 shows two factors with a cumulative percentage of variance (criterion) exceeds the 60 percent considered satisfactory in the social sciences (Hair et al., 2006).

Table 4.35: Total variances explained of seven indicators (adapted Model 1)

Factor	Eigenvalues	Percentage of variance	Accumulative percentage
1	3.452	49.311	49.311
2	.958	13.688	62.999
3	.715		
4	.636		
5	.592		
6	.337		
7	.311		

With the results of the rotation method as shown in Table 4.36, values of factor loadings range from 0.337 to 0.808. Conceptually interpreted, factor 1 (the first construct) can explain 0.808, 0609, 0504, 0.337, and 0.417 of the variance associated with the responses in indicators 3, 4, 5, 6 and 7, respectively. In addition, factor 2 can explain 0.752 and 0.725 of the variance associated with the responses in indicators 1 and 2, respectively. However, this study uses the value of 0.40 as a minimum level of satisfaction, as Hair et al. (2010) suggested. Therefore, indicator 6 with the value of 0.337 is removed from the construct. In summary, EFA suggests a dimensionality of the “organisational performance construct” as consisting of two constructs (factors). Each construct has been arranged by subsequent indicators. Indicators 1 and 2 are grouped in the first construct (factor 1), whereas indicators 3, 4, 5, and 7 are incorporated into factor 2. Factor 1 was named as **financial performance** based on the literature, while factor 2 was called **operational performance.**

Table 4.36: Rotated factor matrix of seven indicators (Model 1)

Indicator	Factor	
	1	**2**
ABC-Y1	.254	**.752**
ABC-Y2	.405	**.725**
ABC-Y3	**.808**	.308
ABC-Y4	**.609**	.407
ABC-Y5	**.504**	.174
ABC-Y6	***.337***	.231
ABC-Y7	**.417**	.371

In Table 4.37, the values of the corrected item-total correlation (CITC) range from 0.44 to 0.68, which exceeds the value at 0.40 suggested as a satisfactory level (Nunnally & Bernstein, 1994). The reliability scores of the two constructs are 0.78 and 0.75, which are more than the 0.60, as recommended by Nunnally (1978). Regarding the results in the last column, removal of any indicator would result in a lower Cronbach's alpha or equivalent value. Therefore, all indicators are kept in for further investigation.

Table 4.37: Descriptive statistics and reliability analysis (Model 1)

Factors and variables	Descriptive statistic		Reliability	
	Mean	S.D.	CITC	Cronbach' s alpha
Financial performance				**0.78**
Sales(ABC-Y1)	5.56	1.039	0.65	n/a
Return on assets (ABC-Y2)	5.57	0.937	0.65	n/a
Operational performance				**0.75**
Total costs (ABC-Y3)	4.60	1.179	0.68	0.61
Product/service quality (ABC-Y4)	4.63	1.180	0.58	0.67
Delivery reliability (ABC-Y5)	4.86	1.047	0.44	0.74
Process effectiveness (ABC-Y7)	4.40	1.174	0.48	0.73

Model 2

The strength of the inter-correlations among the seven indicators in measuring the organisational performance construct has been presented in Table 4.3 (see section 4.1.3.4); some pairs have correlation coefficients of more than 0.30. On the other hand, some have values below 0.30 (between 0.128 and 0.295). However, it is not enough to conclude that factor analysis is not feasible. This needs to consider Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO), as shown in Table 4.38. Bartlett's test of sphericity is significant (p-value < 0.05) with KMO index of 0.773, which is considered middling. As a result, seven indicators have been entered into with EFA because they met all the requirements.

Table 4.38: KMO and Bartlett's Test (Model 2)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.773
Bartlett's Test of Sphericity	Approx. Chi-Square	301.746
	Df	21
	Sig.	.000

With Kaiser's criterion or eigenvalue rule (1 or more than 1), there are two factors with an eigenvalue of 1 or above (see Table 4.39). The cumulative percentage of variance (criterion) is close to the traditional 60 percent and is more than the 50 percent satisfactory level (Beavers et al., 2013).

Table 4.39: Total variances explained of seven indicators (Model 2)

Factor	Eigenvalues	Percentage of variance	Accumulative percentage
1	2.945	42.074	42.074
2	1.115	15.922	57.997
3	.792		
4	.672		
5	.614		
6	.451		
7	.411		

In Table 4.40, values of factor loadings range from 0.501 to 0.839, which exceed the value of 0.40 seen as the minimum level of satisfaction (Hair et al., 2010). Conceptually interpreted, factor 1 (the first construct) can explain 0.501, 0.508, 0.743, 0.510, and 0.608 of the variance associated with the responses in indicators 3, 4, 5, 6, and 7, respectively. In addition, factor 2 can explain 0.839 and 0.570 of the variance associated with the responses in indicators 1 and 2, respectively. In Model 1, process efficiency (indicator 6) was removed from the construct. Therefore, this indicator needs to be deleted from Model 2 because of the consistency required when comparing the four models. In summary, EFA suggests dimensionality of organisational performance construct as two constructs (factors): operational performance (consisting of four indicators), and financial performance (consisting of two indicators).

Table 4.40: Rotated factor matrix of seven indicators (Model 2)

Indicator	Factor	
	1	2
ISO-Y1	.206	**.839**
ISO-Y2	.184	**.570**
ISO-Y3	**.501**	.252
ISO-Y4	**.508**	.156
ISO-Y5	**.743**	.198
ISO-Y6	**.510**	.318
ISO-Y7	**.608**	.091

In Table 4.41, the values of the corrected item-total correlation (CITC) range from 0.46 to 0.56, which exceed the value at 0.40 seen as a satisfactory level (Nunnally & Bernstein, 1994). The reliability scores of the two constructs are 0.68 and 0.71, which are more than 0.60 as recommended by Nunnally (1978). Regarding the results in the last column, removal of any indicator would result in a lower Cronbach's alpha or equivalent value. Therefore, all indicators are kept in for further investigation.

Table 4.41: Descriptive statistics and reliability analysis (Model 2)

Factors and variables	Descriptive statistic		Reliability	
	Mean	S.D.	CITC	Cronbach’ s alpha
Financial performance				**0.68**
Sales(ISO-Y1)	5.05	0.942	0.52	n/a
Return on assets (ISO-Y2)	5.30	0.924	0.52	n/a
Operational performance				**0.71**
Total costs (ISO-Y3)	5.00	.923	0.49	0.66
Product/service quality (ISO-Y4)	5.34	1.001	0.46	0.67
Delivery reliability (ISO-Y5)	4.88	.933	0.56	0.61
Process effectiveness (ISO-Y7)	4.86	1.017	0.48	0.66

Model 3

The strength of the inter-correlations among the seven indicators in measuring the organisational performance construct has been presented in Table 4.4 (see Section 4.1.3.4); some pairs have correlation coefficients of more than 0.30, whereas some have values below 0.30 (between 0.011 and 0.278). Bartlett’s test of sphericity is significant (p-value < 0.05) with KMO index at 0.778, as shown in Table 4.42, which is considered as middling. As a result, seven indicators have been further tested with EFA because they met all the requirements for EFA.

Table 4.42: KMO and Bartlett’s Test (Model 3)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.778
Bartlett's Test of Sphericity	Approx. Chi-Square	1209.951
	Df	21
	Sig.	.000

With Kaiser’s criterion or eigenvalue rule (1 or more than 1), there are two factors with an eigenvalue of 1 or above (see Table 4.43). The cumulative percentage of variance is more than 60 percent seen as satisfactory in the social sciences (Hair et al., 2006).

Table 4.43: Total variances explained of seven indicators (Model 3)

Factor	Eigenvalues	Percentage of variance	Accumulative percentage
1	3.191	45.584	45.584
2	1.293	18.472	64.056
3	.965		
4	.629		
5	.527		
6	.221		
7	.174		

In Table 4.44, values of factor loadings range from 0.262 to 0.890. Conceptually interpreted, factor 1 (the first construct) can explain 0.867, 0.860, 0.890, 0.262, and 0.626 of the variance associated with the responses in indicators 3, 4, 5, 6, and 7, respectively. On the other hand, factor 2 can explain 0.707 and 0.514 of the variance associated with the responses in indicators 1 and 2, respectively. This study uses the value of 0.40 as a minimum level of satisfaction, as Hair et al. (2010) suggested. Thus, indicator 6 with the value of 0.262 is removed from the construct. In summary, EFA suggests the dimensionality of organisational performance construct as two constructs (factors). They are named as operational performance and financial performance.

Table 4.44: Rotated factor matrix of seven indicators (Model 3)

Indicator	Factor	
	1	2
ISO-Y1	.038	**.707**
ISO-Y2	.117	**.514**
ISO-Y3	**.867**	.082
ISO-Y4	**.860**	.104
ISO-Y5	**.890**	.220
ISO-Y6	***.262***	.008
ISO-Y7	**.626**	.142

In Table 4.45, the values of the corrected item-total correlation (CITC) range from 0.47 to 0.85, which exceed the value of 0.40 seen a the satisfactory level (Nunnally & Bernstein, 1994). The reliability score of the overall operational performance construct is 0.89, which is more than the 0.60 as recommended by Nunnally (1978). On the other hand, the reliability score of the overall financial performance construct is 0.55, which is less than the value at 0.60. However, for exploratory studies, alphas ranging from 0.50 to 0.60 are considered adequate (Nunnally, 1978). Thus, two variables adequately measure financial performance. Regarding the results in the last column, removal of any indicator would result in a lower Cronbach's alpha or equivalent value. Therefore, all indicators are kept in for further investigation.

Table 4.45: Descriptive statistics and reliability analysis (Model 3)

Factors and variables	Descriptive statistic		Reliability	
	Mean	**S.D.**	**CITC**	**Cronbach' s alpha**
Financial performance				**0.55**
Sales(ISO-Y1)	5.29	0.968	0.47	n/a
Return on assets (ISO-Y2)	5.14	0.996	0.47	n/a
Operational performance				**0.89**
Total costs (ISO-Y3)	5.03	1.209	0.78	0.85
Product/service quality (ISO-Y4)	4.91	1.253	0.81	0.84
Delivery reliability (ISO-Y5)	4.53	1.239	0.85	0.82
Process effectiveness (ISO-Y7)	4.78	1.144	0.61	0.88

Model 4

The strength of the inter-correlations among the seven indicators in measuring the organisational performance construct has been presented in Table 4.5 (see Section 4.1.3.4); some pairs have correlation coefficients of more than 0.30. On the other hand, some have values below 0.30 (between 0.090 and 0.271). Bartlett's test of sphericity is significant (p-value < 0.05) with KMO index at 0.787 as shown in Table 4.46, which is considered middling. As a result, seven indicators have been further tested with EFA because they met all assumptions of EFA.

Table 4.46: KMO and Bartlett's Test (Model 4)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.787
Bartlett's Test of Sphericity	Approx. Chi-Square	1386.185
	Df	21
	Sig.	.000

With Kaiser's criterion or eigenvalue rule, there are two factors with an eigenvalue of 1.266 or above (see Table 4.47). The cumulative percentage of variance is more than 60 percent seen as satisfactory in the social sciences (Hair et al., 2006).

Table 4.47: Total variances explained of seven indicators (Model 4)

Factor	Eigenvalues	Percentage of variance	Accumulative percentage
1	3.074	43.916	43.916
2	1.266	18.084	62.000
3	.913		
4	.615		
5	.568		
6	.308		
7	.257		

The findings are consistent with the results of rotation method. In Table 4.48, values of factor loadings range from 0.307 to 0.868. Conceptually interpreted, factor 1 (the first construct) can explain 0.782, 0.807, 0.868, 0.307, and 0.618 of the variance associated with the responses in indicators 3, 4, 5, 6, and 7, respectively. On the other hand, factor 2 can explain 0.859 and 0.457 of the variance associated with the responses in indicators 1 and 2 respectively. This study uses the value of 0.40 as minimum level of satisfaction (Hair et al., 2010). Then, indicator 6 with the value of 0.307 is removed from the construct. Finally, EFA suggests dimensionality of the organisational performance construct as two constructs (factors). They are named as operational performance and financial performance.

Table 4.48: Rotated factor matrix of seven indicators (Model 4)

Indicator	Factor	
	1	**2**
ISO-Y1	.053	**.859**
ISO-Y2	.163	**.457**
ISO-Y3	**.782**	.125
ISO-Y4	**.807**	.086
ISO-Y5	**.868**	.181
ISO-Y6	***.307***	.097
ISO-Y7	**.618**	.108

In Table 4.49, the values of the corrected item-total correlation (CITC) range from 0.40 to 0.80 which exceeds the value at 0.40 seen as a satisfactory level (Nunnally & Bernstein, 1994). The reliability score of the overall operational performance construct is 0.86, which is more than 0.60 as recommended by Nunnally (1978). On the other hand, the reliability score of the overall financial performance construct is 0.59, which is less than the value at 0.60. However, for exploratory studies alphas ranging from 0.50 to 0.60 are considered adequate (Nunnally, 1978). Thus, two variables adequately measure financial performance.

Table 4.49: Descriptive statistics and reliability analysis (Model 4)

Factors and variables	**Descriptive statistic**		**Reliability**	
	Mean	**S.D.**	**CITC**	**Cronbach' s alpha**
Financial performance				**0.59**
Sales (ISO-Y1)	5.21	.965	0.40	n/a
Return on assets (ISO-Y2)	5.19	.976	0.40	n/a
Operational performance				**0.86**
Total costs (ISO-Y3)	5.02	1.125	0.71	0.82
Product/service quality (ISO-Y4)	5.04	1.194	0.74	0.81
Delivery reliability (ISO-Y5)	4.64	1.162	0.80	0.78
Process effectiveness (ISO-Y7)	4.81	1.105	0.58	0.86

In summary, EFA and Cronbach's alpha suggest the appropriate number of three factors in the extent of ABC use construct and two factors in the extent of ISO 9000 implementation construct. In the dependent construct, EFA suggests two factors of organisational performance. The results indicate that the independent and dependent constructs can be explained as multidimensional constructs. They are further tested by CFA, in the next section.

4.4 Results of confirmatory factor analysis (CFA)

This study aims to test the dimensionality of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance. It conducts CFA in order to test the dimensionality of constructs testing validity and reliability of the measurements as follows:

4.4.1 Results of testing the dimensionality

4.4.1.1 Results of testing the dimensionality of independent constructs (the extent of ABC use, the extent of ISO 9000 implementation)

Each model has been tested by CFA by following five steps: 1) model specification, 2) identification, 3) estimation, 4) evaluation, and 5) modification.

Model 1

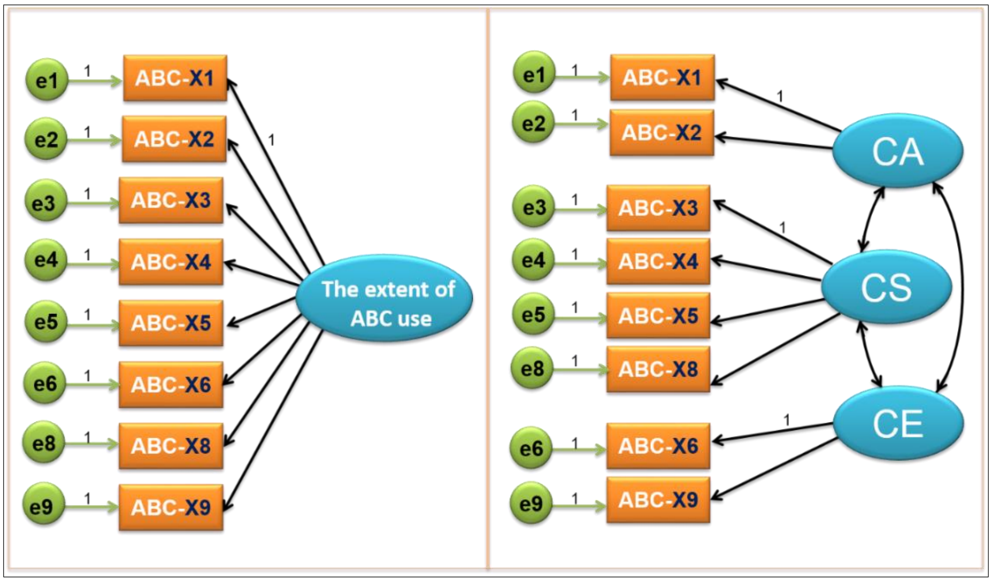
Step 1 Model specification

With the extent of ABC use, two alternative models (see Figure 4.3) are specified in order to test the dimensionality of the measures, namely

I. One factor model, all indicators might be employed to measure only one factor.

II. First-order factor model using, EFA results to specify three factors and the pattern of indicator-factor loading.

Figure 4.3: Models I and II of the extent of ABC use (Model 1)



Note: Product costing (ABC-X1), cost management (ABC-X2), pricing decisions (ABC-X3), product mix decisions (ABC-X4), determine customer profitability (ABC-X5), budgeting (ABC-X6), outsourcing decisions (ABC-X8), performance measurement (ABC-X9)

Step 2 Model identification

Model I contains a construct with eight indicators. As shown in Figure 4.3 with eight observed variables, the number of variances and co-variances of the observed variables is [8(8+1)]/2 = 36. With 16 parameters (7+9) specified for estimation (number of weights + number of variances), the degree of freedom is 36-16= 20 presenting the model over-identified.

Model II consists of three constructs. As shown in Figure 4.3 with eight observed variables, the number of variances and co-variances of the observed variables is [8(8+1)]/2 = 36. With 19 parameters (5+3+11) specified for estimation (number of weights + number of covariance + number of variances), the degree of freedom is 36-19= 17 presenting the model over-identified.

Step 3-5 Model estimation, evaluation, and modification

In model estimation, the data for the model is entered into the AMOS program by employing Maximum Likelihood (ML) estimation. Schumacker and Lomax (2010) concluded two ways to think about model fit: first is model-fit criteria, second is the individual parameters of the model.

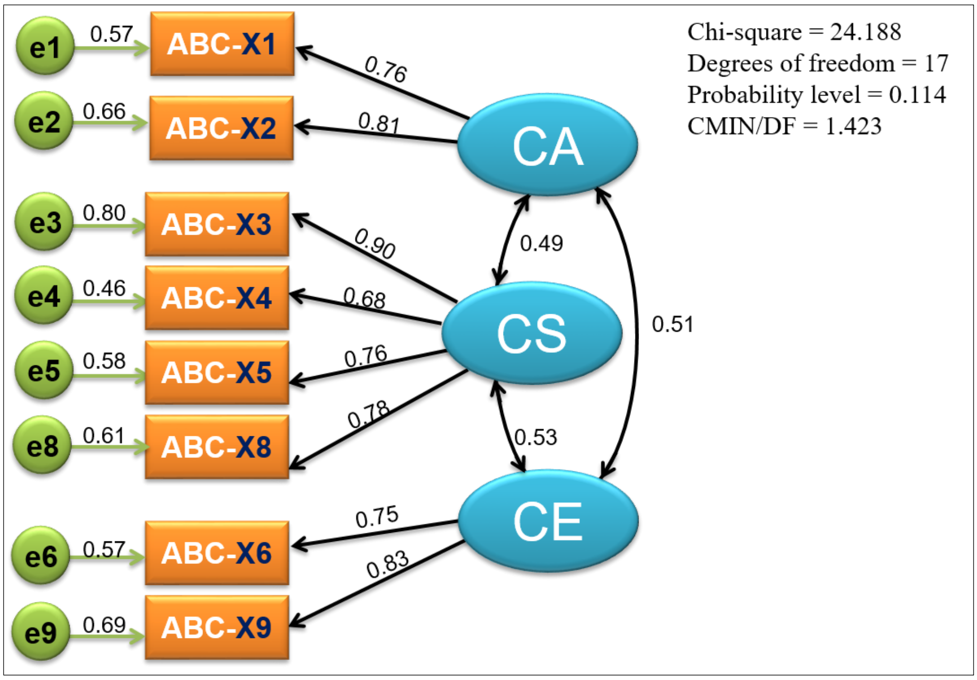
Model I yielded a $\chi 2$ value of 157.635, with 20 degrees of freedom and a probability of 0.000 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). On the other hand, Model II reported $\chi 2$ value of 24.188 and with a probability of 0.114 ($p > 0.05$), thereby indicating that the fit of the data to the hypothesised model is entirely sufficient (Byrne, 2010). In addition, the outputs of goodness-of-fit (GOF) indices of each model are presented in Table 4.50. It provides evidence that the Model II outputs of GOF are better than the same outputs of GOF in Model I. The GOF measures indicate that the Model II GOF fits the data well: GFI=0.969, RMSEA=0.047, RMR=0.046, NFI=0.963, CFI=0.989, TLI=0.981, AGFI=0.935, chi-square/df=1.423.

Table 4.50: Model Fit Summary of ABC (Models I and II)

Measures	Recommended	I	II
Chi-square		157.635	24.188
P-value		0.000	0.114
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.828	0.969
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.190	0.047
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.124	0.046
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.759	0.963
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.780	0.989
Tucker-Lewis Index (TLI)	Above 0.90 (Hair et al., 2010)	0.692	0.981
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.691	0.935
Chi-square /df	Below 5.00 (Wheaton et al., 1977)	7.882	1.423

Considering the individual parameters of Model II (see Figure 4.4), the path coefficient from each construct to the observed variables are significant and the standardised regression weights (factor loadings) are above the cut off value of 0.50, supporting the validity and reliability of the variables. All variances show nonzero ($p<0.05$). There is no negative variance and no standardised parameter estimate greater than 1. With statistical evidence, the extent of ABC use can be considered in this study as a multidimensional construct in order to determine which constructs measure the use of ABC impact on the organisation performance.

Figure 4.4: Model II: First-order factor model (Model 1)



Model 2

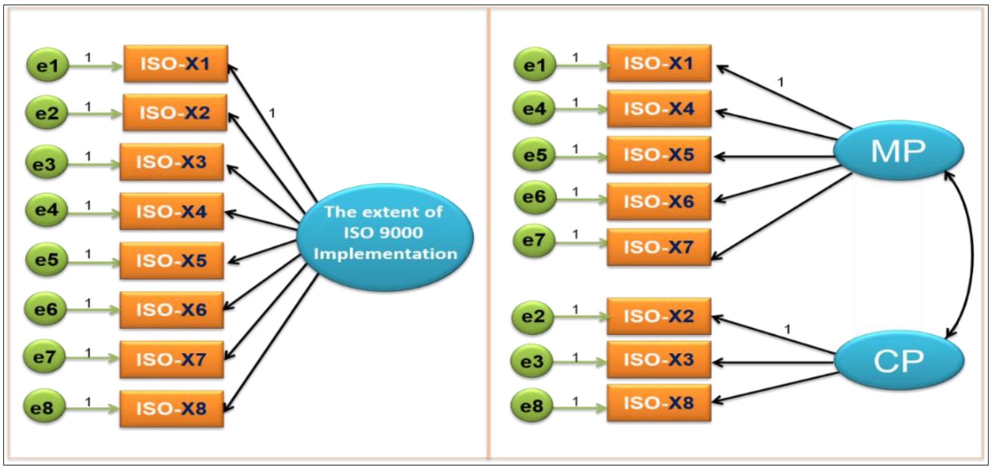
Step 1 Model specification

In the extent of ISO 9000 implementation, two alternative models are specified in order to test the dimensionality of measures: namely,

I) One factor model, all indicators might be employed to measure only one factor;

II) First-order factor model, using EFA results to specify two factors and the pattern of indicator-factor loading.

Figure 4.5: Models I and II of the extent of ISO 9000 implementation (Model 2)



Note: Customer focus (ISO-X1), leadership (ISO-X2), involvement of people (ISO-X3), process approach (ISO-X4), system approach to management (ISO-X5), continual improvement (ISO-X6), factual approach to decision making (ISO-X7) and mutually beneficial supplier relationships (ISO-X8)

Step 2 Model identification

Model I contains a construct with eight indicators. As shown in Figure 4.5 with eight observed variables, the number of variances and covariances of the observed variables is [8(8+1)]/2 = 36. With 15 parameters (7+8) specified for estimation (number of weights + number of variances), the degree of freedom is 36-15= 21, presenting the model as over-identified.

Model II consists of two constructs. As shown in Figure 4.5 with eight observed variables, [8(8+1)]/2 = 36. With 17 parameters (6+1+10) specified for estimation (number of weights + number of covariance + number of variances), the degree of freedom is 36-17= 19 presenting the model over-identified.

Step 3-5 Model estimation, evaluation, and modification

The data for this model are entered into the AMOS program by using ML estimation. Model-fit criteria and the individual parameters have been considered in this model.

Model I, yielded a $\chi 2$ value of 88.080, with 21 degrees of freedom and a probability of 0.000 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). Model II reports $\chi 2$ value of 48.386 with a probability of 0.000 ($p < 0.05$). However, with the limitations of $\chi 2$ on sample size and its basis on the central $\chi 2$ distribution (Byrne, 2010), developing goodness-of-fit indices takes a more practical approach to the evaluation process. The outputs of goodness-of-fit (GOF) indices of each model are presented in Table 4.51. With the results of three sets of goodness-of-fit statistics: absolute fit indices, incremental fit indices, and parsimony fit indices. The Model II GOF is better than the same GOF in Model I. The GOF measures show that the Model II GOF fits the data well: GFI=0.944, RMSEA=0.090, RMR=0.057, NFI=0.907, CFI=0.941, TLI=0.913, AGFI=0.893, chi-square/df=2.547.

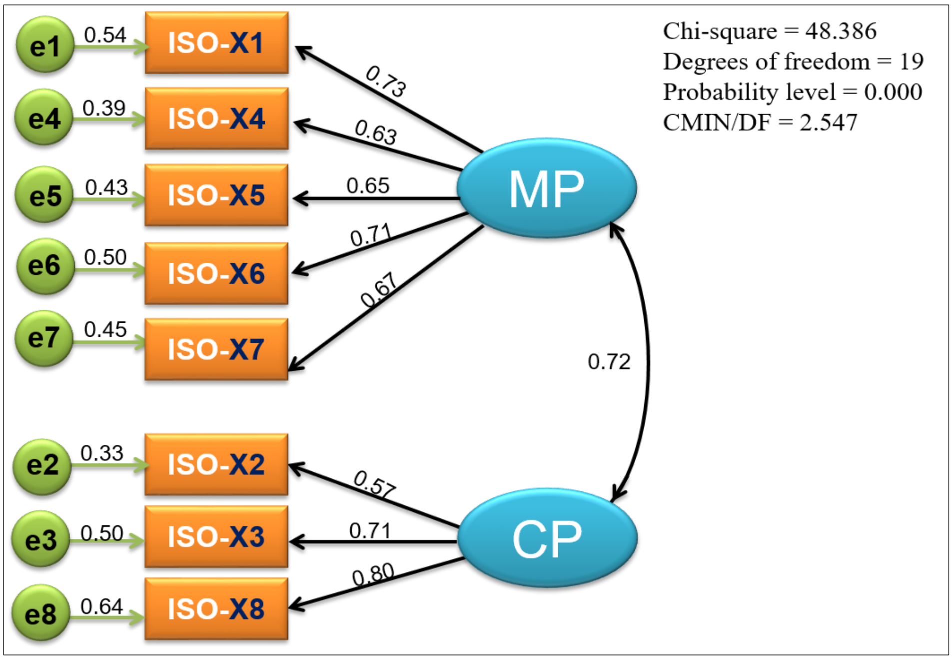
Table 4.51: Model Fit Summary of ISO (Models I and II)

Measures	Recommended	I	II
Chi-square		88.080	48.386
P-value		0.000	0.000
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.897	0.944
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996), however below 0.10 presents a mediocre fit	0.134	0.090
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.084	0.057
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.832	0.907
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.862	0.941
Tucker-Lewis Index (TLI)	Above 0.90 (Hair et al., 2010)	0.807	0.913
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.814	0.893
Chi-square /df	Below 5.00 (Wheaton et al., 1977)	4.404	2.547

Considering the individual parameters of Model II (See Figure 4.6), the path coefficient from each construct to the observed variables are significant and the standardised regression weights (factor loadings) above the value of 0.50 supporting the validity and reliability of the variables. All variances show nonzero ($p<0.05$). There is no negative variance and no standardised parameter estimate greater than the value of 1.

With the statistical evidence, the extent of ISO 9000 implementation can be considered in this study as a multidimensional construct in order to determine which constructs measuring ISO 9000 implementation influence the organisational performance.

Figure 4.6: Model II: First-order factor model (Model 2)

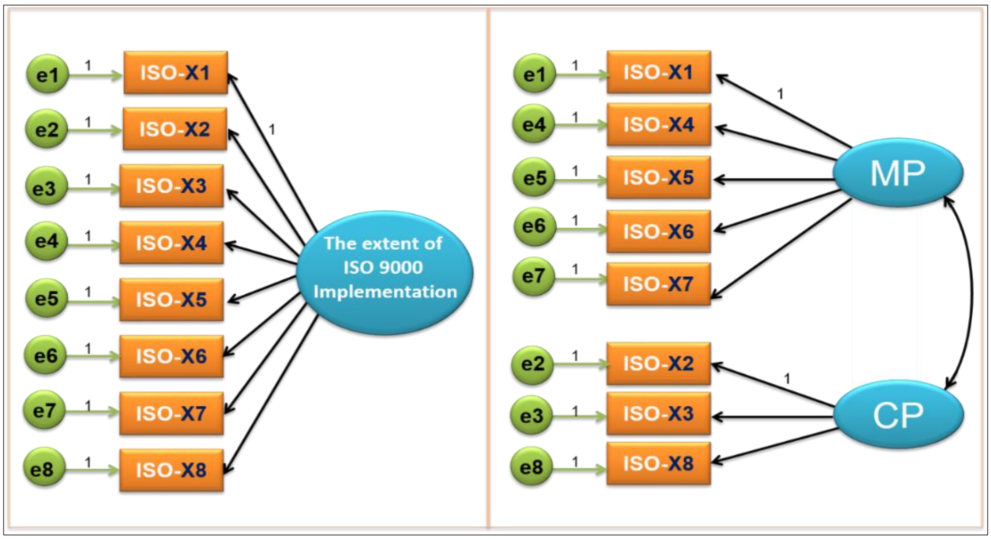


Model 3

Step 1 Model specification

In Model 3, two alternative models are specified in order to test dimensionality of measures; I) one factor model, and II) First-order factor model.

Figure 4.7: Models I and II of the extent of ISO 9000 implementation (Model 3)



Note: Customer focus (ISO-X1), leadership (ISO-X2), involvement of people (ISO-X3), process approach (ISO-X4), system approach to management (ISO-X5), continual improvement (ISO-X6), factual approach to decision making (ISO-X7) and mutually beneficial supplier relationships (ISO-X8)

Step 2 Model identification

It is noted that Model 2 and Model 3 have the same indicators, which are explained by the same constructs. Then, both Model I and II of Model 3 have the same number of the degree of freedom as Model 2 which present the model over-identified.

Step 3-5 Model estimation, evaluation, and modification

The data for the model was entered into the AMOS program by using ML estimation. Model-fit criteria and the individual parameters are discussed.

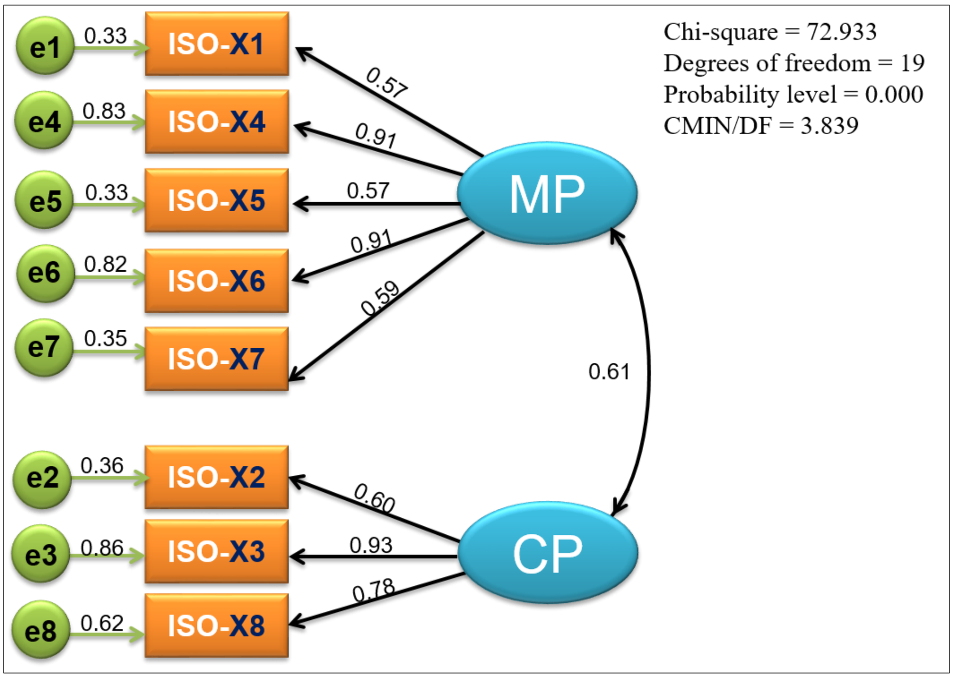
Model I yielded a $\chi 2$ value of 355.282, with 21 degrees of freedom and a probability of 0.000 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). Model II reports $\chi 2$ value of 72.933 with a probability of 0.000 ($p < 0.05$). However, with the limitations of $\chi 2$ namely sample size and its basis on the central $\chi 2$ distribution (Byrne, 2010), developing goodness-of-fits indices takes a more practical approach to the evaluation process. The outputs of goodness-of-fit (GOF) indices of each model are presented in Table 4.52. With the provided results of three sets of GOF statistics: absolute fit indices, incremental fit indices, and parsimony fit indices. Model II GOF is better than the same GOF in Model I. The goodness of fit measures indicate that the Model II GOF fits the data well: GFI=0.956, RMSEA=0.083, RMR=0.061, NFI=0.954, CFI=0.966, TLI=0.950, AGFI=0.917, Chi-square/df=3.839.

Table 4.52: Model Fit Summary of ISO (Models I and II)

Measures	Recommended	I	II
Chi-square		355.282	72.933
P-value		0.000	0.000
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.815	0.956
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.202	0.073
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.135	0.061
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.778	0.954
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.787	0.966
Tucker-Lewis index (TLI)	Above 0.90 (Hair et al., 2010)	0.702	0.950
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.667	0.917
Chi-square /df	Below 5.00 (Wheaton et al., 1977)	17.764	3.839

Considering the individual parameters of Model II (see Figure 4.8), the path coefficients are significant and above the cut off value of 0.5. All variances show nonzero ($p<0.05$). No negative variance and no standardised parameter estimate greater than the value of 1. With statistical evidence, the extent of ISO 9000 implementation can be considered in this study as a multidimensional construct.

Figure 4.8: Model II: First-order factor model (Model 3)

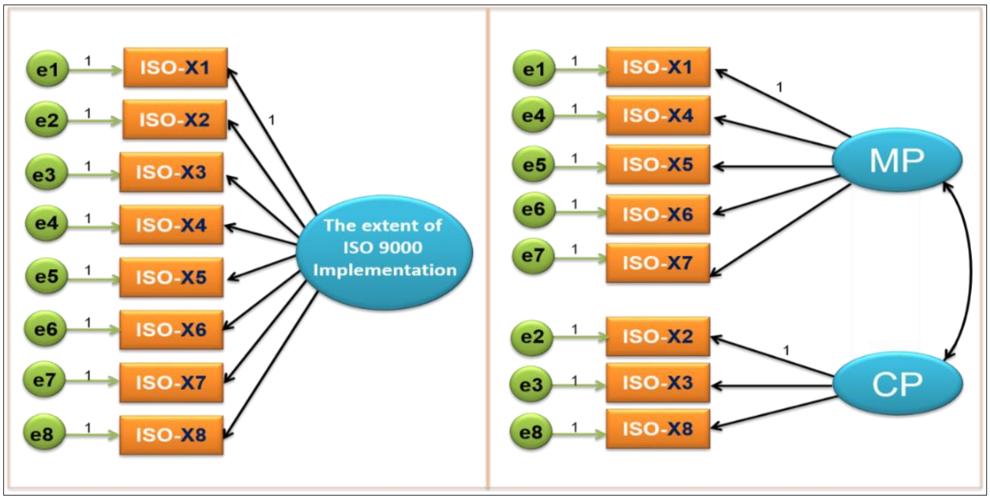


Model 4

Step 1 Model specification

In Model 4 (similar to Model 2 and 3), two alternative models are specified in order to test dimensionality of measures as shown in Figure 4.9.

Figure 4.9: Models I and II of the extent of ISO 9000 implementation (Model 4)



Note: Customer focus (ISO-X1), leadership (ISO-X2), involvement of people (ISO-X3), process approach (ISO-X4), system approach to management (ISO-X5), continual improvement (ISO-X6), factual approach to decision-making (ISO-X7) and mutually beneficial supplier relationships (ISO-X8)

Step 2 Model identification

It is noted that Models 2, 3 and 4 have the same indicators, which are explained in the same construct. Therefore, both Models I and II of Model 4 have the same number of degree of freedom as Model 2 and 3, which present the model over-identified.

Steps 3-5 Model estimation, evaluation, and modification

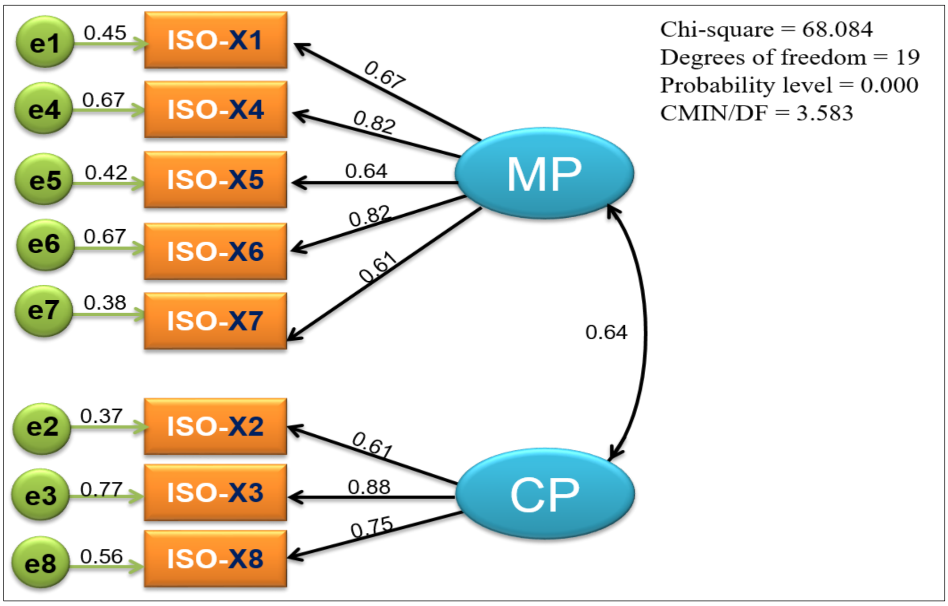
The data for the model were entered into the AMOS program using ML estimation. Model I yielded a $\chi 2$ value of 336.175, with 21 degrees of freedom and a probability of 0.000 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). Model II reports a $\chi 2$ value of 68.084 with a probability of 0.000 ($p < 0.05$). However, the limitations of $\chi 2$ (namely sample size and its basis on central $\chi 2$ distribution) (Byrne, 2010), then developing goodness-of-fit (GOF) indices takes a more practical approach to the evaluation process. The GOF indices of each model are presented in Table 4.53, resulting in three sets: absolute fit indices, incremental fit indices, and parsimony fit indices. The Model II GOF is better than the same GOF in Model I. GOF measures show that the Model II GOF fits the data well: GFI=0.974, RMSEA=0.066, RMR=0.041, NFI=0.965, CFI=0.974, TLI=0.962, AGFI=0.950, chi-square/df=3.583.

Table 4.53: Model fit summary of ISO (Models I and II)

Measures	Recommended	I	II
Chi-square		336.175	68.084
P-value		0.000	0.000
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.868	0.974
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.162	0.066
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.105	0.041
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.828	0.965
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.836	0.974
Tucker-Lewis index (TLI)	Above 0.90 (Hair et al., 2010)	0.770	0.962
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.482	0.950
Chi-square/df	Below 5.00 (Wheaton et al., 1977)	16.809	3.583

Considering the individual parameters of Model II (see Figure 4.10), the path coefficient from each construct to the observed variables is significant and the standardised regression weights (factor loadings) of more than 0.50 support the validity and reliability of the variables. All variances show nonzero ($p<0.05$): no negative variance and no standardised parameter estimate greater than the value of 1. With statistical evidence, the extent of ISO 9000 implementation can be considered and employed in this study as a multidimensional construct.

Figure 4.10: Model II: First-order factor model (Model 4)



4.4.1.2 Results of testing the dimensionality of the dependent construct (organisational performance)

Model 1

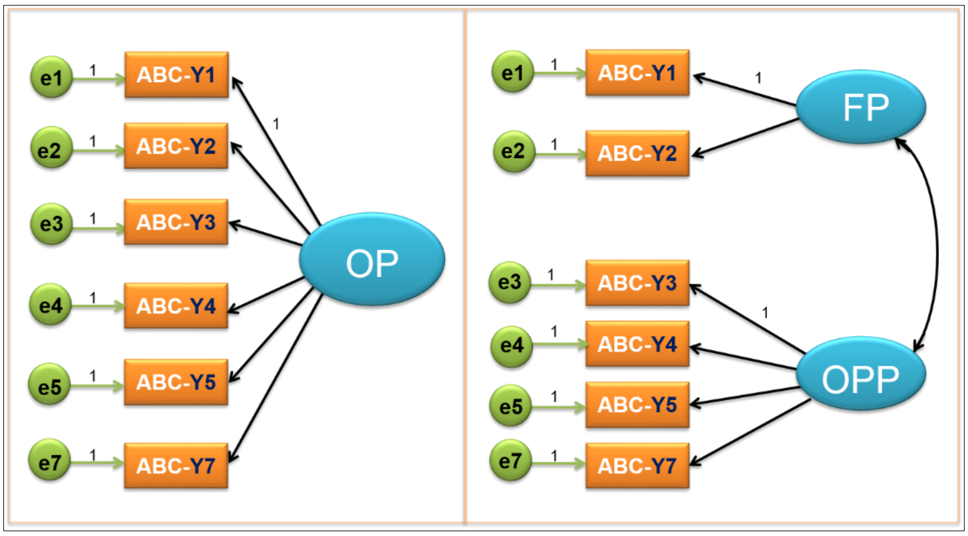
Step 1 Model specification

In the organisational performance (OP) construct, two alternative models are specified in order to test dimensionality of measures, namely:

I) One factor model, in which all indicators might employ measuring only one factor.

II) First-order factor model, using EFA results to specify two factors and the pattern of indicator-factor loading.

Figure 4.11: Models I and II of OP (Model 1)



Note: sales (ABC-Y1), ROA (ABC -Y2), total reduced costs (ABC -Y3), product/service quality (ABC -Y4), delivery reliability (ABC -Y5), and process effectiveness (ABC -Y7)

Step 2 Model identification

Model I contains a construct with six indicators. As shown in Figure 4.11 with six observed variables, the number of variances and covariances of the observed variables is [6(6+1)]/2 = 21. With 12 parameters (5+7) specified for estimation (number of weights + number of variances), the degree of freedom is 21-12= 9 presenting the model as over-identified.

Model II consists of two constructs, as shown in Figure 4.11 with six observed variables, [6(6+1)]/2 = 21. With 13 parameters (4+1+8) specified for estimation (number of weights + number of covariance + number of variances), the degree of freedom is 21-13= 8, presenting the model as over-identified.

Steps 3-5 Model estimation, evaluation, and modification

Model I yielded a $\chi2$ value of 39.913, with 9 degrees of freedom and a probability of 0.000 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). On the other hand, Model II reports a $\chi2$ value of 14.136 and with a probability of 0.078 ($p > 0.05$), thereby indicating that the fit of the data to the hypothesised model is entirely sufficient (Byrne, 2010). The output of goodness-of-fit (GOF) indices of each Model is presented in Table 4.54. It provides evidence that the Model II GOF is better than the same GOF in Model I. GOF measures indicate the Model II GOF fits the data well: GFI=0.976, RMSEA=0.064, RMR=0.040, NFI=0.965, CFI=0.984, TLI=0.971, AGFI=0.937, chi-square/df=1.767.

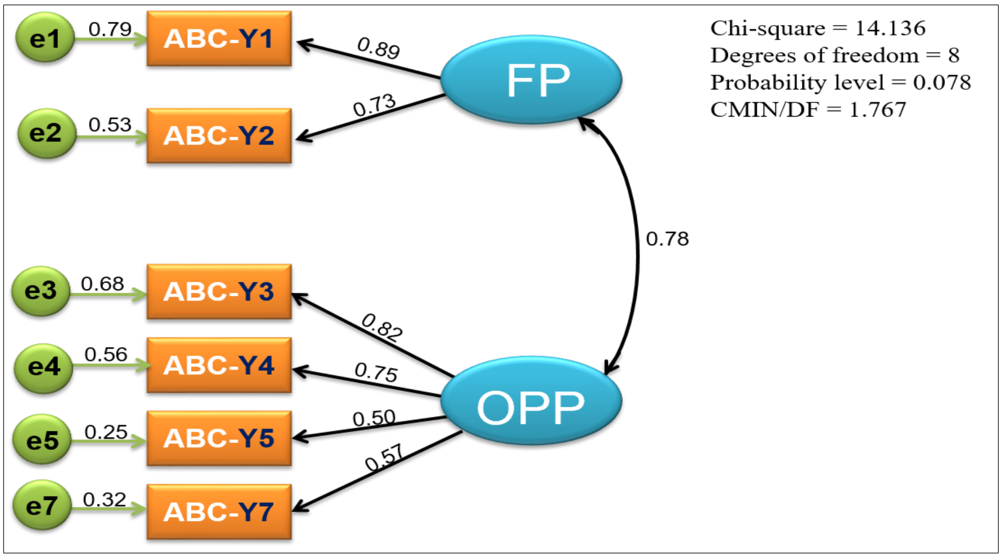
Table 4.54: Model fit summary of OP (Models I and II)

Measures	Recommended	I	II
Chi-square		39.913	14.136
P-value		0.000	0.078
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.933	0.976
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.134	0.064
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.058	0.040
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.902	0.965
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.921	0.984
Tucker-Lewis index (TLI)	Above 0.90 (Hair et al., 2010)	0.868	0.971
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.843	0.937
Chi-square /df	Below 5.00 (Wheaton et al., 1977)	4.435	1.767

Considering the individual parameters of Model II (see Figure 4.12), the path coefficient from each construct to the observed variables is significant and the standardised regression weights (factor loadings) of more than the value of 0.50

support the validity and reliability of the variables. All variances show nonzero (p<0.05); no negative variance and no standardised parameter estimate is greater than the value of 1. With statistical evidence, the organisational performance construct can be considered in this study as a multidimensional construct.

Figure 4.12: Model II: First-order factor model of OP (Model 1)

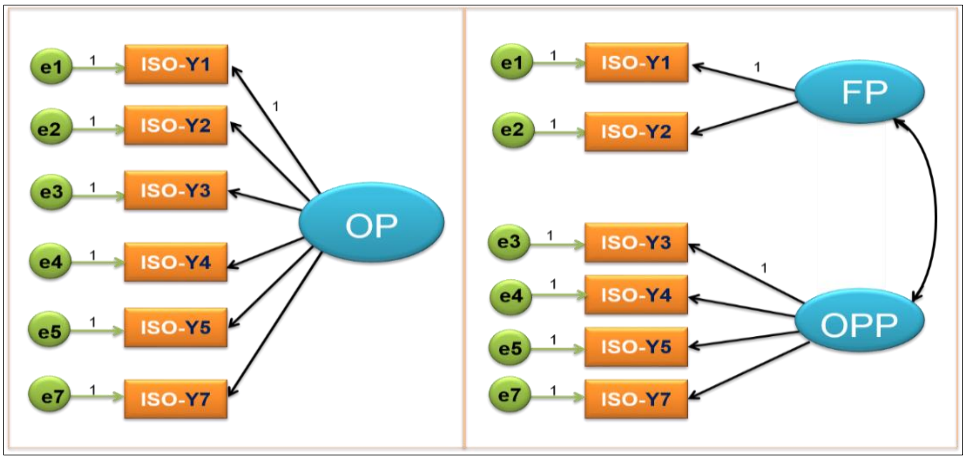


Model 2

Step 1 Model specification

In Model 2, two alternative models are specified in order to test dimensionality of measures, the same as Model 1, as shown in Figure 4.13.

Figure 4.13: Models I and II of OP (Model 2)



Note: sales (ISO-Y1), ROA (ISO-Y2), total costs (ISO-Y3), product/service quality (ISO-Y4), delivery reliability (ISO-Y5), and process effectiveness (ISO-Y7)

Step 2 Model identification

It is noted that Models 1 and 2 have the same indicators in measuring the same constructs. Therefore, both Models I and II of Model 2 have the same numbers of the degree of freedom as Model 1, which present as an over-identified model.

Steps 3-5 Model estimation, evaluation, and modification

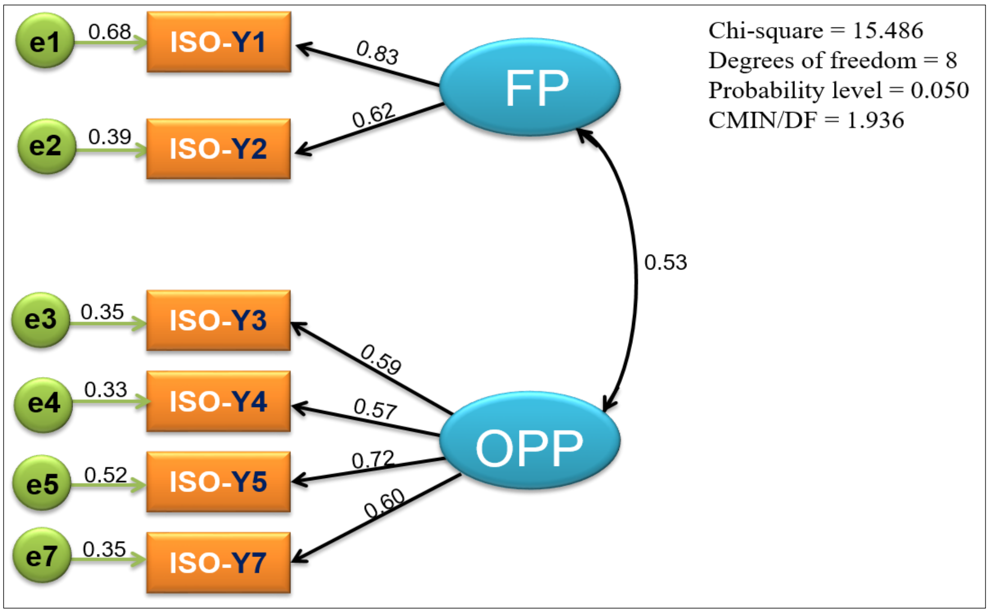
The data for the model were entered into the AMOS program using ML estimation. Model I yielded a $\chi 2$ value of 51.208, with 9 degrees of freedom and a probability of 0.000 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is also not entirely sufficient (Byrne, 2010). Model II reports a $\chi 2$ value of 15.486 with a probability of 0.05 (≤ 0.05), thereby indicating that the fit of the data to the hypothesised model is also not entirely sufficient (Byrne, 2010). However, the output of goodness-of-fit (GOF) indices (see Table 4.55) provides evidence that the Model II GOF is better than the same GOF in Model I. Overall the GOF measures indicate that the Model II GOF fits the data at an acceptable level: GFI=0.975, RMSEA=0.070, RMR=0.036, NFI=0.935, CFI=0.966, TLI=0.937, AGFI=0.935, chi-square/df=1.936.

Table 4.55: Model fit summary of OP (Models I and II)

Measures	**Recommended**	**I**	**II**
Chi-square		51.208	15.486
P-value		0.000	0.050
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.922	0.975
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.157	0.070
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.072	0.036
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.785	0.935
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.811	0.966
Tucker-Lewis index (TLI)	Above 0.90 (Hair et al., 2010)	0.685	0.937
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.817	0.935
Chi-square/df	Below 5.00 (Wheaton et al., 1977)	5.690	1.936

Considering the individual parameters of the model (see Figure 4.14), the path coefficients are significant and the standardised regression weights more than the value of 0.50 which supports the validity and reliability of the variables. All variances show nonzero (p<0.05). There is no negative variance and no standardised parameter estimate greater than 1. With statistical evidence, the organisational performance construct can be considered in this study as a multidimensional construct.

Figure 4.14: Model II: First-order factor model of OP (Model 2)

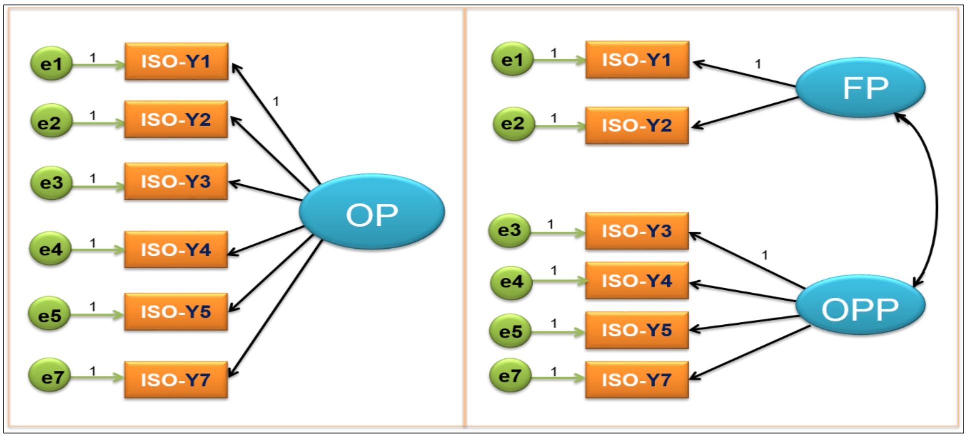


Model 3

Step 1 Model specification

In the organisational performance (OP) construct, two alternative models (I and II) are specified in order to test dimensionality of measures, as shown in Figure 4.15.

Figure 4.15: Models I and II of OP (Model 3)



Note: sales (ISO-Y1), ROA (ISO-Y2), total costs (ISO-Y3), product/ service quality (ISO-Y4), delivery reliability (ISO-Y5), and process effectiveness (ISO-Y7)

Step 2 Model identification

It is noted that all four models have the same indicators, which are explained by the same constructs. Therefore, both Model I and II have the same number of the degrees of freedom, which presents an over-identified model.

Step 3-5 Model estimation, evaluation, and modification

Model I yielded a $\chi 2$ value of 104.390, with 9 degrees of freedom and a probability of 0.000 ($p<0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). Similarly, Model II reports a $\chi 2$ value of 50.400 with a probability of 0.000 ($p<0.05$). However, the limitations of $\chi 2$ (Byrne, 2010) mean it needs to consider goodness-of-fit (GOF) indices. The GOF indices are presented in Table 4.56. It provides evidence that the Model II GOF is better than the same GOF in I. GOF measures indicate that the Model II GOF fits the data at an acceptable level (except RMSEA and Chi-square/df): GFI=0.962, RMR=0.037, NFI=0.957, CFI=0.963, TLI=0.931, AGFI=0.901. Regarding the values of RMSEA and chi-square/df not being satisfactory, further modification was required to improve the key model fit statistics.

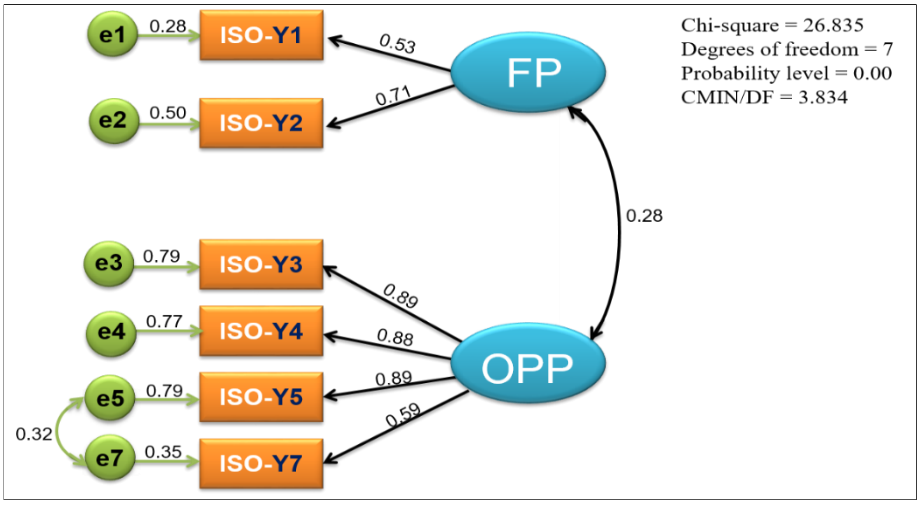
Table 4.56: Model Fit Summary of OP (Models I, II and III)

Measures	Recommended	I	II	III
Chi-square		104.390	50.400	26.835
P-value		0.000	0.000	0.000
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.924	0.962	0.979
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.161	***0.114***	0.083
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.080	0.037	0.030
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.911	0.957	0.977
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.918	0.963	0.983
Tucker-Lewis index (TLI)	Above 0.90 (Hair et al., 2010)	0.863	0.931	0.963
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.822	0.901	0.937
Chi-square /df	Below 5.00 (Wheaton et al., 1977)	11.599	***6.300***	3.834

Considering the modification indices, this study decided to add an additional parameter by selecting the highest value of the modification index, which would reduce the $\chi 2$ value. Within indicators in the same construct, the covariance between measurement errors of indicators 5 and 7 is suggested (Kline, 2013). Consequently, the $\chi 2$ value has decreased from 50.4 to 26.835 (a probability of 0.00) indicating the fit of the data to the hypothesised model is not entirely sufficient. However, all other GOF indices are satisfactory (see Model III).

In Figure 4.16, the path coefficients are significant and the standardised regression weights more than the value of 0.50 which supports the validity and reliability of the variables. All variances show nonzero ($p<0.05$). There is no negative variance and no standardised parameter estimate greater than 1. With statistical evidence, the organisational performance construct can be considered in this study as a multidimensional construct.

Figure 4.16: Model III: First-order factor model of OP (Model 3)

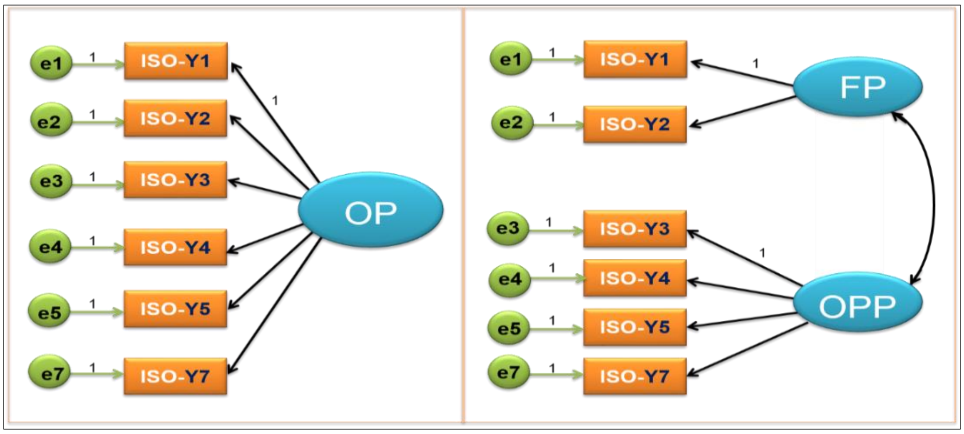


Model 4

Step 1 Model specification

In the organisational performance construct, two alternative models (I and II) are specified in order to test the dimensionality of measures, as shown in Figure 4.17.

Figure 4.17: Models I and II of OP (Model 4)



Note: sales (ISO-Y1), ROA (ISO-Y2), total costs (ISO-Y3), product/service quality (ISO-Y4), delivery reliability (ISO-Y5), and process effectiveness (ISO-Y7)

Step 2 Model identification

It is noted that all four models have the same indicators, which are explained by the same constructs. Then, both Models I and II of Model 4 have the same number of the degree of freedom as Models 1, 2, and 3, which presents the model as over-identified.

Steps 3-5 Model estimation, evaluation, and modification

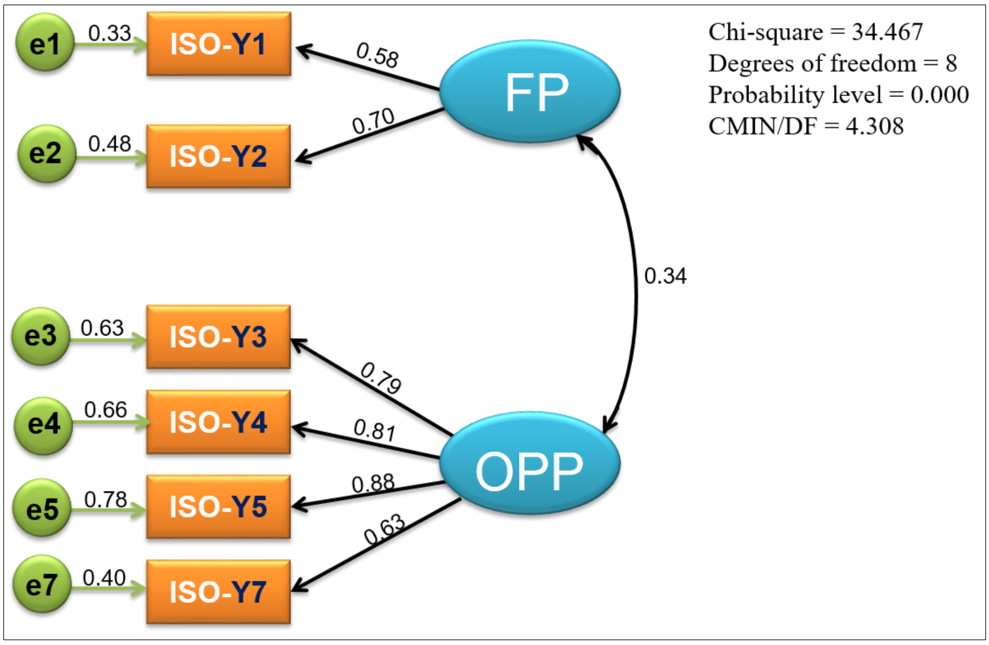
The data for the model are entered into the AMOS program using ML estimation. Model I yielded a $\chi 2$ value of 123.336, with 9 degrees of freedom and a probability of 0.000 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). Model II reports a $\chi 2$ value of 34.467 with a probability of 0.000 ($p < 0.05$). However, the limitations of $\chi 2$ (Byrne, 2010) mean that developing goodness-of-fits indices takes a more practical approach to the evaluation process. The output of the goodness-of-fit (GOF) indices (Table 4.57) provides evidence that the Model II GOF is better than the same GOF in Model I. GOF measures indicate that the Model II GOF fits the data at an acceptable level: GFI=0.981, RMSEA=0.074, RMR=0.028, NFI=0.974, CFI=0.98, TLI=0.962, AGFI=0.950, chi-square/df=4.308

Table 4.57: Model Fit Summary of OP (Models I and II)

Measures	Recommended	I	II
Chi-square		123.336	34.467
P-value		0.000	0.000
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.939	0.981
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.146	0.074
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.078	0.028
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.906	0.974
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.912	0.980
Tucker-Lewis index (TLI)	Above 0.90 (Hair et al., 2010)	0.854	0.962
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.857	0.950
Chi-square /df	Below 5.00 (Wheaton et al., 1977)	13.704	4.308

Considering the individual parameters of the model (see Figure 4.18), the path coefficients are significant and the standardised regression weights of more than the value of 0.50 support the validity and reliability of the variables. All variances show nonzero ($p<0.05$) with no negative variance and no standardised parameter estimate greater than the value of 1. With statistical evidence, the organisational performance can be considered in this study as a multidimensional construct.

Figure 4.18: Model II: First-order factor model of OP (Model 4)



The statistical results of CFA support EFA and Cronbach's alpha results and indicate both independent and dependent constructs are multidimensional. The next step is to evaluate the measurement model by testing the validity and reliability.

4.4.2 Results of testing the validity and reliability

4.4.2.1 Results of testing the validity and reliability of the independent construct (the extent of ABC use and the extent of ISO 9000 implementation)

Model 1

As shown in Table 4.58, none of the factor loadings (FL) of the eight observed variables is less than 0.50 (range from 0.752-0.897), as Hair et al. (2010) suggested. Thus, it can be concluded that all observed variables converge on each latent construct. Additionally, in CA, CS and CE constructs, the average variance extracted (AVE) values show 0.78, 0.78 and 0.79 respectively, which exceed the value of 0.50 and which represents a good overall amount of variance in the observed variables accounting for the three constructs (Hair et al., 2010). The construct reliability (CR) values of CA, CS and CE constructs are 0.78, 0.81 and 0.71, each exceeding 0.60, which provides evidence that indicators measuring each construct have an overall good reliability (Diamantopoulos & Siguaw, 2000).

Table 4.58: Selected AMOS output relating to independent construct (Model 1)

Construct	U.Est	FL	SE	CR	Er	E.Est	SE	CR
Cost Analysis (CA)								
Product costing	1	0.757			e1	0.351	0.073	4.789
Cost management	1.192	0.811	0.181	6.585	e2	0.347	0.097	3.557
Cost Strategy (CS)								
Pricing decisions	1	0.897			e3	0.259	0.055	4.700
Product mix decisions	0.779	0.681	0.075	10.435	e4	0.746	0.086	8.679
Determine customer profitability	0.871	0.763	0.071	12.212	e5	0.58	0.073	7.961
Outsourcing decisions	0.979	0.780	0.078	12.594	e8	0.657	0.085	7.728
Cost evaluation (CE)								
Budgeting	1	0.752			e6	0.391	0.115	3.402
Performance measurement	1.03	0.832	0.144	7.149	e7	0.636	0.121	5.275

Note: U.Est: unstandardised regression estimates; FL: factor loading; SE: standard error; CR: critical ratio; Er: Error; E.Est: error variance estimates

In discriminant validity, this study compares the average variance-extracted (AVE) value and the square of correlation estimates between a pair of constructs (CA, CS, and CE). The first pair, CA and CE, have average variance extracted (AVE) values

= 0.78, exceeding the square of correlation estimates = 0.24. The second pair, CA and CS, have average variance extracted (AVE) values = 0.79, also exceeding the square of correlation estimates = 0.28. Similarly, the last pair, CS and CE, have average variance extracted (AVE) values = 0.79, exceeding the square of correlation estimates = 0.26. These provide evidence to support discriminant validity.

Model 2

As shown in Table 4.59, none of the factor loadings (FL) of the eight observed variables is less than 0.50 (range from 0.574-0.802), as Hair et al. (2010) suggested. Thus, it can be concluded that all observed variables converge on each latent construct. Additionally, in MP and CP constructs, the average variance extracted (AVE) values show 0.68 and 0.69 respectively which exceed the value of 0.50, which represents a good overall amount of variance in the observed variables accounting for the three constructs (Hair et al., 2010). The construct reliability (CR) values of MP and CP constructs are 0.78, and 0.71, exceeding 0.60 and providing evidence that indicators measuring each construct have an overall good reliability (Diamantopoulos & Siguaw, 2000).

Table 4.59: Selected AMOS output relating to the independent construct (Model 2)

Construct	**U.Est**	**FL**	**SE**	**CR**	**Er**	**E.Est**	**SE**	**CR**
Management principle (MP)								
customer focus	1	.733			e1	.469	.063	7.458
process approach	.980	.627	.126	7.794	e4	.807	.095	8.478
system approach to management	.856	.652	.106	8.087	e5	.539	.065	8.295
continual improvement	1.087	.710	.124	8.743	e6	.631	.082	7.740
factual approach to decision making	1.136	.670	.137	8.295	e7	.862	.106	8.145
Cooperation principle (CP)								
Leadership	1	.574			e2	.635	.075	8.501
involvement of people	1.388	.705	6.724	.206	e3	.607	.086	7.086
supplier relationships	1.762	.802	6.978	.252	e8	.539	.106	5.102

Note: U.Est: unstandardised regression estimates; FL: factor loading; SE: standard error; CR: critical ratio; Er: error; E.Est: error variance estimates

In discriminant validity, this study compares the average variance-extracted (AVE) value and the square of correlation estimates between a pair of constructs (MP and CP). As a result, average variance extracted (AVE) values = 0.69, exceeding the square of correlation estimates = 0.52, which provide evidence of discriminant validity.

Model 3

As shown in Table 4.60, none of the factor loadings (FL) of the eight observed variables is less than 0.50 (range from 0.571-0.930) as Hair et al. (2010) suggested. Therefore, it can be concluded that all observed variables converge on each latent construct. Additionally, in MP and CP constructs, the average variance extracted (AVE) values show 0.71 and 0.77 respectively which exceed the value of 0.50, representing a good overall amount of variance in the observed variables accounting for the three constructs (Hair et al., 2010). The construct reliability (CR) values of MP and CP constructs are 0.80 and 0.78, exceeding 0.60, which provides evidence that indicators that measure each construct have an overall good reliability (Diamantopoulos & Siguaw, 2000).

Table 4.60: Selected AMOS output relating to the independent construct (Model 3)

Construct	**U.Est**	**FL**	**SE**	**CR**	**Er**	**E.Est**	**SE**	**CR**
Management principle (MP)								
customer focus	1	.571			e1	.905	.066	13.691
process approach	1.528	.913	.120	12.690	e4	.205	.029	7.048
system approach to management	.949	.574	.099	9.545	e5	.804	.059	13.683
continual improvement	1.458	.905	.115	12.658	e6	.205	.027	7.526
factual approach to decision making	1.102	.587	.113	9.711	e7	1.010	.074	13.637
Cooperation principle (CP)								
Leadership	1	.597			e2	.766	.058	13.220
involvement of people	1.656	.930	.133	12.433	e3	.182	.052	3.521
supplier relationships	1.497	.784	.123	12.148	e8	.594	.059	10.062

Note: U.Est: unstandardised regression estimates; FL: factor loading; SE: standard error; CR: critical ratio; Er: error; E.Est: error variance estimates

In discriminant validity, this study compares the average variance-extracted (AVE) value and the square of correlation estimates between a pair of constructs (MP and CP). As a result, average variance extracted (AVE) values = 0.74, exceeding the square of correlation estimates = 0.37, which provide evidence of discriminant validity.

Model 4

As shown in Table 4.61, none of the factor loadings (FL) of the eight observed variables is less than 0.50 (range from 0.752-0.897), as Hair et al. (2010) suggested. Therefore, it can be concluded that all observed variables converge on each latent construct. Additionally, in MP and CP constructs, the average variance extracted (AVE) values show 0.71 and 0.75 respectively, exceeding the value of 0.50, which represents a good overall amount of variance in the observed variables accounting for the three constructs (Hair et al., 2010). The construct reliability (CR) values of MP and CP constructs are 0.80 and 0.75, exceeding 0.60, which provides evidence that indicators that measure each construct have an overall good reliability (Diamantopoulos & Siguaw, 2000).

Table 4.61: Selected AMOS output relating to the independent construct (Model 4)

Construct	**U.Est**	**FL**	**SE**	**CR**	**Er**	**E.Est**	**SE**	**CR**
Management principle (MP)								
customer focus	1	.668			e1	.758	.050	15.202
process approach	1.247	.819	.075	16.735	e4	.467	.039	11.837
system approach to management	0.898	.645	.065	13.808	e5	.693	.045	15.458
continual improvement	1.150	.821	.069	16.761	e6	.391	.033	11.760
factual approach to decision making	.981	.615	.074	13.237	e7	.970	.062	15.738
Cooperation principle (CP)								
Leadership	1	.608			e2	.712	.046	15.348
involvement of people	1.557	.878	.108	14.358	e3	.303	.047	6.499
supplier relationships	1.441	.749	.104	13.901	e8	.680	.055	12.363

Note: U.Est: unstandardised regression estimates; FL: factor loading; SE: standard error; CR: critical ratio; Er: error; E.Est: error variance estimates

In discriminant validity, this study compares the average variance-extracted (AVE) value and the square of correlation estimates between a pair of constructs (MP and CP). As a result, average variance extracted (AVE) values = 0.73, exceeding the square of correlation estimates = 0.41, which provide evidence of discriminant validity.

4.4.2.2 Results of testing the validity and reliability of the dependent construct (organisational performance)

Model 1

As shown in Table 4.62, none of the factor loadings (FL) of the six observed variables is less than 0.50 (range from 0.498-0.891), as Hair et al. (2010) suggested. Therefore, it can be concluded that all observed variables converge on each latent construct. Additionally, in FP and OPP constructs, the average variance extracted (AVE) values show 0.81 and 0.66 respectively, exceeding the value of 0.50, which represents a good overall amount of variance in the observed variables accounting for the two constructs (Hair et al., 2010). The construct reliability (CR) values of FP and OPP constructs are 0.81 and 0.71, exceeding 0.60, which provides evidence that indicators that measure each construct have an overall good reliability (Diamantopoulos & Siguaw, 2000).

Table 4.62: Selected AMOS output relating to dependent construct (Model 1)

Construct	**U.Est**	**FL**	**SE**	**CR**	**Er**	**E.Est**	**SE**	**CR**
Financial performance (FP)								
Sales	1	.891			e1	.222	.077	2.899
ROA	0.737	.728	.081	9.058	e2	.410	.058	7.087
Operational performance (OPP)								
Total costs	1	.823			e3	.446	.079	5.625
P/S quality	0.914	.751	.092	9.971	e4	.603	.084	7.146
Delivery Reliability	0.538	.498	.083	6.510	e5	.820	.090	9.122
Process Effectiveness	0.687	.567	.092	7.474	e7	.930	.105	8.843

Note: P/S: product/service; U.Est: unstandardised regression estimates; FL: factor loading; SE: standard error; CR: critical ratio; Er: error; E.Est: error variance estimates

In discriminant validity, this study compares the average variance-extracted (AVE) value and the square of correlation estimates between a pair of constructs (MP and CP). As a result, average variance extracted (AVE) values = 0.74, exceeding the square of correlation estimates = 0.61, which provide evidence of discriminant validity.

Model 2

As shown in Table 4.63, none of the factor loadings of the six observed variables is less than 0.50 (range from 0.571-0.825), as Hair et al. (2010) suggested. Thus, it can be concluded that all observed variables converge on each latent construct. Additionally, in the FP and OPP constructs, the average variance extracted (AVE) values show 0.72 and 0.62 respectively, exceeding the value of 0.50, which represents a good overall amount of variance in the observed variables accounting for the two constructs (Hair et al., 2010). The construct reliability (CR) values of the FP and OPP constructs are 0.72 and 0.73, exceeding 0.60, which provide evidence that indicators that measure these two constructs have an overall good reliability (Diamantopoulos & Siguaw, 2000).

Table 4.63: Selected AMOS output relating to the dependent construct (Model 2)

Construct	U.Est	FL	SE	CR	Er	E.Est	SE	CR
Financial performance (FP)								
Sales	1	.825			e1	.281	.132	2.131
ROA	.742	.624	.170	4.355	e2	.519	.089	5.847
Operational performance (OPP)								
Total costs	1	.593			e3	.550	.070	7.854
P/S quality	1.044	.571	.185	5.633	e4	.673	.083	8.068
Delivery Reliability	1.229	.721	.196	6.274	e5	.416	.070	5.974
Process Effectiveness	1.106	.595	.191	5.784	e7	.664	.085	7.828

Note: P/S: product/service; U.Est: unstandardised regression estimates; FL: factor loading; SE: standard error; CR: critical ratio; Er: error; E.Est: error variance estimates

In discriminant validity, this study compares the average variance-extracted (AVE) value and the square of correlation estimates between a pair of constructs (MP and

CP). As a result, average variance extracted (AVE) values = 0.67, exceeding the square of correlation estimates = 0.28, which provide evidence of discriminant validity.

Model 3

As shown in Table 4.64, none of the factor loadings (FL) of the six observed variables is less than 0.50 (range from 0.528-0.887), as Hair et al. (2010) suggested. Thus, it can be concluded that all observed variables converge on each latent construct. Additionally, the average variance extracted (AVE) values of the FP and OPP constructs are 0.62 and 0.81, exceeding the value of 0.5, which represents a good overall amount of variance in the observed variables accounting for the two constructs (Hair et al., 2010). In addition, the construct reliability (CR) value of the OPP construct is 0.85, above 0.60, which provides evidence that indicators that measure the OPP construct have an overall good reliability (Diamantopoulos & Siguaw, 2000). In the FP construct, CR is 0.59, which is close to 0.60, the minimum acceptable level. Therefore, it can be concluded than the two indicators that measure FP have an overall acceptable level.

Table 4.64: Selected AMOS output relating to the dependent construct (Model 3)

Construct	**U.Est**	**FL**	**SE**	**CR**	**Er**	**E.Est**	**SE**	**CR**
Financial performance (FP)								
Sales	1	.528			e1	.673	.101	6.663
ROA	1.376	.706	.477	2.886	e2	.496	.173	2.873
Operational performance (OPP)								
Total costs	1	.886			e3	.312	.035	8.895
P/S quality	1.023	.875	.043	23.652	e4	.366	.039	9.501
Delivery Reliability	1.026	.887	.043	24.078	e5	.326	.037	8.833
Process Effectiveness	.628	.588	.050	12.641	e7	.855	.064	13.263

Note: P/S: product/service; U.Est: unstandardised regression estimates; FL: factor loading; SE: standard error; CR: critical ratio; Er: error; E.Est: error variance estimates

In discriminant validity, this study compares the average variance-extracted (AVE) value and the square of correlation estimates between a pair of constructs (MP and

CP). As a result, average variance extracted (AVE) values = 0.72, exceeding the square of correlation estimates = 0.08, which provides evidence of discriminant validity.

Model 4

As shown in Table 4.65, none of the factor loadings of the six observed variables is less than 0.50 (range from 0.557-0.882), as Hair et al. (2010) suggested. Therefore, it can be concluded that all observed variables converge on each latent construct. Additionally, the average variance extracted (AVE) values of the FP and OPP constructs are 0.64 and 0.78, exceeding the value of 0.5, which represents a good overall amount of variance in the observed variables accounting for two constructs (Hair et al., 2010). The construct reliability (CR) values of the FP and OPP constructs are 0.62 and 0.83, exceeding 0.60, which provides evidence that indicators measuring these two constructs have an overall good reliability (Diamantopoulos & Siguaw, 2000).

Table 4.65: Selected AMOS output relating to the dependent construct (Model 4)

Construct	**U.Est**	**FL**	**SE**	**CR**	**Er**	**E.Est**	**SE**	**CR**
Financial performance (FP)								
Sales	1	.577			e1	.620	.077	8.071
ROA	1.218	.696	.271	4.490	e2	.491	.105	4.683
Operational performance (OPP)								
Total costs	1	.791			e3	.473	.036	13.289
P/S quality	1.089	.812	.052	20.870	e4	.485	.039	12.582
Delivery Reliability	1.151	.882	.052	22.331	e5	.300	.033	9.037
Process Effectiveness	.784	.631	.050	15.587	e7	.733	.046	15.812

Note: P/S: product/service; U.Est: unstandardised regression estimates; FL: factor loading; SE: standard error; CR: critical ratio; Er: error; E.Est: error variance estimates

In discriminant validity, this study compares the average variance-extracted (AVE) value and the square of correlation estimates between a pair of constructs (MP and CP). As a result, average variance extracted (AVE) values = 0.71, exceeding the square of correlation estimates = 0.12, which provide evidence of discriminant validity

Testing common method variance (CMV) of the independent construct and dependent construct

In the independent construct of the four models, all selected variables are entered into the SPSS program for EFA. In addition, the number of factors extracted is restricted to 1 without the rotation method. The Harman's single factor results include only one factor that emerged to explain 41, 40, 43, and 43 percent of the variance in Models 1, 2, 3, and 4 respectively, which implies CMV is not a major concern. Similarly, with the dependent construct of the four models, according to the Harman's single factor results, only one factor emerged to explain 45, 31, 46, and 42 percent of the variance in Models 1, 2, 3, and 4, respectively, which implies CMV is not a major concern.

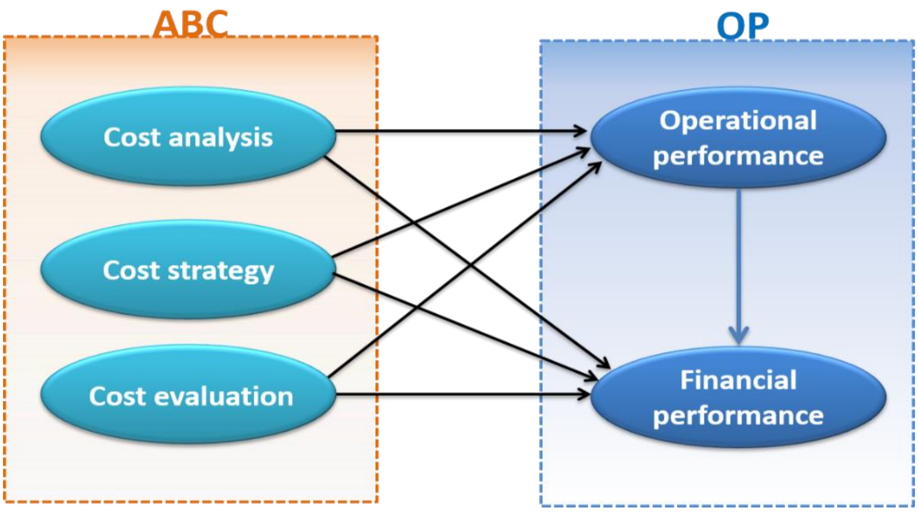
In addition, in order to support the Harman's single factor results above, each model compares the model fit between two models (Model I and II). The first model (I) and second model (II) are presented in Section 4.4.1. It shows the second model (II) of all Models (1-4) fits the data better than the first model (I) of all Models (1-4), indicating that CMV is not responsible for the relationship among the variables.

4.5 Results of structural equation modelling (SEM)

4.5.1 Results of Model 1: The extent of ABC use and organisational performance model (191 cases of organisations that adopted both ABC and ISO 9000)

This study aims to investigate the causal relationship between the extent of ABC use and organisational performance. From the EFA and CFA results, the extent of ABC use can be explained as a multidimensional construct including three factors: cost analysis, cost strategy and cost evaluation. Likewise organisational performance can be divided into two constructs (operational performance and financial performance) as a multidimensional construct. The three-factor CFA model of independent structure is presented on the left in Figure 4.19, whereas the two dependent constructs are on the right. It is noted that all indicators, error terms associated with indicators, and all double-headed arrows indicating correlations among the independent and dependent factors have been excluded from the figure, though they are contained in the model before the program will operate the analysis, presented later in this section.

Figure 4.19: SEM of Model 1



The steps of structural equation modelling (SEM)

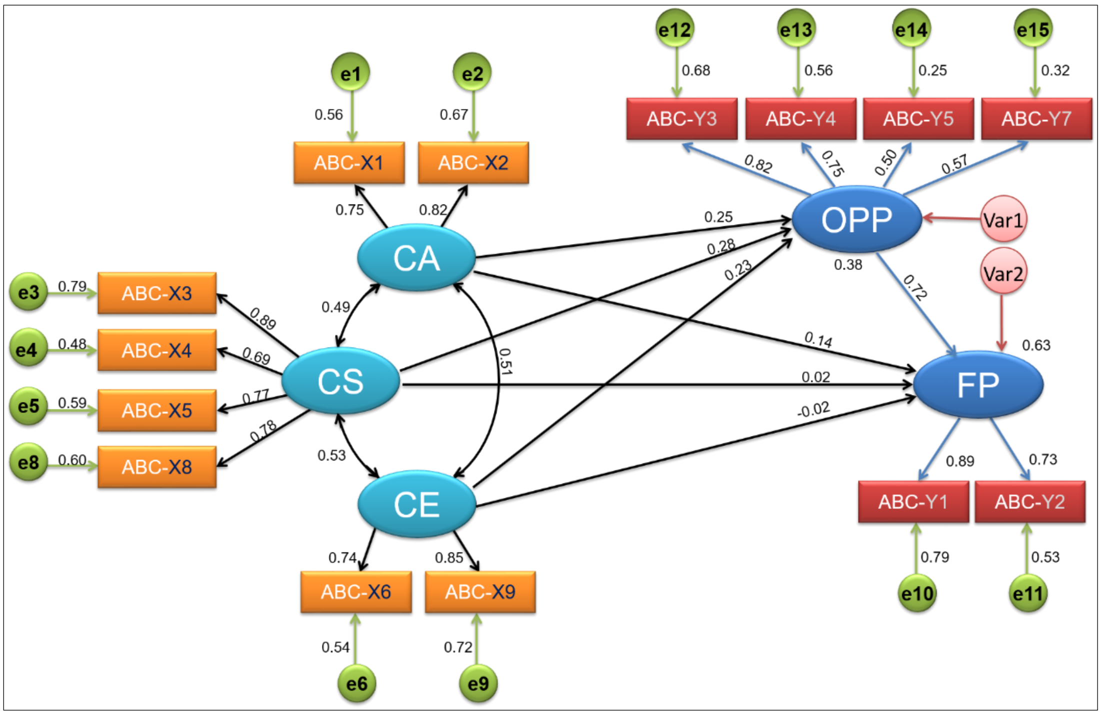
The model has been tested with SEM by the following five steps: 1) model specification, 2) identification, 3) estimation, 4) evaluation, and 5) modification.

Model specification

Model specification was first developed as illustrated earlier in Chapter 2, based on previous studies and relevant theories (see section 2.6). Regarding the EFA and CFA results, the extent of ABC use construct is explained using the three-factor CFA model as a multidimensional construct (see sections 4.3.1 and 4.4.1.1). Similarly, organisational performance is considered a multidimensional construct (two-factor CFA model) with regard to EFA and CFA results (see sections 4.3.2 and 4.4.1.2).

As shown in Figure 4.20, Model 1 consists of five constructs. Each construct has been tested for validity of the indicator variables (see section 4.4.2). These five constructs are measured by using indicators (see section 3.2.2) which constitute the measurement model section. Each indicator has its related error term.

Figure 4.20: The relationship between the extent of ABC use and OP (Model 1)



Model identification

The next step of SEM is model identification. This is needed to compute the degrees of freedom. The degrees of freedom are equal to the number of elements in a correlation matrix minus the number of parameters in the model to be estimated. As shown in Figure 4.20 with *eight* observed variables (the extent of ABC use construct), *four* observed variables (operational performance construct) and *two* observed variables (financial performance construct), the number of observed (measured) variables = 8+4+2= 14. Then, the number of elements in a correlation matrix = [14(14+1)]/2 = 105 follows before the number of parameters in the model is estimated = 38 (16 regression weights, 13 covariances and 19 variances). Thereby the degree of freedom is 105-38 = 67, indicating it is over-identified. It means that there is more than one way to estimate the parameters.

Figure 4.21: Selected AMOS output for Model 1: Model summary

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	105
Number of distinct parameters to be estimated:	38
Degrees of freedom (105 - 38):	67

Result (Default model)

Minimum was achieved
Chi-square = 99.772
Degrees of freedom = 67
Probability level = .006

Table 4.66: Parameter summary of Model 1

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	21	0	0	0	0	21
Labelled	0	0	0	0	0	0
Unlabelled	***16***	***3***	***19***	***0***	***0***	***38***
Total	37	3	19	0	0	59

Before proceeding to model estimation, the requirements of SEM should be considered. Sample size, multicollinearity, and missing data have been discussed earlier (see section 4.1) and have met the conditions for SEM. Multivariate normality is discussed next.

Multivariate normality

The normality of each variable has been tested earlier in the chapter, indicating that data comes from a normal distribution (see section 4.1.3.3). The AMOS output also confirms the normality with CR of skew and kurtosis less than 3 (See Table 4.67). In particular multivariate normality, Byrne (2010) suggested that in practice, values more than 5.00 are suggestive of data that are a non-normal distribution. In this model, the z-statistic of 4.684 (less than 5.00) is indicative of normality in the sample. In addition, the Mardia's coefficient (14.348) is less than the value obtained from the formula p(p+2) = 14(14+2) supporting the fact that the data is deemed as multivariate normal (Khine, 2013). Therefore, it can confirm that there is a multivariate normal distribution which met the conditions of the Maximum Likelihood (ML) estimation method in further analysis.

Table 4.67: Output of assessment of normality

Variable	min	max	skew	CR	kurtosis	CR
ABC_X6	2.000	7.000	-.040	-.226	-.678	-1.914
ABC_X9	2.000	7.000	-.209	-1.181	-.297	-.838
ABC_X3	2.000	7.000	-.294	-1.660	-.274	-.772
ABC_X4	2.000	7.000	.142	.804	-.371	-1.046
ABC_X5	2.000	7.000	-.296	-1.673	-.239	-.674
ABC_X8	2.000	7.000	-.153	-.861	-.634	-1.789
ABC_X2	3.000	7.000	-.188	-1.062	-.461	-1.301
ABC_X1	2.000	7.000	-.412	-2.327	.243	.685
ABC_Y1	3.000	7.000	-.288	-1.625	-.669	-1.887
ABC_Y2	3.000	7.000	-.321	-1.812	-.301	-.850
ABC_Y7	2.000	7.000	-.177	-.999	-.895	-2.526
ABC_Y5	2.000	7.000	-.084	-.476	-.368	-1.039
ABC_Y4	2.000	7.000	.057	.324	-.581	-1.640
ABC_Y3	2.000	7.000	.144	.814	-.838	-2.364
Multivariate					***14.348***	***4.684***

<u>Model estimation</u>

In this step, the data for the model are entered into Amos program by using ML estimation technique as discussed in Chapter 3 (See Section 3.3.4.1.3).

<u>Model evaluation</u>

As depicted in Figure 4.21, the model yielded a $\chi 2$ value of 99.772, with 67 degrees of freedom and a probability of 0.006 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). However, as mentioned earlier given the limitations of $\chi 2$ (see Section 3.3.4.1.4) developing other goodness-of-fit (GOF) indices takes a more practical approach to the evaluation process.

The outputs of GOF indices are presented in Table 4.68. GFI = 0.932 which is more than 0.90 and considered as an acceptable value (Hair et al., 2010). Thus, it can be concluded that the hypothesised model fits the sample fairly well. RMSEA value is 0.051 which is below 0.08 are indicated as reasonable errors of approximation in the population (MacCallum et al., 1996). RMR shows 0.059 which below 0.08, are indicating an acceptable level of fit (Hooper et al., 2008).

In incremental fit indices, a NFI value of 0.916 exceeds 0.90 (Hooper et al., 2008). The CFI (0.970) indicates that the model fits the data well in the terms that the hypothesised model adequately explains the sample data (Bentler, 1992; Byrne, 2010). TLI yields values of 0.960 which fits the data well (Hair et al., 2010) . The next set of fit statistics is model parsimony, the AGFI value of 0.893 is adequate as it is more than 0.85 as (Hair et al., 2006). Chi-square shows 1.489 (below 5) being indicative of a good fit (Wheaton et al., 1977).

Table 4.68: Model fit summary of Model 1

Measures	**Recommended**	**Output**
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.932
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.051
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.059
Normed Fit Index (NFI)	Above 0.90 (Hooper et al., 2008)	0.916
Comparative Fit Index (CFI)	Above 0.90 (Bentler, 1992)	0.970
Tucker-Lewis Index (TLI)	Above 0.90 (Hair et al., 2010)	0.960
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.893
Chi-square /df	Below 5.00 (Wheaton et al., 1977)	1.489

Both the unstandardised and standardised regression weights are shown in Table 4.69. “Standardised parameter estimates are transformations of unstandardised estimates that remove scaling and can be used for informal comparisons of parameters throughout the model” (Suhr, 2010: 2). This study interprets the outputs of standardised estimates because it is typically used for interpretation (Hox &

Bechger, 2001). However, it considers unstandardised parameters for variance and covariance because the SEM output provides only unstandardised variances and covariances.

In reviewing the structural parameter estimates for Model 1, it is highlighted that three parameters that are not significant (P>0.05), these parameters represent the regression paths from cost analysis to financial performance (P =0.153), from cost strategy to financial performance (P =0.837), and cost evaluation to financial performance (P =0.822). Other regression paths and factor loadings are significant and no standardised parameter estimate greater than the value of 1. In addition, all variances and covariances show nonzero (p<0.05) and no negative variances. Squared multiple correlation (R^2) for the endogenous variables are as follows: operational performance (0.38) and financial performance (0.63). With the given information (Table 4.68 and 4.69), the Model 1 fits the data well due to the goodness-of-fits (GOF) indices and individual parameters met the requirements.

Table 4.69: Selected AMOS Output (Model 1)

			Unstd.	**Std.**	**S.E.**	**C.R.**	**P**
Regression weights							
OPP	<---	CA	.353	.248	.151	2.344	.019
OPP	<---	CS	.263	.277	.094	2.802	.005
OPP	<---	CE	.245	.226	.117	2.102	.036
FP	<---	CA	.186	.137	.130	1.428	**.153**
FP	<---	CS	.017	.019	.081	.206	**.837**
FP	<---	CE	-.022	-.022	.100	-.225	**.822**
FP	<---	OPP	.681	.716	.101	6.752	***
ABC_Y3	<---	OPP	1.000	.824			
ABC_Y4	<---	OPP	.911	.750	.089	10.278	***
ABC_Y5	<---	OPP	.541	.502	.081	6.643	***
ABC_Y2	<---	FP	.739	.729	.079	9.387	***
ABC_Y1	<---	FP	1.000	.889			
ABC_X8	<---	CS	.982	.776	.079	12.484	***
ABC_X5	<---	CS	.883	.767	.072	12.286	***
ABC_X4	<---	CS	.795	.690	.075	10.603	***
ABC_X3	<---	CS	1.000	.890			
ABC_X9	<---	CE	1.072	.849	.144	7.465	***
ABC_X6	<---	CE	1.000	.737			
ABC_X1	<---	CA	1.000	.750			
ABC_X2	<---	CA	1.212	.818	.165	7.326	***
ABC_Y7	<---	OPP	.684	.566	.090	7.569	***
Variances							
CS			1.047		.141	7.439	***

			Unstd.	Std.	S.E.	C.R.	P
CE			.797		.162	4.914	***
CA			.463		.093	4.949	***
Var1			.581		.104	5.594	***
Var2			.317		.081	3.932	***
e12			.443		.075	5.873	***
e13			.607		.082	7.397	***
e14			.817		.089	9.158	***
e15			.933		.105	8.919	***
e11			.409		.056	7.263	***
e10			.224		.072	3.094	.002
e1			.359		.066	5.444	***
e2			.336		.087	3.841	***
e8			.666		.085	7.795	***
e5			.570		.072	7.912	***
e4			.728		.084	8.617	***
e3			.275		.055	5.018	***
e9			.355		.111	3.189	.001
e6			.669		.114	5.848	***
Covariances							
CS	<-->	CA	.343		.073	4.706	***
CE	<-->	CA	.310		.072	4.305	***
CS	<-->	CE	.486		.099	4.926	***

Note: Unstd: unstandardised regression estimates, Std: standardised regression estimates (factor loadings), SE: standard error, CR: Critical Ratio, P: probability, product costing (ABC-X1), cost management (ABC-X2), pricing decisions (ABC-X3), product mix decisions (ABC-X4), determine customer profitability (ABC-X5), budgeting (ABC-X6), as an off-line analytic tool (ABC-X7), outsourcing decisions (ABC-X8), performance measurement (ABC-X9), sales (ABC-Y1), ROA (ABC -Y2), total reduced costs (ABC -Y3), product/service quality (ABC -Y4), delivery reliability (ABC -Y5), process effectiveness (ABC -Y7), CA: cost analysis, CS: cost strategy, CE: cost evaluation OPP: operational performance, FP: financial performance

Model modification and validation

As discussed in Section 3.3.4.1.5, Table 4.70 shows the values of EVCI, BIC and AIC. It can be seen that the default model (hypothesised model) has the smallest values of these three indexes which it is the most stable in the population (Schumacker & Lomax, 2010). In addition, it can be seen that the results from ML (See Table 4.69) and from bootstrap (See Table 4.71) are similar. The values of bias provide evidence that the difference between ML results and bootstrap is very small which is indicative of being stable estimates of the whole population.

Table 4.70: EVCI, BIC and AIC values (Model 1)

Models	**ECVI**	**BIC**	**AIC**
Default model	.925	299.358	175.772
Saturated model	1.105	551.489	210.000
Independence model	6.427	1266.754	1221.222

Table 4.71: Bootstrap results (Model 1)

Parameter			**Estimate**	**SE**	**Bias**	**P**
OPP	<---	CA	.248	.133	.002	.042
OPP	<---	CS	.277	.109	-.003	.015
OPP	<---	CE	.226	.117	.001	.047
FP	<---	CA	.137	.094	.001	**.130**
FP	<---	CS	.019	.098	-.002	**.858**
FP	<---	CE	-.022	.113	.002	**.867**
FP	<---	OPP	.716	.103	.004	.002
ABC_Y3	<---	OPP	.824	.039	.001	.002
ABC_Y4	<---	OPP	.750	.049	.002	.002
ABC_Y5	<---	OPP	.502	.069	.000	.002
ABC_Y2	<---	FP	.729	.064	.005	.002
ABC_Y1	<---	FP	.889	.044	.000	.002
ABC_X8	<---	CS	.776	.037	.000	.002
ABC_X5	<---	CS	.767	.035	-.001	.002
ABC_X4	<---	CS	.690	.054	.001	.002
ABC_X3	<---	CS	.890	.036	-.001	.002
ABC_X9	<---	CE	.849	.068	.000	.002
ABC_X6	<---	CE	.737	.058	-.001	.002
ABC_X1	<---	CA	.750	.058	-.001	.002
ABC_X2	<---	CA	.818	.056	.001	.002
ABC_Y7	<---	OPP	.566	.060	-.002	.002

Hypothesis testing (Model 1)

It is hypothesised that the extent of ABC use positively impacts on financial and operational performance as indicated in H1 and H2 respectively. However, as results of EFA and CFA found the extent of ABC use and organisational performance are multidimensional, the hypotheses have been modified as follows:

Hypothesis 1a: Cost analysis (CA) has a positive impact on FP

Hypothesis 1b: Cost strategy (CS) has a positive impact on FP

Hypothesis 1c: Cost evaluation (CE) has a positive impact on FP

Hypothesis 2a: Cost analysis (CA) has a positive impact on OPP

Hypothesis 2b: Cost strategy (CS) has a positive impact on OPP

Hypothesis 2c: Cost evaluation (CE) has a positive impact on OPP

Path coefficients and related p-value are used to examine the impact of CA, CS, and CE on OPP and FP. As presented in Table 4.72, the results reveal only three out of six constructs have a direct positive direct impact on FP and OPP. The path coefficients between CA, CS, CE and OPP are 0.25 ($P \leq 0.05$), 0.28 ($P \leq 0.01$), and 0.23 ($P \leq 0.05$). These acceptable significant path coefficients provide evidence to reject the Null hypothesis and indicate that the extent of ABC use has a positive direct impact on operational performance.

On the other hand, the path coefficients between CA, CS, CE and FP are not significant. These indicate that there is no evidence to indicate the positive impact of the extent of ABC use on financial performance.

It is also hypothesised that the extent of ABC use indirectly impacts on financial performance (FP) through operational performance (OPP) as indicated in H3. However, as discussed above in the results of EFA and CFA the hypothesis has been modified as follows:

Hypothesis 3a: Cost analysis (CA) has an indirect impact on FP through OPP

Hypothesis 3b: Cost strategy (CS) has an indirect impact on FP through OPP

Hypothesis 3c: Cost evaluation (CE) has an indirect impact on FP through OPP

As presented in Table 4.73, the results report that CA, CS, and CE have impact on FP though OPP. Relating to CA and FP, this indirect impact increases the standardised coefficient from 0.14 to 0.32. Similarly, in CS and FP, this indirect impact increases the standardised coefficient from 0.02 to 0.22. Additionally, as CE has a very small negative direct impact on FP, this indirect impact increases the standardised coefficient from -0.02 to 0.14. With this evidence, this study rejects the Null hypothesis and indicates that the extent of ABC use has an indirect impact on financial performance through operational performance.

Table 4.72: Hypothesised relationships (Model 1)

	Hypothesised Relationships	Standardised estimate	S.E.	C.R.	P-value	Null hypothesis	interpretation
H1	FP <--- the extent of ABC use						
	FP <--- CA	0.14	0.097	1.420	0.156	Fail to Rej.	The positive effect of CA on FP is not found at p-value 0.05
	FP <--- CS	0.02	0.060	0.206	0.837	Fail to Rej.	The positive effect of CS on FP is not found at p-value 0.05
	FP <--- CE	-0.02	0.074	-0.225	0.822	Fail to Rej.	The positive effect of CE on FP is not found at p-value 0.05
H2	OPP <--- the extent of ABC use						
	OPP <--- CA	**0.25**	0.151	2.344	**0.019***	Reject	CA has a positive direct impact on OPP at p-value 0.05
	OPP <--- CS	**0.28**	0.094	2.802	**0.005****	Reject	CS has a positive direct impact on OPP at p-value 0.05
	OPP <--- CE	**0.23**	0.117	2.102	**0.036***	Reject	CE has a positive direct impact on OPP at p-value 0.05

Table 4.73: Direct, indirect and total impact (Model 1)

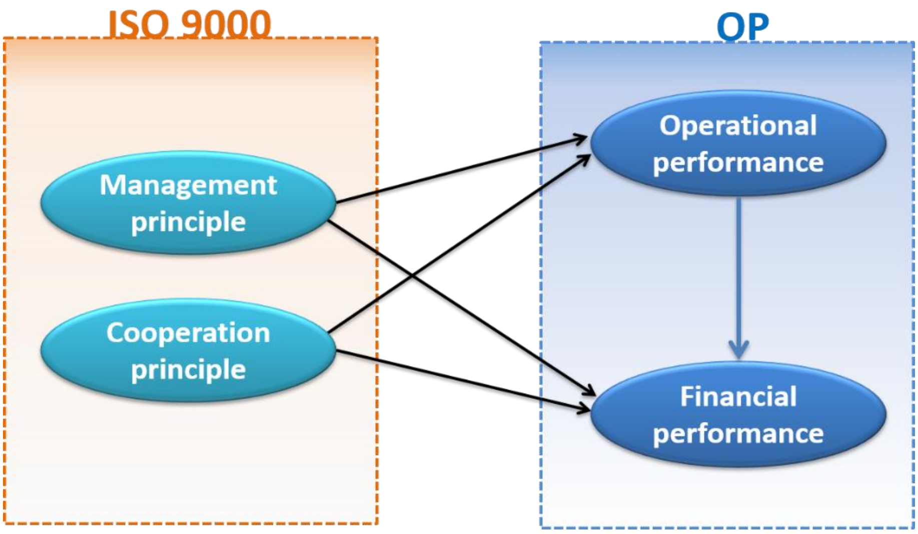
Dependent construct	Independent construct	Direct impact	Indirect impact (H3)	Total impact
FP (R^2=0.63)	CA	0.14	**0.18***	0.32
	CS	0.02	**0.20****	0.22
	CE	-0.02	**0.16***	0.14

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

4.5.2 Results of Model 2: The extent of ISO 9000 implementation and organisational performance (191 cases of organisations that adopted both ABC and ISO 9000)

This study aims to examine the causal relationship between the extent of ISO 9000 implementation and organisational performance. From the EFA and CFA results, the extent of ISO 9000 implementation can be explained as a multidimensional construct including two factors: management principle and cooperation principle. As well as organisational performance, which can be explained by two constructs (operational performance and financial performance) as a multidimensional construct. A two-factor CFA model of independent structure is presented on the left in Figure 4.22 whereas on the right of the figure shows the two dependent constructs.

Figure 4.22: SEM of Model 2



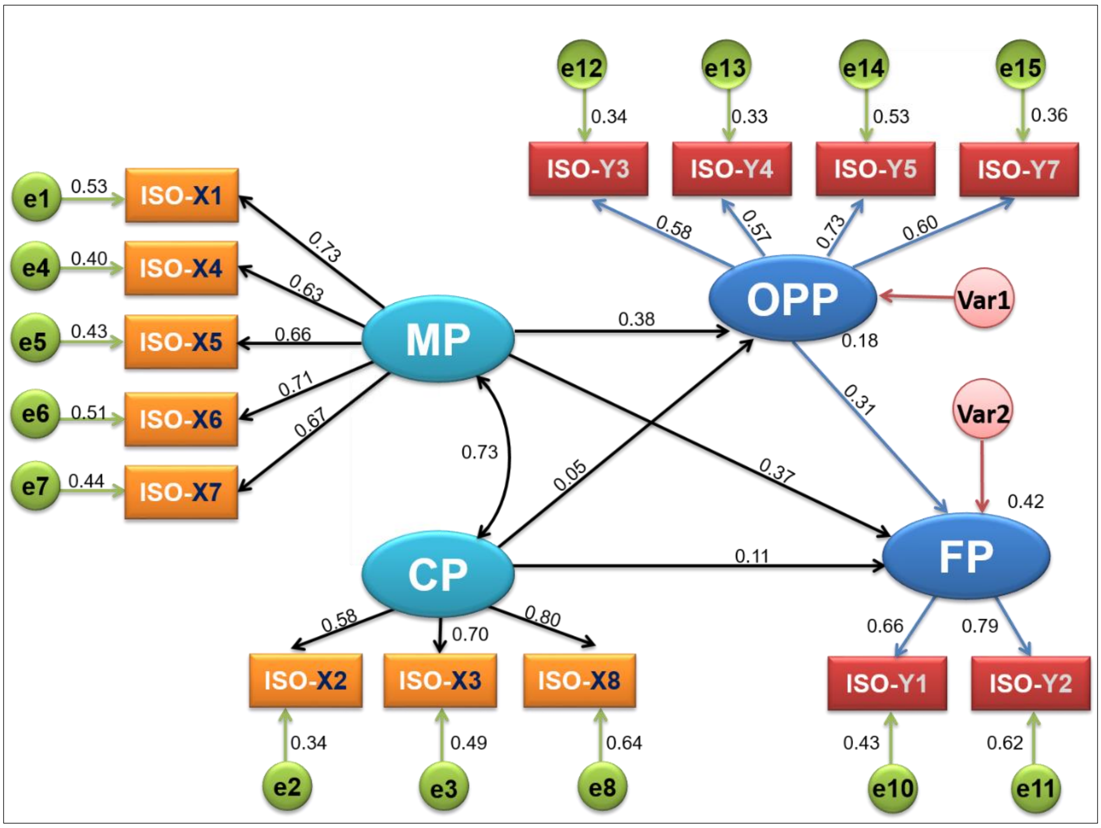
The steps of structural equation modelling (SEM)

<u>Model specification</u>

Model specification is first developed as illustrated earlier in Chapter 2 based on previous studies and relevant theories (see Section 2.6). Regarding with EFA and CFA results, the extent of ISO 9000 implementation construct is explained by two-factor CFA model as a multidimensional construct (see Section 4.3.1 and 4.4.1.1). Similarly, organisational performance is considered as a multidimensional construct (two-factor CFA model) with regard to EFA and CFA results (see Section 4.3.2 and 4.4.1.2).

As shown in Figure 4.23, Model 2 consists of four constructs. Each construct has been tested for validity of the indicator variables (see Section 4.4.2). These five constructs are measured by using indicators (see Section 3.2.2) which constitute the measurement model section. Each indicator has its related error term.

Figure 4.23: The relationship between the extent of ISO 9000 implementation and OP (Model 2)



<u>Model identification</u>

The next step of SEM is model identification. As shown in Figure 4.23 with *eight* observed variables (the extent of ISO 9000 implementation construct), *four* observed variables (operational performance construct) and *two* observed variables (financial performance construct), the number of observed (measured) variables = 8+4+2= 14. Then the number of elements in a correlation matrix = [14(14+1)]/2 = 105. The number of parameters in the model to be estimated = 34 (15 regression weights, 1 covariances and 18 variances), thereby the degrees of freedom is 105-34 = 71 indicating it is over-identified.

Figure 4.24: Selected AMOS Output for Model 2: Model Summary

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	105
Number of distinct parameters to be estimated:	34
Degrees of freedom (105 - 34):	71

Result (Default model)

Minimum was achieved
Chi-square = 130.213
Degrees of freedom = 71
Probability level = .000

Table 4.74: Parameter Summary of Model 2

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	20	0	0	0	0	20
Labelled	0	0	0	0	0	0
Unlabelled	***15***	***1***	***18***	***0***	***0***	***34***
Total	35	1	18	0	0	54

This model met the assumptions of SEM namely sample size, multivariate normality, multicollinearity and missing data (See Section 4.1). Multivariate normality is discussed next.

Multivariate normality

Normality of each variable has been tested in the previous chapter indicating the data come from a normal distribution (See Section 4.1). The AMOS output also confirms the normality with a CR of skew and kurtosis of less than 3 (See Table 4.75). Concerning multivariate normality in particular, Byrne (2010) suggested that, in practice, values above 5.00 are suggestive of data that are non-normally distributed. In this model, the z-statistic of 4.687 (less than 5.00) is indicative of normality in the sample. In addition, the Mardia's coefficient (14.357) is less than the value obtained from the formula p(p+2) = 14(14+2), supporting the idea that the data are deemed as multivariate normal (Khine, 2013). Therefore, it can be confirmed that this is a multivariate normal distribution.

Table 4.75: Output of assessment of normality

Variable	min	max	skew	CR	kurtosis	CR
ISO_X8	2.000	7.000	-.296	-1.673	-.508	-1.433
ISO_X1	3.000	7.000	-.339	-1.915	-.526	-1.484
ISO_X4	2.000	7.000	-.351	-1.979	-.522	-1.473
ISO_X5	3.000	7.000	-.385	-2.171	-.108	-.305
ISO_X6	2.000	7.000	-.309	-1.743	-.411	-1.159
ISO_X7	2.000	7.000	-.177	-1.001	-.615	-1.734
ISO_X2	2.000	7.000	-.236	-1.330	-.163	-.459
ISO_X3	2.000	7.000	-.378	-2.135	-.379	-1.069
ISO_Y1	3.000	7.000	-.018	-.102	-.585	-1.651
ISO_Y2	3.000	7.000	-.075	-.425	-.173	-.489
ISO_Y7	2.000	7.000	.094	.530	-.287	-.809
ISO_Y5	3.000	7.000	.074	.420	-.376	-1.062
ISO_Y4	3.000	7.000	-.077	-.437	-.701	-1.979
ISO_Y3	2.000	7.000	.000	.000	.275	.776
Multivariate					***14.357***	***4.687***

Model estimation

In this step, the data for the model are entered into the Amos program by ML estimation. The results are reported in the next step.

Model evaluation

As shown in Figure 4.24, it yielded a $\chi 2$ value of 130.213, with 71 degrees of freedom and a probability of less than 0.000 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). However, given the limitations of $\chi 2$ (see Section 3.3.4.1.4)**,** developing other goodness-of-fit (GOF) indices takes a more comprehensive approach to the evaluation process.

The outputs of GOF indices are presented in Table 4.76. With a GFI = 0.918, which is more than 0.90 which is considered as an acceptable value (Hair et al., 2010). Therefore, it can be concluded that the hypothesised model fits the sample fairly well. RMSEA shows 0.066, which is below 0.08 indicates reasonable errors of approximation in the population (MacCallum et al., 1996). The RMR value of 0.057 is below 0.08, indicating an acceptable level of fit (Hooper et al., 2008).

In incremental fit indices, a NFI value of 0.891 would seem to be an adequate fitting model as it is relatively close to 0.90 (Hooper et al., 2008). The CFI (0.924) identified that the model fits the data well in that the hypothesised model adequately explained the sample data (Bentler, 1992; Byrne, 2010). The TLI yields a value of 0.903, which is more than 0.90, as (Hair et al., 2010) suggested. The next set of fit statistics is model parsimony. An AGFI value of 0.879 is an adequate fitting model as it exceeds 0.85, as Hair et al. (2006) indicated. Chi-square/df shows 1.834, which is below 5 and therefore indicative of good fit (Wheaton et al., 1977).

Table 4.76: Model fit summary (Model 2)

Measures	Recommended	Output
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.918
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.066
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.057
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.891
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.924
Tucker-Lewis index (TLI)	Above 0.90 (Hair et al., 2010)	0.903
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.879
Chi-square/df	Below 5.00 (Wheaton et al., 1977)	1.834

Table 4.77, in reviewing the structural parameter estimates for Model 2, highlights the two parameters that are not significant at a 95% confidence level (P>0.05); these parameters represent the paths from cooperation principle to operational performance (P = 0.741), and from cooperation principle to financial performance P = 0.454). Other regression paths and factor loadings are significant and no standardised parameter estimate is greater than 1. In addition, all variances and covariances show nonzero (p<0.05) with no negative variances. Squared multiple correlation (R^2) for the endogenous variables are as follows: operational performance (0.18) and financial performance (0.42). With the given information (Tables 4.76 and 4.77), Model 2 fits the data well as the goodness-of-fit (GOF) indices and individual parameters met the requirements.

Table 4.77: Selected AMOS Output (Model 2)

			Unstd.	Std.	S.E.	C.R.	P
Regression weights							
OOP	<---	MP	.279	.379	.123	2.275	.023
OOP	<---	CP	.051	.054	.154	.331	**.741**
FP	<---	MP	.308	.365	.138	2.238	.025
FP	<---	CP	.124	.114	.165	.749	**.454**
FP	<---	OOP	.352	.307	.129	2.717	.007
ISO_Y3	<---	OOP	1.000	.584			
ISO_Y4	<---	OOP	1.066	.574	.190	5.623	***
ISO_Y5	<---	OOP	1.256	.726	.201	6.254	***
ISO_Y2	<---	FP	1.179	.787	.199	5.930	***
ISO_Y1	<---	FP	1.000	.655			
ISO_Y7	<---	OOP	1.124	.596	.195	5.756	***
ISO_X3	<---	CP	1.368	.704	.201	6.795	***
ISO_X2	<---	CP	1.000	.581			
ISO_X7	<---	MP	1.140	.666	.138	8.274	***
ISO_X6	<---	MP	1.103	.714	.125	8.823	***
ISO_X5	<---	MP	.871	.656	.107	8.166	***
ISO_X4	<---	MP	.997	.631	.127	7.870	***
ISO_X1	<---	MP	1.000	.726			
ISO_X8	<---	CP	1.735	.799	.245	7.080	***
Variances							
MP			.533		.099	5.372	***
CP			.319		.081	3.919	***
Var1			.238		.065	3.666	***
Var2			.221		.059	3.726	***
e12			.559		.070	7.970	***
e13			.669		.083	8.065	***
e14			.410		.069	5.931	***
e15			.663		.085	7.849	***
e11			.324		.086	3.783	***
e10			.504		.077	6.558	***
e3			.610		.085	7.163	***
e2			.628		.074	8.471	***
e7			.871		.105	8.274	***
e6			.624		.080	7.814	***
e5			.534		.064	8.347	***
e4			.800		.094	8.524	***
e1			.480		.062	7.679	***
e8			.546		.104	5.240	***
Covariances							
MP	<-->	CP	.299		.059	5.117	***

Note: Unstd: unstandardised regression estimates, Std: standardised regression estimates (factor loadings), SE: standard error, CR: Critical Ratio, P: probability, customer focus (ISO-X1), leadership (ISO-X2), involvement of people (ISO-X3), process approach (ISO-X4), system approach to management (ISO-X5), continual improvement (ISO-X6), factual approach to decision-making (ISO-X7) and mutually beneficial supplier relationships (ISO-X8), sales (ISO-Y1), ROA (ISO-Y2), total costs (ISO-Y3), product/service quality (ISO-Y4), delivery reliability (ISO-Y5), and process effectiveness (ISO-Y7)

Model modification and validation

Table 4.78 shows the values of EVCI, BIC and AIC. It can be seen that the default model (hypothesised model) has the smallest values of these three indices, being the most stable in the population (Schumacker & Lomax, 2010). In addition, it can be seen that the results from ML (See Table 4.77) and from bootstrap (see Table 4.79) are similar. The values of bias provide evidence that the difference between ML results and bootstrap is very small, which suggests stability of the estimates of the whole population.

Table 4.78: EVCI, BIC and AIC values (Model 2)

Models	**ECVI**	**BIC**	**AIC**
Default model	1.043	308.790	198.213
Saturated model	1.105	551.489	210.000
Independence model	4.749	947.792	902.260

Table 4.79: Bootstrap results (Model 2)

Parameter			**Estimate**	**SE**	**Bias**	**P**
OOP	<---	MP	.379	.175	.009	.024
OOP	<---	CP	.054	.162	-.008	**.809**
FP	<---	MP	.365	.190	-.007	.042
FP	<---	CP	.114	.164	-.010	**.500**
FP	<---	OOP	.307	.165	.008	.023
ISO_Y3	<---	OOP	.584	.074	.005	.002
ISO_Y4	<---	OOP	.574	.076	.001	.002
ISO_Y5	<---	OOP	.726	.068	-.004	.002
ISO_Y2	<---	FP	.787	.128	.003	.002
ISO_Y1	<---	FP	.655	.107	.001	.002
ISO_Y7	<---	OOP	.596	.074	-.004	.002
ISO_X3	<---	CP	.704	.054	.002	.002
ISO_X2	<---	CP	.581	.068	.002	.002
ISO_X7	<---	MP	.666	.056	.001	.002
ISO_X6	<---	MP	.714	.061	-.001	.002
ISO_X5	<---	MP	.656	.054	.003	.002
ISO_X4	<---	MP	.631	.058	-.005	.002
ISO_X1	<---	MP	.726	.052	-.002	.002
ISO_X8	<---	CP	.799	.049	-.001	.002

Hypothesis testing (Model 2)

It is hypothesised that the extent of ISO 9000 implementation positively impacts on financial and operational performance, as indicated in H4 and H5, respectively. However, as the results of the EFA and CFA found the extent of ISO 9000 implementation and organisational performance are multidimensional, the hypotheses have been modified as follows:

Hypothesis 4a: Management principle (MP) has a positive impact on FP

Hypothesis 4b: Cooperation principle (CP) has a positive impact on FP

Hypothesis 5a: Management principle (MP) has a positive impact on OPP

Hypothesis 5b: Cooperation principle (CP) has a positive impact on OPP

Path coefficients and related p-values are used to examine the impact of MP and CP on OPP and FP. This study considers that p-value < 0.05 is considered an acceptable significance level. As presented in Table 4.80, the results reveal only two out of four constructs have a direct positive direct impact on FP and OPP. The path coefficient between MP and FP is 0.37 and the path coefficient between MP and OPP is 0.38. These results give evidence to reject a Null hypothesis and indicate that management principle (MP) has a positive direct impact on both financial performance (FP) and operational performance (OPP). On the other hand, the path coefficients between CP and FP and OPP are not significant. These indicate that there is no evidence to indicate the positive impact of CP on FP and CP on OPP.

It is also hypothesised that the extent of ISO 9000 implementation (MP and CP) indirectly impacts on financial performance (FP), as indicated in H6. However, as discussed above in the results of EFA and CFA, the hypotheses have been modified as follows:

Hypothesis 6a: Management principle (MP) has an indirect impact on FP through OPP

Hypothesis 6b: Cooperation principle (CP) has an indirect impact on FP through OPP

In Table 4.81, the result of indirect impact between MP and FP is significant, whereas the indirect impact of CP and FP is insignificant at a 0.05 level. With the evidence provided, this study rejects the Null hypothesis and indicates the impact of mediation between management principle (MP) on financial performance through operational performance, but fails to reject the Null hypothesis indicating no indirect impact of cooperation principle (CP) on financial performance via operational performance.

Table 4.80: Hypothesised relationships (Model 2)

	Hypothesised Relationships	Standardised Estimate	S.E.	C.R.	P-value	Null hypothesis	Interpretation
H4	FP <--- the extent of ISO 9000						
	FP <--- MP	**0.37**	0.138	2.238	**0.025***	Reject	MP has a positive direct impact on FP at p-value 0.05
	FP <--- CP	0.11	0.165	0.749	0.454	Fail to Reject	The positive effect of CP on FP is not found at p-value 0.05
H5	OPP <--- the extent of ISO 9000						
	OPP <--- MP	**0.38**	0.123	2.275	**0.023***	Reject	MP has a positive direct impact on OPP at p-value 0.05
	OPP <--- CP	0.05	0.154	0.331	0.741	Fail to Reject	The positive effect of CP on FP is not found at p-value 0.05

Table 4.81: Direct, indirect and total impact (Model 2)

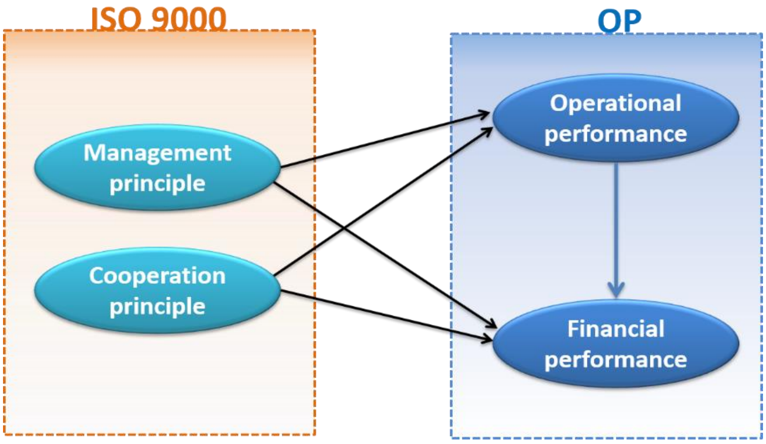
Dependent construct	Independent construct	Direct impact	Indirect impact (H6)	Total impact
FP (R^2=0.42)	MP	**0.37***	***0.12 ****	0.49
	CP	0.11	0.02	0.13

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

4.5.3 Results of Model 3: The extent of ISO 9000 implementation and organisational performance (410 cases of organisations adopting only ISO 9000)

This model examines the causal relationship between the extent of ISO 9000 implementation and organisational performance of organisations that adopted only ISO 9000. EFA and CFA results provide evidence that the extent of ISO 9000 implementation can be explained as a multidimensional construct including two factors as well as organisational performance, as depicted in Figure 4.25.

Figure 4.25: SEM of Model 3



The steps of structural equation modelling (SEM)

Model specification

As shown in Figure 4.26, Model 3 consists of four constructs. Each construct has been tested for validity of the indicator variables (see section 4.4.2). These four constructs are measured by using indicators (see section 3.2.2), which constitute the measurement model section. Each indicator has its related error term.

Model identification

As shown in Figure 4.26 with *eight* observed variables (the extent of ISO 9000 implementation construct), *four* observed variables (operational performance construct) and *two* observed variables (financial performance construct), the number of observed (measured) variables = 8+4+2= 14. Therefore, the number of elements in a correlation matrix = [14(14+1)]/2 = 105. The number of parameters in the model to be estimated = 35 (15 regression weights, 2 covariances and 18 variances), thereby the number of degrees of freedom is 105-35 = 70, indicating it is over-identified.

Figure 4.26: The relationship between the extent of ISO 9000 implementation and OP (Model 3)

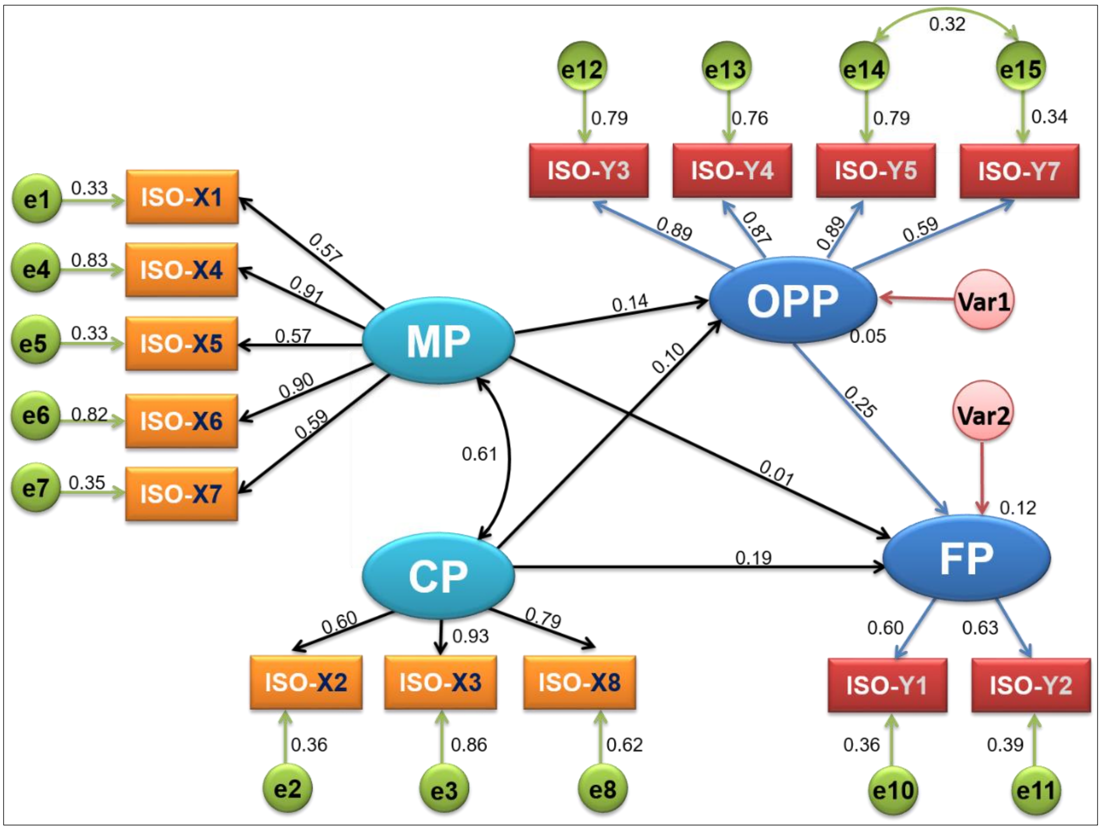


Figure 4.27: Selected AMOS output for Model 3: Model summary

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	105
Number of distinct parameters to be estimated:	35
Degrees of freedom (105 - 35):	70

Result (Default model)

Minimum was achieved
Chi-square = 163.017
Degrees of freedom = 70
Probability level = .000

Table 4.82: Parameter Summary (Model 3)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	20	0	0	0	0	20
Labelled	0	0	0	0	0	0
Unlabelled	***15***	***2***	***18***	***0***	***0***	***35***
Total	35	2	18	0	0	55

In this model, all assumptions met SEM requirements, such as sample size, multicollinearity, and missing data. Multivariate normality is discussed next.

Multivariate normality

The normality of each variable has been tested as in the previous chapter, indicating the data come from a normal distribution (see section 4.1) as well as the result from AMOS's output in Table 4.83. For multivariate normality in particular, the z-statistic of 11.501 (more than 5.00), as shown in Table 4.83, might not be suggestive of normality in the sample (Byrne, 2010). However, the Mardia's coefficient (24.043) is less than the value obtained from the formula p(p+2) = 14(14+2), supporting the idea the data are deemed as multivariate normal (Khine, 2013). Therefore, it is confirmed that there is a multivariate normal distribution of the data, which can employ the maximum likelihood (ML) estimation method in further analysis.

Table 4.83: Output of assessment of normality

Variable	min	max	skew	CR	Kurtosis	CR
ISO_X8	2.000	7.000	-.357	-2.949	-.632	-2.614
ISO_X1	2.000	7.000	-.030	-.246	-.563	-2.325
ISO_X4	2.000	7.000	.221	1.823	-.331	-1.368
ISO_X5	2.000	7.000	.068	.565	-.795	-3.286
ISO_X6	2.000	7.000	-.092	-.757	-.617	-2.550
ISO_X7	2.000	7.000	-.018	-.153	-.656	-2.712
ISO_X2	2.000	7.000	-.345	-2.850	-.201	-.832
ISO_X3	2.000	7.000	-.133	-1.102	-.676	-2.792
ISO_Y1	3.000	7.000	-.272	-2.245	-.483	-1.998
ISO_Y2	2.000	7.000	-.316	-2.608	-.298	-1.232
ISO_Y7	2.000	7.000	-.176	-1.458	-.535	-2.213
ISO_Y5	2.000	7.000	.120	.991	-.673	-2.781
ISO_Y4	2.000	7.000	-.016	-.134	-.828	-3.423
ISO_Y3	2.000	7.000	-.157	-1.298	-.550	-2.274
Multivariate					***24.043***	***11.501***

Model estimation

In this step, the data for the model are entered into the AMOS program by using ML estimation.

Model evaluation

As depicted in Figure 4.27, the evaluation yielded a $\chi 2$ value of 163.017, with 70 degrees of freedom and a probability of less than 0.000 ($p < 0.05$), thereby suggesting that the fit of the data to the hypothesised model is not entirely adequate (Byrne, 2010). However, as per the limitations of $\chi 2$ (see section 3.3.4.1.4), the other goodness-of-fit (GOF) indices need to be considered.

The outputs of GOF indices are presented in Table 4.84. GFI = 0.945 which is more than 0.90, which is considered an acceptable value (Hair et al., 2010). RMSEA is 0.057, which is below 0.08 and indicates a reasonable error of approximation in the population (MacCallum et al., 1996). RMR shows 0.053, which is below 0.08 and is an acceptable level of fit (Hooper et al., 2008). In incremental fit indices, a NFI value of 0.943 exceeds 0.90, the value Hooper et al. (2008) suggested. The CFI (0.966) indicates that the model fits the data well in the sense that the hypothesised model adequately explained the sample data (Bentler, 1992; Byrne, 2010). TLI = 0.956, which fits the data well (Hair et al., 2010). The next set of fit statistics is model parsimony. An AGFI value of 0.917 suggest an adequate fitting model with a value more than 0.85 (Hair et al., 2006). Chi-square/df shows 2.329 (below 5), which is indicative of a good fit (Wheaton et al., 1977).

Table 4.84: Model fit summary (Model 3)

Measures	Recommended	Output
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.945
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.057
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.053
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.943
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.966
Tucker-Lewis index (TLI)	Above 0.90 (Hair et al., 2010)	0.956
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.917
Chi-square /df	Below 5.00 (Wheaton et al., 1977)	2.329

Both the unstandardised and standardised factor loadings are shown in Table 4.85. In considering the structural parameter estimates for Model 3, it is highlighted that four parameters are not significant at a 95% confidence level (P >0.05); these parameters represent the paths from management principle to operational performance (P =0.056), from cooperation principle to operational performance (P =0.151), management principle to financial performance (P =0.904), and cooperation principle to financial performance (P =0.053). Other regression paths and factor loadings are significant and no standardised parameter estimate is greater than 1. In addition, all variances and covariances show nonzero (p <0.05) and no negative variances. Squared multiple correlation (R^2) for the endogenous variables are as follows: operational performance (0.05) and financial performance (0.12). With the information given (Tables 4.84 and 4.85), the Model 3 fits the data well as the goodness-of-fit (GOF) indices and individual parameters met the requirements.

Table 4.85: Selected AMOS Output (Model 3)

			Unstd.	**Std.**	**S.E.**	**C.R.**	**P**
Regression weights							
OOP	<---	MP	.221	.137	.116	1.912	**.056**
OOP	<---	CP	.170	.104	.118	1.437	**.151**
FP	<---	MP	.010	.011	.080	0.121	**.904**
FP	<---	CP	.166	.188	.086	1.934	**.053**
FP	<---	OOP	.135	.251	.043	3.164	.002
ISO_Y3	<---	OOP	1.000	.888			
ISO_Y4	<---	OOP	1.018	.872	.043	23.583	***

			Unstd.	Std.	S.E.	C.R.	P
ISO_Y5	<---	OOP	1.028	.890	.042	24.226	***
ISO_Y2	<---	FP	1.078	.625	.295	3.661	***
ISO_Y1	<---	FP	1.000	.597			
ISO_Y7	<---	OOP	.626	.587	.050	12.609	***
ISO_X3	<---	CP	1.642	.926	.131	12.518	***
ISO_X2	<---	CP	1.000	.599			
ISO_X7	<---	MP	1.103	.588	.113	9.724	***
ISO_X6	<---	MP	1.456	.905	.115	12.664	***
ISO_X5	<---	MP	.948	.574	.099	9.549	***
ISO_X4	<---	MP	1.528	.913	.120	12.702	***
ISO_X1	<---	MP	1.000	.572			
ISO_X8	<---	CP	1.496	.787	.123	12.201	***
Variances							
MP			.439		.072	6.094	***
CP			.428		.068	6.321	***
Var1			1.095		.099	11.057	***
Var2			.293		.092	3.197	.001
e12			.309		.035	8.848	***
e13			.376		.039	9.694	***
e14			.320		.037	8.734	***
e15			.857		.065	13.265	***
e11			.603		.113	5.344	***
e10			.601		.099	6.053	***
e3			.192		.051	3.785	***
e2			.762		.058	13.199	***
e7			1.009		.074	13.635	***
e6			.207		.027	7.598	***
e5			.804		.059	13.684	***
e4			.204		.029	7.037	***
e1			.904		.066	13.691	***
e8			.587		.059	10.030	***
Covariances							
MP	<-->	CP	.265		.038	6.933	***
e14	<-->	e15	.166		.037	4.522	***

Note: Unstd: unstandardised regression estimates, Std: standardised regression estimates (factor loadings), SE: standard error, CR: Critical Ratio, P: probability, customer focus (ISO-X1), leadership (ISO-X2), involvement of people (ISO-X3), process approach (ISO-X4), system approach to management (ISO-X5), continual improvement (ISO-X6), factual approach to decision-making (ISO-X7) and mutually beneficial supplier relationships (ISO-X8), sales (ISO-Y1), ROA (ISO-Y2), total costs (ISO-Y3), product/service quality (ISO-Y4), delivery reliability (ISO-Y5), and process effectiveness (ISO-Y7)

Model modification and validation

Table 4.86 shows the values of EVCI, BIC and AIC. It can be seen that the default model (hypothesised model) has the smallest values of these three indices and is the most stable in the population (Schumacker & Lomax, 2010). In addition, it can be seen that the results from ML (see Table 4.85) and from bootstrap (see Table 4.87) are similar. The values of bias provide evidence that the difference between ML results and bootstrap is very small, which indicates that they are stable estimates of the whole population.

Table 4.86: EVCI, BIC and AIC values (Model 3)

Models	**ECVI**	**BIC**	**AIC**
Default model	.488	373.583	210.000
Saturated model	.513	631.697	233.017
Independence model	6.655	2949.359	2893.132

Table 4.87: Bootstrap results (Model 3)

Parameter			**Estimate**	**SE**	**Bias**	**P**
OOP	<---	MP	.137	.070	-.002	**.051**
OOP	<---	CP	.104	.074	-.001	**.152**
FP	<---	MP	.011	.103	-.003	**.942**
FP	<---	CP	.188	.106	-.002	**.090**
FP	<---	OOP	.251	.080	-.012	.007
ISO_Y3	<---	OOP	.888	.019	.000	.002
ISO_Y4	<---	OOP	.872	.023	.001	.002
ISO_Y5	<---	OOP	.890	.020	-.001	.002
ISO_Y2	<---	FP	.625	.137	.000	.002
ISO_Y1	<---	FP	.597	.153	.022	.002
ISO_Y7	<---	OOP	.587	.044	-.001	.002
ISO_X3	<---	CP	.926	.021	.000	.002
ISO_X2	<---	CP	.599	.053	-.001	.002
ISO_X7	<---	MP	.588	.045	-.002	.002
ISO_X6	<---	MP	.905	.017	.000	.002
ISO_X5	<---	MP	.574	.048	.002	.002
ISO_X4	<---	MP	.913	.014	-.001	.002
ISO_X1	<---	MP	.572	.041	.000	.002
ISO_X8	<---	CP	.787	.032	.000	.002

Hypothesis testing (Model 3)

It is hypothesised that the extent of ISO 9000 implementation positively impacts on financial and operational performance, as indicated in H7 and H8 respectively. However, as the results of EFA and CFA found the extent of ISO 9000 implementation and organisational performance are multidimensional, then the hypotheses have been modified, as follows:

Hypothesis 7a: Management principle (MP) has a positive impact on FP

Hypothesis 7b: Cooperation principle (CP) has a positive impact on FP

Hypothesis 8a: Management principle (MP) has a positive impact on OPP

Hypothesis 8b: Cooperation principle (CP) has a positive impact on OPP

Path coefficients and related p-value are used to examine the impact of MP and CP on OPP and FP. As presented in Table 4.88, the results reveal no independent construct (MP and CP) has a direct positive impact on FP and OPP. Therefore, this study fails to reject the Null hypotheses because there is no evidence to indicate the positive impact of MP and CP on FP and OPP at a 0.05 significant level.

It is also hypothesised that the extent of ISO 9000 implementation (MP and CP) indirectly impacts on financial performance (FP) through operational performance (OPP), as indicated in H9. However, as discussed in the results of EFA and CFA, the hypothesis has been modified as follows:

Hypothesis 9a: Management principle (MP) has an indirect impact on FP through OPP

Hypothesis 9b: Cooperation principle (CP) has an indirect impact on FP through OPP

As presented in Table 4.89, the results report that the indirect impacts of both MP and CP on FP through OPP are not significant. With the evidence provided, this study fails to reject the Null hypotheses because there is no evidence to indicate the positive impact of MP and CP on FP though OPP

Table 4.88: Hypothesised relationships (Model 3)

	Hypothesised relationships	Standardised estimate	S.E.	C.R.	P-value	Null hypothesis	Interpretation
H7	FP <--- the extent of ISO 9000						
	FP <--- MP	0.01	0.080	0.121	0.904	Fail to Reject	The positive effect of MP on FP is not found at p-value 0.05
	FP <--- CP	0.19	0.086	1.934	0.053	Fail to Reject	The positive effect of MP on FP is not found at p-value 0.05
H8	OPP <--- the extent of ISO 9000						
	OPP <--- MP	0.14	0.116	1.912	0.056	Fail to Reject	The positive effect of MP on OPP is not found at p-value 0.05
	OPP <--- CP	0.10	0.118	1.437	0.151	Fail to Reject	The positive effect of CP on OPP is not found at p-value 0.05

Table 4.89: Direct, indirect and total impact (Model 3)

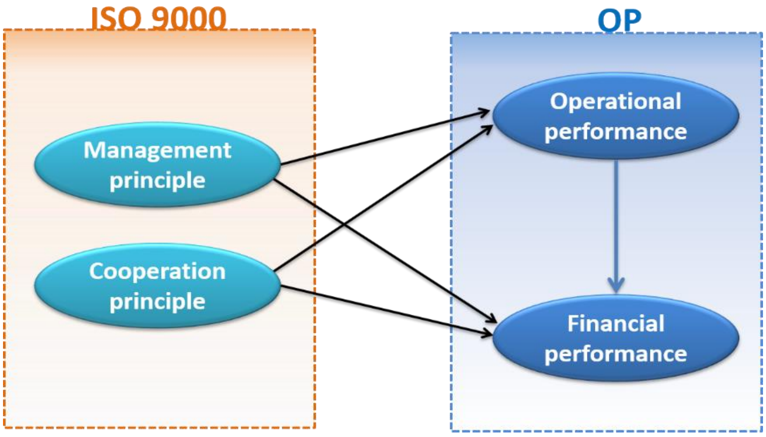
Dependent construct	Independent construct	Direct impact	Indirect impact (H9)	Total impact
FP (R^2=0.12)	MP	0.01	0.03	0.04
	CP	0.19	0.03	0.22

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

4.5.4 Results of Model 4: The extent of ISO 9000 implementation and organisational performance model (601 cases of all respondents)

This model investigates the causal relationship between the extent of ISO 9000 implementation and organisational performance of all organisations studied. EFA and CFA results provide evidence of the extent to which ISO 9000 implementation can be explained as a multidimensional construct as well as organisational performance; which can be explained by two constructs, as shown in Figure 4.28.

Figure 4.28: SEM of Model 4



The steps of structural equation modelling (SEM)

Model specification

As shown in Figure 4.29, Model 4 consists of four constructs. Each construct has been tested for validity of the indicator variables (see section 4.4.2). These four constructs are measured by using indicators (see section 3.2.2), which constitute the measurement model section. Each indicator has its related error term.

Model identification

As presented in Figure 4.29 with *eight* observed variables (the extent of ISO 9000 implementation construct), *four* observed variables (operational performance construct), and *two* observed variables (financial performance construct), the number of observed (measured) variables = 8+4+2= 14. Then, the number of elements in a correlation matrix = [14(14+1)]/2 = 105, and the number of parameters in the model to be estimated = 34 (15 regression weights, 1 covariances and 18 variances), thereby the number of degrees of freedom is 105-34 = 71, indicating it is over-identified.

Figure 4.29: The relationship between the extent of ISO 9000 implementation and OP (Model 4)

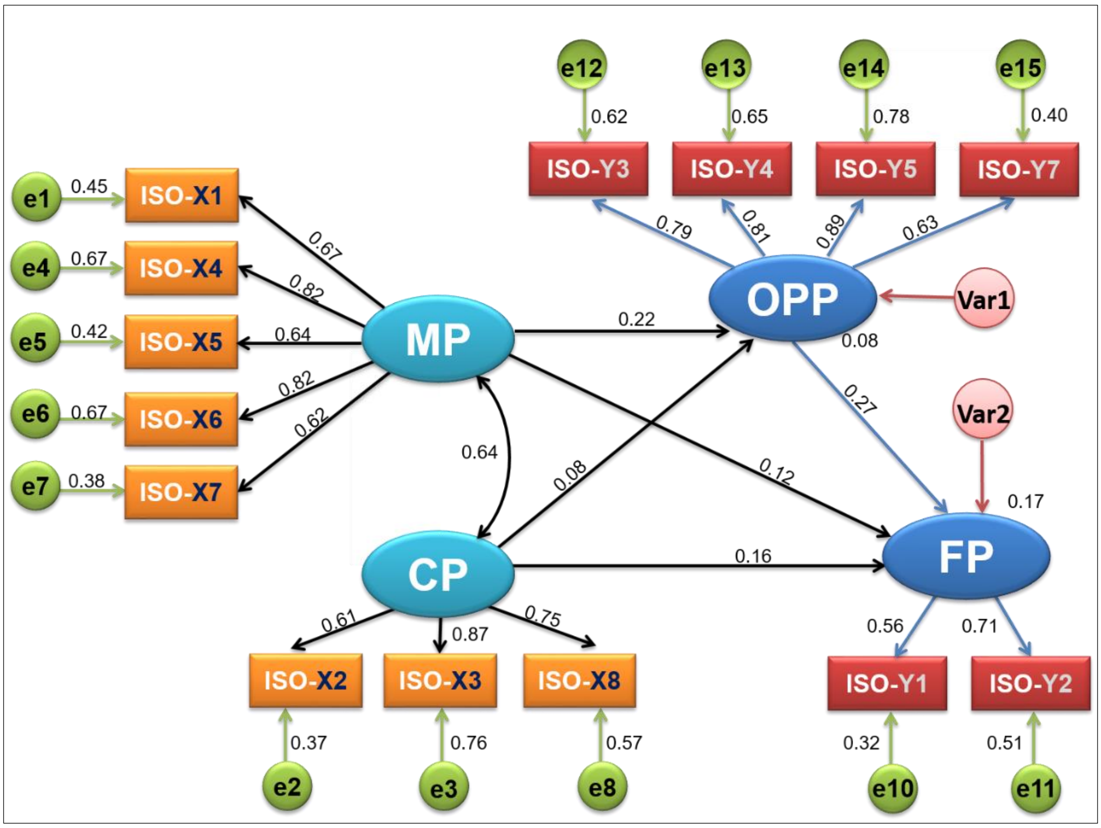


Figure 4.30: Selected AMOS Output for Model 4: Model Summary

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	105
Number of distinct parameters to be estimated:	34
Degrees of freedom (105 - 34):	71

Result (Default model)

Minimum was achieved
Chi-square = 165.829
Degrees of freedom = 71
Probability level = .000

Table 4.90: Parameter summary (Model 4)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	20	0	0	0	0	20
Labelled	0	0	0	0	0	0
Unlabelled	***15***	***1***	***18***	***0***	***0***	***34***
Total	35	1	18	0	0	54

In this model, all assumptions met SEM requirements such as sample size, multicollinearity, and missing data. Multivariate normality is discussed next.

Multivariate normality

The normality of each variable has been tested in the previous chapter indicating the data come from a normal distribution (see section 4.1) as well as the AMOS's results in Table 4.90. For multivariate normality in particular, as shown in Table 4.91, the z-statistic of 10.279 (more than 5.00) might not be suggestive of normality in the sample (Byrne, 2010). However, the Mardia's coefficient (17.749) is less than the value obtained from the formula p(p+2) = 14(14+2), supporting the idea the data are deemed as multivariate normal (Khine, 2013). Therefore, it can be confirmed that there is a multivariate normal distribution of the data, which is appropriate to apply the maximum likelihood (ML) estimation method in further analysis.

Table 4.91: Output of assessment of normality

Variable	min	max	skew	CR	kurtosis	CR
ISO_X8	2.000	7.000	-.331	-3.308	-.596	-2.982
ISO_X1	2.000	7.000	-.169	-1.696	-.594	-2.971
ISO_X4	2.000	7.000	.082	.819	-.620	-3.101
ISO_X5	2.000	7.000	-.102	-1.021	-.731	-3.659
ISO_X6	2.000	7.000	-.143	-1.427	-.573	-2.870
ISO_X7	2.000	7.000	-.067	-.673	-.658	-3.292
ISO_X2	2.000	7.000	-.347	-3.474	-.122	-.611
ISO_X3	2.000	7.000	-.214	-2.144	-.617	-3.088
ISO_Y1	3.000	7.000	-.184	-1.838	-.556	-2.782
ISO_Y2	2.000	7.000	-.264	-2.645	-.213	-1.066
ISO_Y7	2.000	7.000	-.121	-1.212	-.434	-2.171
ISO_Y5	2.000	7.000	.014	.145	-.535	-2.677
ISO_Y4	2.000	7.000	-.116	-1.160	-.722	-3.613
ISO_Y3	2.000	7.000	-.123	-1.232	-.314	-1.571
Multivariate					***17.749***	***10.279***

Model estimation

The data for the model are entered into the AMOS program by using ML estimation.

Model evaluation

The model-fit criteria, as presented in Figure 4.30, yielded a $\chi 2$ value of 165.829, with 71 degrees of freedom and a probability of less than 0.000 ($p < 0.05$), thereby indicating that the fit of the data to the hypothesised model is not entirely sufficient (Byrne, 2010). However, because of the limitations of $\chi 2$ (see Section 3.3.4.1.4), the goodness-of-fit (GOF) indices must be considered.

The outputs of GOF indices are presented in Table 4.92. GFI = 0.963, above 0.90, is considered as an acceptable value (Hair et al., 2010). An RMSEA is 0.047, which is below 0.08 and indicates a reasonable error of approximation in the population (MacCallum et al., 1996). RMR shows 0.041, which is below 0.08 and indicates an acceptable level of fit (Hooper et al., 2008). In incremental fit indices, a NFI value of 0.951 exceeds 0.90 as Hooper et al. (2008) suggested. The CFI (0.971) indicates that the model fits the data well in the sense that the hypothesised model adequately explains the sample data (Bentler, 1992; Byrne, 2010). TLI = 0.963 which fits the data well, as (Hair et al., 2010) suggested. The next set of fit statistics is model parsimony. An AGFI value of 0.945 is an adequate fitting model as it is more than 0.85, the number Hair et al. (2006) indicated. Chi-square shows 2.336 (below 5), which is indicative of good fit (Wheaton et al., 1977).

Table 4.92: Model fit summary (Model 4)

Measures	Recommended	Output
Goodness-of fit statistic (GFI)	Above 0.90 (Hair et al., 2010)	0.963
The root mean square error of approximation (RMSEA)	Below 0.08 (MacCallum et al., 1996)	0.047
The root mean square residual (RMR)	Below 0.08 (Hooper et al., 2008)	0.041
Normed fit index (NFI)	Above 0.90 (Hooper et al., 2008)	0.951
Comparative fit index (CFI)	Above 0.90 (Bentler, 1992)	0.971
Tucker-Lewis index (TLI)	Above 0.90 (Hair et al., 2010)	0.963
The adjusted goodness-of-fit statistic (AGFI)	Above 0.85 (Hair et al., 2006)	0.945
Chi-square /df	Below 5.00 (Wheaton et al., 1977)	2.336

Both the unstandardised and standardised factor loadings are shown in Table 4.93. In reviewing the structural parameter estimates for Model 4, it is highlighted that there are three parameters that are not significant at a 95% confidence level ($P>0.05$); these parameters represent the paths from cooperation principle to operational performance ($P = 0.218$), from management principle to financial performance ($P = 0.128$), and from cooperation principle to financial performance ($P=0.053$).

Other regression paths and factor loadings are significant and no standardised parameter estimate exists greater than the value of 1. In addition, all variances and covariances show nonzero ($p<0.05$) and no negative variances. Squared multiple correlation (R^2) for the endogenous variables are as follows: operational performance (0.08) and financial performance (0.17). With the information given (Tables 4.92 and 4.93), the Model 4 fits the data well as the goodness-of-fit (GOF) indices and individual parameters met the requirements.

Table 4.93: Selected AMOS Output (Model 4)

			Unstd.	**Std.**	**S.E.**	**C.R.**	**P**
Regression weights							
OPP	<---	MP	.247	.217	.075	3.284	.001
OPP	<---	CP	.111	.081	.090	1.233	**.218**
FP	<---	MP	.085	.123	.056	1.523	**.128**
FP	<---	CP	.132	.158	.068	1.932	**.053**
FP	<---	OPP	.166	.271	.040	4.111	***
ISO_Y3	<---	OPP	1.000	.790			
ISO_Y4	<---	OPP	1.086	.808	.052	20.790	***
ISO_Y5	<---	OPP	1.158	.886	.052	22.435	***
ISO_Y2	<---	FP	1.279	.713	.231	5.544	***
ISO_Y1	<---	FP	1.000	.563			
ISO_Y7	<---	OPP	.784	.631	.050	15.581	***
ISO_X3	<---	CP	1.540	.872	.107	14.457	***
ISO_X2	<---	CP	1.000	.611			
ISO_X7	<---	MP	.982	.616	.074	13.274	***
ISO_X6	<---	MP	1.149	.821	.068	16.788	***
ISO_X5	<---	MP	.897	.645	.065	13.819	***
ISO_X4	<---	MP	1.246	.819	.074	16.764	***
ISO_X1	<---	MP	1.000	.669			
ISO_X8	<---	CP	1.440	.752	.103	13.978	***
Variances							
MP			.612		.070	8.743	***
CP			.422		.055	7.644	***

			Unstd.	Std.	S.E.	C.R.	P
Var1			.729		.066	10.966	***
Var2			.244		.053	4.609	***
e12			.475		.036	13.369	***
e13			.494		.039	12.768	***
e14			.290		.033	8.861	***
e15			.734		.046	15.839	***
e11			.468		.089	5.256	***
e10			.635		.064	9.999	***
e3			.315		.046	6.865	***
e2			.707		.046	15.310	***
e7			.968		.061	15.744	***
e6			.392		.033	11.836	***
e5			.693		.045	15.480	***
e4			.467		.039	11.904	***
e1			.757		.050	15.221	***
e8			.672		.055	12.305	***
Covariances							
MP	<-->	CP	.326		.037	8.861	***

Note: Unstd: unstandardised regression estimates, Std: standardised regression estimates (factor loadings), SE: standard error, CR: Critical Ratio, P: probability, customer focus (ISO-X1), leadership (ISO-X2), involvement of people (ISO-X3), process approach (ISO-X4), system approach to management (ISO-X5), continual improvement (ISO-X6), factual approach to decision-making (ISO-X7) and mutually beneficial supplier relationships (ISO-X8), sales (ISO-Y1), ROA (ISO-Y2), total costs (ISO-Y3), product/service quality (ISO-Y4), delivery reliability (ISO-Y5), and process effectiveness (ISO-Y7)

Model modification and validation

Table 4.94 shows the values of EVCI, BIC and AIC. It can be seen that the default model (hypothesised model) has the smallest values of these three indexes and it is the most stable in the population (Schumacker & Lomax, 2010). In addition, it can be seen that the results from ML (see Table 4.93) and from bootstrap (see Table 4.95) are similar. The values of bias provide evidence that the difference between ML results and bootstrap is very small, which indicates they are stable estimates of the whole population.

Table 4.94: EVCI, BIC and AIC values (Model 4)

Models	**ECVI**	**BIC**	**AIC**
Default model	.350	383.381	210.000
Saturated model	.390	671.852	233.829
Independence model	5.700	3481.369	3419.789

Table 4.95: Bootstrap results (Model 4)

Parameter			**Estimate**	**SE**	**Bias**	**P**
OOP	<---	MP	.217	.063	.000	.003
OOP	<---	CP	.081	.065	-.001	**.218**
FP	<---	MP	.123	.090	-.004	**.186**
FP	<---	CP	.158	.090	.004	**.070**
FP	<---	OOP	.271	.062	-.001	.002
ISO_Y3	<---	OOP	.790	.023	-.001	.002
ISO_Y4	<---	OOP	.808	.027	.000	.002
ISO_Y5	<---	OOP	.886	.019	.000	.002
ISO_Y2	<---	FP	.713	.082	.002	.002
ISO_Y1	<---	FP	.563	.071	.004	.002
ISO_Y7	<---	OOP	.631	.036	-.001	.002
ISO_X3	<---	CP	.872	.022	.000	.002
ISO_X2	<---	CP	.611	.042	-.003	.002
ISO_X7	<---	MP	.616	.032	.000	.002
ISO_X6	<---	MP	.821	.021	.002	.002
ISO_X5	<---	MP	.645	.035	-.001	.002
ISO_X4	<---	MP	.819	.021	.000	.002
ISO_X1	<---	MP	.669	.032	-.001	.002
ISO_X8	<---	CP	.752	.026	.001	.002

Hypothesis testing (Model 4)

It is hypothesised that the extent of ISO 9000 implementation positively impacts on financial and operational performance, as indicated in H10 and H11, respectively. However, as the results of EFA and CFA found the extent of ISO 9000 implementation and organisational performance to be multidimensional, the hypotheses have been modified, as follows:

Hypothesis 10a: Management principle (MP) has a positive impact on FP

Hypothesis 10b: Cooperation principle (CP) has a positive impact on FP

Hypothesis 11a: Management principle (MP) has a positive impact on OPP

Hypothesis 11b: Cooperation principle (CP) has a positive impact on OPP

Path coefficients and related p-value are used to examine the impact of MP and CP on OPP and FP. As presented in Table 4.96, the results reveal no independent construct (both MP and CP) has a direct positive impact on FP ($P > 0.05$). Therefore, this study fails to reject the Null hypotheses (10a, 10b) as there is no evidence to indicate the positive impact of MP and CP on FP.

On the other hand, the path coefficient between MP and OPP is highly significant (p-value ≤ 0.001). With significant p-value, the Null hypothesis (11a) is rejected and it can be implied that MP has a positive impact on OPP. However, this study fails to reject all the Null hypotheses (11b) as there is no evidence to indicate the positive impact of CP on OPP.

It is also hypothesised that the extent of ISO 9000 implementation indirectly impacts on financial performance (FP) through operational performance (OPP), as indicated in H12. However, as discussed in the results of EFA and CFA, the hypothesis has been modified as follows:

Hypothesis 12a: Management principle (MP) has an indirect impact on FP through OPP

Hypothesis 12b: Cooperation principle (CP) has an indirect impact on FP through OPP

As presented in Table 4.97, the results report that MP has an indirect impact on FP though OPP (p-value ≤ 0.001). In terms of MP and FP, this indirect impact increases the standardised coefficient from 0.12 to 0.18. On the other hand, the indirect impact of CP on FP through OPP is insignificant. With the information provided, this study rejects the Null hypothesis 12a and indicates that MP has an indirect impact on FP though OPP. Conversely, it fails to reject the Null hypothesis 12b, because there is no evidence to indicate the positive impact of CP on FP though OPP.

Table 4.96: Hypothesised relationships (Model 4)

	Hypothesised relationships	Standardised estimate	S.E.	C.R.	P-value	Null hypothesis	Interpretation
H 10	FP <--- the extent of ISO 9000						
	FP <--- MP	0.12	0.056	1.523	0.128	Fail to Reject	The positive effect of MP on FP is not found at p-value 0.05
	FP <--- CP	0.16	0.068	1.932	0.053	Fail to Reject	The positive effect of CP on FP is not found at p-value 0.05
H 11	OPP <--- the extent of ISO 9000						
	OPP <--- MP	**0.22**	0.075	3.284	**0.001*** **	Reject	MP has a positive direct impact on OPP at p-value 0.05
	OPP <--- CP	0.08	0.090	1.233	0.218	Fail to Reject	The positive effect of CP on OPP is not found at p-value 0.05

Table 4.97: Direct, indirect and total impact (Model 4)

Dependent construct	Independent construct	Direct impact	Indirect impact (H12)	Total impact
FP (R^2=0.18)	MP	0.12	**0.06*** **	0.18
	CP	0.16	0.02	0.18

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

4.6 The results of multi-group analysis

The study investigates whether there are significant differences in the organisational performance of organisations that adopted both ABC and ISO (Model 2) as compared with organisations that adopted only ISO 9001 (Model 3) in order to determine whether there is a synergy impact on financial performance and operational performance. Multi-group analysis has been employed in order to discover whether any paths are equivalent across the two models (see section 4.6.1)

In addition, some factors might moderate the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance such as type of business, size of business, age of ABC, age of ISO 9000, and frequency of ABC use. Therefore, the moderating variables effects have been tested using multi-group analysis in order to find out which moderating variable moderate the impact on financial performance and operational performance as Baron and Kenny (1986) suggested (see section 4.6.2).

4.6.1 Testing the significant differences in Model 2 as compared with Model 3

The impact on organisational performance (OP) might differ depending on the employment of ABC and ISO 9000. Two groups are specified: the first comprises organisations that employed both ABC and ISO 9000 (Model 2); and the latter comprises organisations that employed only ISO 9000 (Model 3). This study tests for the equivalence of a causal structure involving the impact of the extent of ISO 9000 implementation on financial performance (FP) and operational performance (OPP) across Model 2 and Model 3. The total sample of Model 2 is 191 cases and Model 3 includes 410 cases. Null hypothesis (H_{Null}), $\Sigma_1 = \Sigma_2$ where Σ_1 is the population variance-covariance matrix of Model 2 and Σ_2 is the population variance-covariance matrix of Model 3.

Before testing the hypothesis, the model fit needs to be examined (Byrne, 2004). Tables 4.98 and 4.99 show the configural models with the $\chi 2$ value = 316.680, CFI 0.951 and CMIN/DF = 2.230, representing a good fit across the two groups. With the automated multi-group approach, Models A and B are generated. In Table 4.98, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of

49.055 with 15 degrees of freedom. The value of the $\chi 2$ difference is significant ($P < 0.05$). It means one or more path coefficients are equivalent across the two models. In addition, on Table 4.99, the ΔCFI value between Model B and the unconstrained model yields a difference of -0.01, which is equal to the cut off value of -0.01, as evidence of non-invariance (Cheung & Rensvold, 2002). Regarding the results, this study tests further in the next step, as shown in Table 4.101.

Table 4.98: Goodness-of-fit measures of the two models

Model	NPAR	CMIN	DF	P	CMIN/DF
Unconstrained (configural model)	68	316.680	142	.000	2.230
Measurement weights (Model A)	58	343.528	152	.000	2.260
Structural weights (Model B)	53	365.735	157	.000	2.330

Table 4.99: Baseline comparisons of the two models

Model	NFI	RFI	IFI	TLI	CFI
Unconstrained (configural model)	.915	.891	.951	.937	.951
Measurement weights (Model A)	.908	.890	.947	.936	.946
Structural weights (Model B)	.902	.887	.942	.932	.941

In Table 4.101, in the measurement model, the $\Delta\chi 2$ value between Model A1 and the unconstrained model yields a difference of 26.848 with 10 degrees of freedom. The value of $\chi 2$ difference is significant ($P < 0.05$). This means one or more factor loadings of the four constructs (MP, CP, OPP and FP) is not identifying equivalently across the two models. As a result, only the MP construct is constrained equally, as shown in Model A2. The $\Delta\chi 2$ value between Model A2 and the unconstrained model yields a difference of 14.759 with 4 degrees of freedom. The value of $\chi 2$ difference is significant ($P < 0.05$). Then, each indicator measuring MP is tested by constraining it equally, as shown in Models A3, A4, A5, and A6. Only Model A3 is significant with a $\Delta\ \chi 2$ value of 8.918 ($P < 0.05$), which indicates that factor loading ISO-X4 (process approach) is operating somewhat differently in measurement for organisations that adopted both ISO and ABC, and organisations that adopted only ISO 9000. In Model A7, only the CP construct is constrained equally. The value of

$\chi 2$ difference of 6.170 ($P > 0.05$) is not significant. Similarly, as with Model A8, the OPP and FP constructs are constrained equally. The $\Delta\chi 2$ difference of 5.988 ($P > 0.05$) is not significant. These results identify equivalently across the two groups of all factors of the CP, OPP, and FP constructs.

In the structural model (Model B), all factor loadings from each construct to its indicators (except ISO-X4) are constrained equally. Model B1 constrains the paths from MP to OPP and CP to OPP, a $\Delta\ \chi 2$ value of 19.828 ($P < 0.05$), which is statistically significant. It indicates that one or more path coefficients are not equivalent across the two models. Similarly Models B2 and B3, results indicate that the paths from MP to OPP and CP to OPP across the two models operate differently. Similarly, in Model B4, all factor loadings (except ISO-X4) and the paths from MP to FP and CP to FP are constrained equally, a $\Delta\ \chi 2$ value of 38.266 ($P < 0.05$), which is statistically significant. It means one or more path coefficients are not equivalent across the two models. With the results of Models B5 and B6, the paths from MP to FP and CP to FP across the two models operate differently.

In the current study, it is hypothesised that there are significant differences between Models 2 and 3, as presented in hypothesis 13.

H13: there are significant differences between organisations that adopted both ABC and ISO 9000 (Model 2) and organisations with only ISO 9000 (Model 3).

With the statistical evidence, this study rejects the Null hypothesis and indicates that there are significant differences between the two models. All the different points are included in Table 4.100. Firstly, the factor loading of ISO-X4 on MP of Model 2 (0.63) is less than that of Model 3 (0.91). Secondly, in Model 2, MP has direct impact on both FP and OPP, whereas there is no significant direct impact of either MP or CP on either FP or OPP at 0.05 level in Model 3. However, in Model 3, CP has direct impact on FP at 0.10 level, while no relationship exists in Model 2. Overall, at a significance level of 0.05, in organisations (in Model 2) that adopted both ABC and ISO 9000, MP has a direct impact on FP and OPP, whereas there was no evidence to indicate that in organisations which adopted only ISO 9000 (in Model 3) MP and CP have any direct impact on either FP or OPP.

Table 4.100: Standardised regression weights and p-values (Model 2 and 3)

The relationships	Model 2		Model 3	
	Std. estimate	p-value	Std. estimate	p-value
MP ---> ISO-X4	0.63	***0.000****	0.91	***0.000****
MP ---> FP	0.37	***0.025****	0.01	0.904
CP ---> FP	0.11	0.454	0.19	0.053
MP ---> OPP	0.38	***0.023****	0.14	0.056
CP ---> OPP	0.05	0.741	0.10	0.151

Note: *** It is significant at the 0.001, ** at the 0.01, *at the 0.05

Table 4.101: Goodness-of-fit statistics for tests of multiple group invariance (Model 2 and 3)

Model description	Comparative model	χ2	df	Δ χ2	Δdf	P-Value	CFI	ΔCFI
Unconstrained (Configural model: *Co model*)	-	316.680	142	-	-	-	0.951	-
Model A; Measurement model								
Model A1; All factor loadings constrained equally	A1 versus *Co model*	343.528	152	26.848	10	***0.003*****	0.946	0.005
Model A2; Factor loadings for only MP constrained equally	A2 versus *Co model*	331.439	146	14.759	4	***0.005*****	0.948	0.003
Model A3; Factor loading of ISO-X4 constrained equally	A3 versus *Co model*	325.598	143	8.918	1	***0.003*****	0.949	0.002
Model A4; Factor loading of ISO-X5 constrained equally	A4 versus *Co model*	316.958	143	0.278	1	0.598	0.951	0.000
Model A5; Factor loading of ISO-X6 constrained equally	A5 versus *Co model*	320.456	143	3.776	1	0.052	0.950	0.001
Model A6; Factor loading of ISO-X7 constrained equally	A6 versus *Co model*	316.724	143	0.044	1	0.834	0.951	0.000
Model A7; Factor loadings for only CP constrained equally	A7 versus *Co model*	322.850	144	6.17	2	0.056	0.950	0.001
Model A8; Factor loadings for only OPP and FP constrained equally	A8 versus *Co model*	322.668	146	5.988	4	0.200	0.950	0.001
Model B; Structural model								
Model B1; factor loadings (except ISO-X4) and paths from MP and CP to OPP constrained equally	B1 versus *Co model*	336.503	153	19.828	11	***0.048****	0.948	0.003
Model B2; factor loadings (except ISO-X4) and path from MP to OPP constrained equally	B2 versus *Co model*	336.501	152	19.821	10	***0.031****	0.948	0.003
Model B3; factor loadings (except ISO-X4) and path from CP to OPP constrained equally	B3 versus *Co model*	336.017	152	19.337	10	***0.036****	0.948	0.003
Model B4; factor loadings (except ISO-X4) and path from MP and CP to FP constrained equally	B4 versus *Co model*	354.946	154	38.266	12	***0.000******	0.943	0.008
Model B5; factor loadings (except ISO-X4) and path from MP to FP constrained equally	B5 versus *Co model*	339.016	152	22.336	10	***0.013****	0.947	0.004
Model B6; factor loadings (except ISO-X4) and path from CP to FP constrained equally	B6 versus *Co model*	335.430	152	18.750	10	***0.044****	0.948	0.003

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

4.6.2 Testing factors moderating the impact of an independent construct on a dependent construct

The last objective of the study was to test the moderating impacts of contingent factors on the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance. Multiple-group analysis was applied in order to find out which moderating variable moderates the direct impact on FP and OPP.

Based on contingency theory and previous studies, the strength of the impact on organisational performance might depend on moderating variables such as type of business, size of business, age of ABC, age of ISO 9000, and frequency of ABC use, as follows.

4.6.2.1 Type of business

This current study proposes the hypotheses that the strength of the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance depends on the type for business.

Model 1

The impact of the extent of ABC use on organisational performance might differ depending on the type of business. The two groups are manufacturing (n=152) and non-manufacturing (n=39). Table 4.102 shows the configural model with the $\chi 2$ value = 183.858, CFI = 0.955 and CMIN/DF = 1.372 representing a good fit across the two groups.

In Table 4.102, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 16.687 with 9 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.007, which is more than the cut off value of -0.01 as evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 19.30 with 16 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.003 which is more than the cut off value of -0.01 and evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups.

Table 4.102: GOF measures of unconstrained and two models (type of business)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	76	183.858	134	.003	1.372	.955
Measurement weights (Model A)	67	200.545	143	.001	1.402	.948
Structural weights (Model B)	60	203.158	150	.003	1.354	.952

Provided with these results, all factor loadings and path coefficients are equivalent across two groups. This current study fails to reject the Null hypothesis and indicates that the extent of ABC use impacts equally on financial performance and operational performance across manufacturing and non-manufacturing.

Model 2

The impact of the extent of ISO 9000 implementation on organisational performance might differ depending on type of business. The two groups are manufacturing (n=152) and non-manufacturing (n=39). Table 4.103 shows the configural model with the $\chi 2$ value = 216.825, CFI = 0.907 and CMIN/DF = 1.527, representing a good fit across two groups.

In Table 4.103, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 7.995 with 10 degrees of freedom. The value of $\chi 2$ difference is not significant (P> 0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.002, which is more than the cut off value of -0.01 and therefore evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 10.73 with 15 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.005, which is more than the cut off value of -0.01 as evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups.

Table 4.103: GOF measures of unconstrained and two models (type of business)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	68	216.825	142	.000	1.527	.907
Measurement weights (Model A)	58	224.820	152	.000	1.479	.909
Structural weights (Model B)	53	227.555	157	.000	1.449	.912

Provided with these results, all factor loadings and path coefficients are equivalent across the two groups. This current study fails to reject the Null hypothesis and indicates that the extent of ISO 9000 implementation impacts equally on financial performance and operational performance across manufacturing and non-manufacturing of organisations that adopted both ABC and ISO 9000.

Model 3

In this model, two groups are manufacturing (n=176) and non-manufacturing (n=234). Table 4.104 shows the configural model with the $\chi 2$ value = 250.420, CFI = 0.961 and CMIN/DF = 1.789 representing a good fit across the two groups.

Table 4.104: GOF measures of unconstrained and two models (type of business)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	70	250.420	140	.000	1.789	.961
Measurement weights (Model A)	60	271.149	150	.000	1.808	.957
Structural weights (Model B)	55	286.568	155	.000	1.849	.954

Table 4.105, in the measurement model, the $\Delta\chi 2$ value between Model A1 and the unconstrained model yields a difference of 20.729 with 10 degrees of freedom. The value of $\chi 2$ difference is significant ($P<0.05$). This means one or more factor loadings of the four constructs (MP, CP, OPP and FP) are not identifying equivalently across the two groups. The $\Delta\chi 2$ value between Model A3 and the unconstrained model yields a difference of 11.883 with 2 degrees of freedom. The

value of the $\chi2$ difference is significant ($P<0.05$). Then, each indicator in measuring CP is tested by constraining it as shown in Model A4, and A5. Both Models A4 and A5 are significant with a $\Delta \chi2$ value of 5.247 and 11.788 ($P<0.05$), which indicates that factor loading ISO-X3 and ISO-X8 are operating somewhat differently in measurement of the construct in manufacturing and in non-manufacturing organisations.

On the other hand, in the structural model, computation of the $\Delta\chi2$ value of Model B1 is not statistically significant ($P>0.05$). It means that all path coefficients are equivalent across the two groups. Then, this study fails to reject the Null hypotheses and indicates that the extent of ISO 9000 implementation impacts equally on financial performance (FP) and operational performance (OPP) across manufacturing and non-manufacturing organisations that adopted only ISO 9000.

Table 4.105: GOF statistics for tests of multiple group invariance (Type of business)

Model description	Comparative model	χ2	Df	Δ χ2	Δdf	P-Value	CFI	ΔCFI
Unconstrained model **(Configural model: *Co model*)**	-	250.420	140	-	-	-	0.961	-
Model A; Measurement model								
Model A1; All factor loadings constrained equally	A1 versus *Co model*	271.149	150	20.729	10	***0.023****	0.957	0.004
Model A2; Factor loadings of MP, OPP and FP constrained equally	A2 versus *Co model*	259.351	148	8.931	8	0.348	0.961	0.000
Model A3; Factor loadings of CP constrained equally	A3 versus *Co model*	262.303	142	11.883	2	***0.003*****	0.958	0.003
Model A4; Factor loading of **ISO-X3** constrained equally	A4 versus *Co model*	255.677	141	5.247	1	***0.022****	0.960	0.001
Model A5; Factor loading of **ISO-X8** constrained equally	A5 versus *Co model*	262.208	141	11.788	1	***0.001*****	0.957	0.004
Model B; Structural model								
Model B1; factor loadings (except ISO-X3 and X8) and paths from MP and CP to OPP and FP constrained equally	B1 versus *Co model*	272.170	153	21.75	13	0.059	0.958	0.003

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

Model 4

Two groups are manufacturing (n=328) and non-manufacturing (n=273). Table 4.106 shows the configural model with the $\chi2$ value = 264.852, CFI = 0.964 and CMIN/DF = 1.865 representing a good fit across two groups.

Table 4.106: GOF measures of unconstrained and two models (type of business)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained	68	264.852	142	.000	1.865	.964
Measurement weights (Model A)	58	284.183	152	.000	1.870	.961
Structural weights (Model B)	53	298.362	157	.000	1.900	.958

In Table 4.107, the measurement model, the $\Delta\chi2$ value between Model A1 and the unconstrained model yields a difference of 19.331 with 10 degrees of freedom. The value of $\chi2$ difference is significant ($P<0.05$). This means one or more factor loadings of four constructs (MP, CP, OPP and FP) are not identifying equivalently across the two groups. As a result, only the CP construct is constrained equally as shown in Model A3. The $\Delta\chi2$ value between Model A3 and the unconstrained model yields a difference of 13.161 with 2 degrees of freedom. The value of $\chi2$ difference is significant ($P<0.05$). Therefore, each indicator in measuring CP is tested by constraining it equally as shown in Models A4 and A5. Both Models A4 and A5 are significant with a $\Delta\chi2$ value of 6.208 and 13.158 ($P<0.05$), which indicate that factor loading ISO-X3 and ISO-X8 are operating somewhat differently in measurement of constructs of manufacturing and non-manufacturing.

On the other hand, in the structural model, computation of the $\Delta\chi2$ value of Model B1 is not statistically significant ($P>0.05$). It means that all path coefficients are equivalent across the two groups. So, this study fails to reject the Null hypotheses and indicates that the extent of ISO 9000 implementation impacts equally on financial performance (FP) and operational performance (OPP) across manufacturing and non-manufacturing groups of all organisations studied.

Table 4.107: GOF statistics for tests of multiple group invariance (Type of business)

Model description	Comparative model	χ2	Df	Δ χ2	Δdf	P-Value	CFI	ΔCFI
Unconstrained **(Configural model: *Co model*)**	-	264.852	142	-	-	-	0.964	-
Model A; Measurement model								
Model A1; All factor loadings constrained equally	A1 versus *Co model*	284.183	152	19.331	10	***0.036****	0.961	0.003
Model A2; Factor loadings of only MP constrained equally	A2 versus *Co model*	267.687	146	2.835	4	0.586	0.964	0.000
Model A3; Factor loadings of only CP constrained equally	A3 versus *Co model*	278.013	144	13.161	2	***0.001******	0.961	0.003
Model A4; Factor loadings of **ISO-X3** constrained equally	A4 versus *Co model*	271.060	143	6.208	1	***0.013****	0.962	0.002
Model A5; Factor loadings of **ISO-X8** constrained equally	A5 versus *Co model*	278.010	143	13.158	1	***0.000******	0.960	0.004
Model A6; Factor loadings of OPP and FP constrained equally	A6 versus *Co model*	268.182	146	3.33	4	0.504	0.964	0.000
Model B; Structural model								
Model B1; factor loadings (except ISO-X3 and X8) and paths from MP and CP to OPP and FP constrained equally	B1 versus *Co model*	284.428	155	19.576	13	0.106	0.962	0.002

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

4.6.2.2 Size of business

This current study proposes hypotheses that the strength of the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance depends on the size of the business.

Model 1

The impact of the extent of ABC use on organisational performance might differ depending on the size of the business. Two groups are small and medium organisations (n=145) and large organisations (n=46). Table 4.108 shows the configural model with the $\chi 2$ value = 184.276, CFI = 0.955 and CMIN/DF = 1.375 representing a good fit across two groups.

In Table 4.108, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 14.703 with 9 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.005, which is more than the value of -0.01 highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 19.727 with 16 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.004, which is more than the value of -0.01 highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups.

Table 4.108: GOF measures of unconstrained and two models (size of business)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	76	184.276	134	.003	1.375	.955
Measurement weights (Model A)	67	198.979	143	.001	1.391	.950
Structural weights (Model B)	60	204.003	150	.002	1.360	.951

Provided with this result, all factor loadings and path coefficients are equivalent across the two groups. This current study fails to reject the Null hypotheses and indicates that the extent of ABC use impacts equally on financial performance and operational performance across small and medium organisations and large organisations.

Model 2

The impact of the extent of ISO 9000 implementation on organisational performance might differ depending on size of business. The two groups are small and medium organisations (n=145) and large organisations (n=46). Table 4.109 shows the configural model with the $\chi 2$ value = 202.355, CFI = 0.923 and CMIN/DF = 1.425 representing a good fit across two groups.

In Table 4.109, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 11.844 with 10 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.003, which is more than the value of -0.01 highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 19.917 with 15 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.004, which is more than the value of -0.01 highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups.

Table 4.109: GOF measures of unconstrained and two models (size of business)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	68	202.355	142	.001	1.425	.923
Measurement weights (Model A)	58	214.199	152	.001	1.409	.920
Structural weights (Model B)	53	220.272	157	.001	1.403	.919

Provided with this result, all factor loadings and path coefficients are equivalent across the two groups. This current study fails to reject the Null hypotheses and indicates that the extent of ISO 9000 implementation use impacts equally on financial performance and operational performance across small and medium organisations and large organisations of organisations that adopted both ABC and ISO 9000.

Model 3

The two groups are small and medium organisations (n=345) and large organisations (n=65). Table 4.110 shows the configural model with the $\chi 2$ value = 238.486, CFI = 0.965 and CMIN/DF = 1.703 representing a good fit across two groups.

Table 4.110: GOF measures of unconstrained and two models (size of business)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	70	238.486	140	.000	1.703	.965
Measurement weights (Model A)	60	260.953	150	.000	1.740	.961
Structural weights (Model B)	55	268.165	155	.000	1.730	.960

In Table 4.111, in the measurement model, the $\Delta\chi 2$ value between Model A1 and the unconstrained model yields a difference of 22.467 with 10 degrees of freedom. The value of $\chi 2$ difference is significant ($P<0.05$). This means one or more factor loadings of four constructs (MP, CP, OPP and FP) are not identifying equivalently across the two groups. As a result, OPP and FP constructs are significant as shown in Models A3 and A6, respectively. The $\Delta\chi 2$ value between Model A3 and the unconstrained model yields a difference of 12.377 with 3 degrees of freedom. The value of $\chi 2$ difference is significant ($P<0.05$). Then, each indicator in measuring OPP is tested by constraining it equally, as shown in Models A4 and A5. Only A5 is significant with a $\Delta\chi 2$ value of 7.438 ($P<0.05$), which indicates that factor loading ISO-Y7 is operating somewhat differently in the measurement of the construct of size of business. In addition, Model A6 provides evidence that ISO-Y2 in measuring FP is not operating equivalently across the two groups. On the other hand, in the structural model, computation of the $\Delta\chi 2$ value of Model B1 is not significant ($P > 0.05$). It means that all path coefficients are equivalent across the two groups.

Regarding the results, this study fails to reject Null hypotheses and indicates that the extent of ISO 9000 implementation use impacts equally on financial performance (FP) and operational performance (OPP) across small and medium organisations and large organisations among organisations that adopted only ISO 9000.

Table 4.111: GOF statistics for tests of multiple group invariance (Size of business)

Model description	Comparative model	χ2	df	Δ χ2	Δdf	P-Value	CFI	ΔCFI
Unconstrained **(Configural model: *Co model*)**	-	238.486	140	-	-	-	0.965	-
Model A; Measurement model								
Model A1; All factor loadings constrained equally	A1 versus *Co model*	260.953	150	22.467	10	***0.013****	0.961	0.004
Model A2; Factor loadings of MP and CP constrained equally	A2 versus *Co model*	243.530	146	5.044	6	0.538	0.965	0.000
Model A3; Factor loadings of OPP constrained equally	A3 versus *Co model*	250.863	143	12.377	3	***0.006*****	0.962	0.003
Model A4; Factor loadings of ISO-Y4 and Y5 constrained equally	A4 versus *Co model*	238.739	142	0.253	2	0.881	0.966	0.001
Model A5; Factor loadings of **ISO-Y7** constrained equally	A5 versus *Co model*	245.924	141	7.438	1	***0.006****	0.963	0.002
Model A6; Factor loadings of **FP** constrained equally	A6 versus *Co model*	243.487	141	5.001	1	***0.025****	0.964	0.001
Model B; Structural model								
Model B1; factor loadings (except ISO-X7 and Y2) and paths from MP and CP to OPP and FP constrained equally	B1 versus *Co model*	253.917	153	15.431	13	0.281	0.964	0.001

Note: ***significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

Model 4

In this model, the two groups are small and medium organisations (n=494) and large organisations (n=107). Table 4.112 shows the configural model with the $\chi2$ value = 230.558, CFI = 0.973 and CMIN/DF = 1.624 representing a good fit across two groups.

Table 4.112: GOF measures of unconstrained and two models (size of business)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	68	230.558	142	.000	1.624	.973
Measurement weights (Model A)	58	258.147	152	.000	1.698	.968
Structural weights (Model B)	53	267.382	157	.000	1.703	.967

In Table 4.113, in the measurement model, the $\Delta\chi2$ value between Model A1 and the unconstrained model yields a difference of 27.589 with 10 degrees of freedom. The value of $\chi2$ difference is significant ($P<0.05$). This means one or more factor loadings of four constructs (MP, CP, OPP and FP) are not identifying equivalently across the two groups.

In the measurement model, computation of the $\Delta\chi2$ values of Models A2-A11 provide evidence that factor loadings of ISO-X5 ($P<0.05$), ISO-X6 ($P<0.05$), ISO-X7 ($P<0.05$), and ISO-Y7 ($P<0.001$) are not operating equivalently across the two groups. On the other hand, in the structural model, computation of the $\Delta\chi2$ value of Model B1 is not statistically significant ($P>0.05$). It means that all path coefficients are equivalent across the two groups.

Therefore, this study fails to reject the Null hypotheses, and indicates that the extent of ISO 9000 implementation use impacts equally on financial performance (FP) and operational performance (OPP) across small and medium organisations and large organisations of all organisations studied.

Table 4.113: GOF statistics for tests of multiple group invariance (Size of business)

Model description	Comparative model	χ2	df	Δ χ2	Δdf	P-Value	CFI	ΔCFI
Unconstrained (Configural model: *Co model*)	-	230.558	142	-	-	-	0.973	-
Model A; Measurement model								
Model A1; All factor loadings constrained equally	A1 versus *Co model*	258.147	152	27.589	10	0.002**	0.967	0.006
Model A2; Factor loadings of only MP constrained equally	A2 versus *Co model*	241.279	146	10.721	4	0.030*	0.971	0.002
Model A3; Factor loading of ISO-X4 constrained equally	A3 versus *Co model*	231.528	143	0.97	1	0.325	0.973	0.000
Model A4; Factor loading of **ISO-X5** constrained equally	A4 versus *Co model*	236.347	143	5.789	1	0.016*	0.972	0.001
Model A5; Factor loading of **ISO-X6** constrained equally	A5 versus *Co model*	237.999	143	7.441	1	0.006**	0.971	0.002
Model A6; Factor loading of **ISO-X7** constrained equally	A6 versus *Co model*	234.409	143	3.851	1	0.05*	0.972	0.001
Model A7; Factor loadings of only CP constrained equally	A7 versus *Co model*	230.653	144	0.095	2	0.954	0.974	0.001
Model A8; Factor loadings of only OPP constrained equally	A8 versus *Co model*	244.689	145	14.131	3	0.003**	0.970	0.003
Model A9; Factor loading of **ISO-Y7** constrained equally	A9 versus *Co model*	241.819	143	11.261	1	0.001**	0.970	0.003
Model A10; Factor loadings of ISO-Y4 and Y5 constrained equally	A10 versus *Co model*	230.767	144	0.209	2	0.901	0.974	0.001
Model A11; Factor loadings of only FP constrained equally	A11 versus *Co model*	233.214	143	2.656	1	0.103	0.973	0.000
Model B; Structural model								
Model B1; factor loadings (except ISO-X5, X6, X7 and Y7) and paths from MP and CP to OPP constrained equally	B1 versus *Co model*	243.845	153	13.287	2	0.275	0.973	0.000

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

4.6.2.3 Age of ABC

Model 1

The impact of the extent of ABC use on organisational performance might differ depending on the age of ABC (classified by average years of using ABC= 5.81). Two groups include organisations that adopted ABC for fewer than average years (n = 99), and organisations that adopted ABC greater or equal to average years (n = 92). Table 4.114 shows the configural model with the $\chi 2$ value = 171.521, CFI = 0.961 and CMIN/DF = 1.280 representing a good fit across two groups.

Table 4.114, in the measurement model, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 16.630 with 9 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). This means all factor loadings of four constructs (MP, CP, OPP and FP) are equivalent across the two groups. On the other hand, in the structural model, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 32.709 with 16 degrees of freedom. The value of $\chi 2$ difference is significant (P<0.05). It means one or more coefficient paths are not equivalent across the two groups. This study proceeds with further examination, as shown in Table 4.116.

Table 4.114: GOF measures of unconstrained and two models (age of ABC)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	76	171.521	134	.016	1.280	.961
Measurement weights (Model A)	67	188.151	143	.007	1.316	.953
Structural weights (Model B)	60	204.230	150	.002	1.362	.944

In Table 4.116, Model B1 is compared with unconstrained model, $\chi 2$ difference value is significant (P<0.05). In addition, Models B2 and B3 are significant (P<0.05). It means the paths from CA to OPP and CS to OPP across the two groups operate differently. Therefore, this study rejects the Null hypothesis and indicates the strength of the impact of CA and CS on operational performance depends on the age of ABC. On the other hand, Model B4 and B5 are not significant (P>0.05) as the evidence of invariance.

Apart from the impact of CA and CS on OPP, this study found no evidence indicating the strength of the impact of CE on operational performance in the context of the age of the ABC. In addition, no evidence indicates the age of ABC moderates the impact of the extent of use of ABC on financial performance.

In summary, Table 4.115 showed for organisations that adopted ABC for greater than or equal to the average number of years, ABC has a much stronger positive impact on OPP (path coefficients =0.442+0.339) than organisations that adopted ABC for less than the average number of years (path coefficients =0.487).

Table 4.115: Standardised regression weights and p-values (age of ABC)

The relationships	Less than Average		Above Average	
	Std. estimate	p-value	Std. estimate	p-value
CA ---> FP	0.014	0.924	0.271	0.059
CS ---> FP	-0.087	0.583	0.086	0.469
CE ---> FP	-0.005	0.973	-0.081	0.564
CA ---> OPP	0.063	0.673	0.442	***0.003***
CS ---> OPP	0.487	***0.001****	-0.041	0.767
CE ---> OPP	0.105	0.499	0.339	***0.028****

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

Table 4.116: GOF statistics for tests of multiple group invariance: The extent of ABC use on organisational performance (Age of ABC)

Model description	Comparative model	$\chi 2$	df	$\Delta \chi 2$	Δdf	P-Value	CFI	ΔCFI
Unconstrained (Configural model: *Co model*)	-	171.521	134	-	-	-	0.961	-
Model A; Measurement model								
Model A1: All factor loadings constrained equally	A1 versus *Co model*	188.151	143	16.630	9	0.055	0.953	0.008
Model B; Structural model								
Model B1; factor loadings and paths from CA, CS and CE to OPP constrained equally	B1 versus *Co model*	198.838	146	27.317	12	***0.007*****	0.945	0.016
Model B2; factor loadings and path from CA to OPP constrained equally	B2 versus *Co model*	191.359	144	19.838	10	***0.031****	0.951	0.010
Model B3; factor loadings and path from CS to OPP constrained equally	B3 versus *Co model*	197.675	144	26.154	10	***0.004*****	0.944	0.017
Model B4; factor loadings and path from CE to OPP constrained equally	B4 versus *Co model*	188.944	144	17.423	10	0.066	0.953	0.008
Model B5; factor loadings and paths from CE to OPP, CA, CS and CE to FP, and OPP to FP constrained equal Model	B5 versus *Co model*	194.395	148	22.874	14	0.062	0.952	0.009

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

Model 2

The impact of the extent of ISO 9000 implementation on organisational performance of organisations adopting both ABC and ISO 9000 might differ depending on the age of the ABC (classified by average years of using ABC). The two groups include one using ABC less-than-average years (n=99) and one using ABC for a greater or equal number of years to average years (n=92) are considered, as mentioned in Model 1. Table 4.117 shows the configural model with the $\chi 2$ value = 212.647, CFI = 0.905 and CMIN/DF = 1.498, representing a good fit across two groups.

In Table 4.117, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 16.403 with 10 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.008, which was more than the cut off value of -0.01 demonstrates evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 21.921 with 15 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.009, which is more than the cut off value of -0.01, highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups.

Table 4.117: GOF measures of unconstrained and two models (age of ABC)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (Configural model)	68	212.647	142	.000	1.498	.905
Measurement weights (Model A)	58	229.050	152	.000	1.507	.897
Structural weights (Model B)	53	234.568	157	.000	1.494	.896

Hence, this study fails to reject the Null hypotheses and indicates that the extent of ISO 9000 implementation impacts equally on financial performance and operational performance of organisations implementing ABC despite differences in the years of maturity of the ABC system.

4.6.2.4 Age of ISO 9000

Model 1

The impact of the extent of ABC use on organisational performance might differ depending on the age of the ISO 9000 (classified by average number of years implementing ISO 9000=6.18). The two groups are organisations that adopted ISO 9000 less than the average number of years (n = 106) and organisations that adopted ISO 9000 for a greater or equal number of years than the average (n = 85). Table 4.118 shows the configural model with the $\chi 2$ value = 175.365, CFI = 0.962 and CMIN/DF = 1.309 representing a good fit across two groups.

In Table 4.118, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 8.201 with 9 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.001, which is more than the value of -0.01, highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 12.575 with 16 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.004, which is more than the value of -0.01, highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups

Table 4.118: GOF measures of unconstrained and two models (age of ISO)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	76	175.365	134	.010	1.309	.962
Measurement weights (Model A)	67	183.566	143	.012	1.284	.963
Structural weights (Model B)	60	187.940	150	.019	1.253	.966

Regarding the result, this study fails to reject the Null hypotheses and indicates that the impact of the extent of ABC use impacts equally on financial performance and operational performance across organisations that implemented ISO 9000 for fewer than the average number of years and organisations that implemented ISO 9000 for more than or equal to the number to the average.

Model 2

The impact of the extent of ISO 9000 implementation on organisational performance of an organisation that adopted both ABC and ISO 9000 might differ depending on the age of the ISO 9000 (classified into two groups: implemented ISO 9000 for fewer than the average years, and greater or equal to average years). Table 4.119 shows the configural model with the $\chi 2$ value = 216.192, CFI = 0.907 and CMIN/DF = 1.522 representing a good fit across two groups.

In Table 4.119, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 11.092 with 10 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.001, which is more than the value of -0.01, highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 16.382 with 15 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.002, which is more than the value of -0.01, highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups

Table 4.119: GOF measures of unconstrained and two models (age of ISO)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	68	216.192	142	.000	1.522	.907
Measurement weights (Model A)	58	227.284	152	.000	1.495	.906
Structural weights (Model B)	53	232.574	157	.000	1.481	.905

Hence, this study fails to reject the Null hypotheses and indicates that the extent of ISO 9000 implementation impacts equally on financial performance and operational performance across organisations that adopted ISO 9000 for fewer than the average and organisations that adopted ISO 9000 for more or equal years.

Model 3

The two samples are organisations which adopted ISO 9000 for fewer than the average years (n = 253) and greater or equal to average years (n = 157). Table 4.120 shows the configural model with the $\chi 2$ value = 256.681, CFI = 0.958 and CMIN/DF = 1.833 representing a good fit across two groups.

In Table 4.120, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 3.818 with 10 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.003, which is more than the value of -0.01, highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 8.49 with 15 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.003, which is more than the cut off value of -0.01, highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups.

Table 4.120: GOF measures of unconstrained and two models (age of ISO)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	70	256.681	140	.000	1.833	.958
Measurement weights (Model A)	60	260.499	150	.000	1.737	.961
Structural weights (Model B)	55	265.171	155	.000	1.711	.961

Regarding the result, this study fails to reject the Null hypotheses and indicates that the extent of ISO 9000 implementation impacts equally on financial performance and operational performance across organisations that implemented ISO 9000 less than the average years and organisations that implemented ISO 9000 greater or equal to the average years.

Model 4

The two samples are organisations that adopted ISO 9000 fewer than the average numbers years ago (n = 359) or greater or equal to average years (n = 242). Table 4.121 shows the configural model with the $\chi 2$ value = 236.856, CFI = 0.971 and CMIN/DF = 1.668 representing a good fit across two groups.

In Table 4.121, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 17.57 with 10 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.002, which is more than the value of -0.01, highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference of 20.828 with 15 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.002, which is more than the cut off value of -0.01 as evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups

Table 4.121: GOF measures of unconstrained and two models (age of ISO)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	68	236.856	142	.000	1.668	.971
Measurement weights (Model A)	58	254.426	152	.000	1.674	.969
Structural weights (Model B)	53	257.684	157	.000	1.641	.969

Regarding the result, this study fails to reject the Null hypotheses and indicates that the extent of ISO 9000 implementation impacts equally on financial performance and operational performance across organisations that implemented ISO 9000 for fewer years than the average and organisations that implemented ISO 9000 for more years or equal to the average.

4.6.2.5 Frequency of ABC use

Model 1

The impact of the extent of ABC use on organisational performance might differ depending on the frequency of ABC use (classified by average of frequency use = 4.85). The two groups include organisations that frequently adopted ABC less often than average (n = 66) and organisations that frequently adopted ABC more often or equally often as the average (n = 125). Table 4.122 shows the configural model with the $\chi2$ value = 172.835, CFI = 0.946 and CMIN/DF = 1.290 representing a good fit across two groups.

Table 4.122: GOF measures of unconstrained and two models (frequency use of ABC)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	76	172.835	134	.013	1.290	.946
Measurement weights (Model A)	67	195.999	143	.002	1.371	.926
Structural weights (Model B)	60	204.812	150	.002	1.365	.923

In Table 4.123, in the measurement model, the $\Delta\chi2$ value between Model A1 and the unconstrained model yields a difference of 23.164 with 9 degrees of freedom. The value of $\chi2$ difference is significant (P<0.05). This means one or more factor loadings of the five constructs (CA, CS, CE, OPP and FP) is not identifying equivalently across the two groups. Models A1-A6 provide evidence that factor loadings of ABC-X4 (P<0.05), and ABC-X8 (P<0.05) are not equivalent across the two groups. On the other hand, in the structural model, computation of the $\Delta\chi2$ value of Model B1 is not significant (P>0.05). It means that all path coefficients are equivalent across the two groups.

Therefore, this study fails to reject the Null hypotheses and indicates that the extent of ABC use impacts equally on financial performance (FP) and operational performance (OPP) across organisations that adopted ABC less frequently than the average and organisations that adopted ABC equally or more often than the average.

Table 4.123: GOF statistics for tests of multiple group invariance (frequency use of ABC)

Model description	Comparative model	χ2	df	Δ χ2	Δdf	P-Value	CFI	ΔCFI
Unconstrained (Configural model: *Co model*)	-	172.835	134	-	-	-	0.946	-
Model A; Measurement model								
Model A1; All factor loadings constrained equally	A1 versus *Co model*	195.999	143	23.164	9	***0.006*****	0.926	0.02
Model A2; Factor loadings of OPP and FP constrained equally	A2 versus *Co model*	173.329	138	0.494	4	0.974	0.951	0.005
Model A3; Factor loadings of CA and CE constrained equally	A3 versus *Co model*	178.602	136	5.767	2	0.056	0.940	0.006
Model A4; Factor loadings of **ABC-X4** constrained equally	A4 versus *Co model*	185.078	135	12.243	1	***0.000******	0.930	0.016
Model A5; Factor loadings of ABC-X5 constrained equally	A5 versus *Co model*	174.472	135	1.637	1	0.201	0.945	0.001
Model A6; Factor loadings of **ABC-X8** constrained equally	A6 versus *Co model*	179.617	135	6.782	1	***0.009*****	0.938	0.008
Model B; Structural model								
Model B1; factor loadings (except ABC-X4 and X8) and paths from CA, CS and CE to OPP and FP constrained equally	B1 versus *Co model*	191.451	148	18.616	14	0.180	0.939	0.007

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

Model 2

The impact of the extent of ISO 9000 implementation on organisational performance might differ depending on the frequency of ABC use. The two groups include organisations that adopted ABC less frequently than average (n = 66), and organisations that adopted ABC more or equally frequently than average (n = 125). Table 4.124 shows the configural model with the $\chi 2$ value = 212.403, CFI = 0.886 and CMIN/DF = 1.496 representing a good fit across two groups.

In Table 4.124, the $\Delta\chi 2$ value between Model A and the unconstrained model yields a difference of 9.719 with 10 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model A and the unconstrained model provides a difference of 0.000, which is more than the value of -0.01, highlighting evidence of invariance (Cheung & Rensvold, 2002). It means that all factor loadings are equivalent across the two groups.

Similarly, the $\Delta\chi 2$ value between Model B and the unconstrained model yields a difference 21.16 with 15 degrees of freedom. The value of $\chi 2$ difference is not significant (P>0.05). The ΔCFI value between Model B and the unconstrained model provides a difference of 0.01, which is more than the value of -0.01, highlighted as evidence of invariance (Cheung & Rensvold, 2002). It means that all path coefficients are equivalent across the two groups.

Table 4.124: GOF measures of unconstrained and two models (frequency use of ABC)

Model	NPAR	CMIN	DF	P	CMIN/DF	CFI
Unconstrained (configural model)	68	212.403	142	.000	1.496	.886
Measurement weights (Model A)	58	222.122	152	.000	1.461	.886
Structural weights (Model B)	53	233.565	157	.000	1.488	.876

Regarding the result, this study fails to reject the Null hypotheses and indicates that the extent of ISO 9000 implementation impacts equally on financial performance and operational performance across organisations that used ABC less frequently than average and organisations that used ABC more or equally frequent to average years.

4.7 Summary

The chapter reports preliminary analysis results namely sample size, response rate, test of non-response bias and screening data (missing data, outliers, normality, multicollinearity, linearity, and homoscedasticity). It provides the evidence that all necessary conditions for conducting multivariate analysis, namely EFA, CFA and SEM, are met. Descriptive analysis is also presented. EFA is employed for identifying the number and pattern of constructs. A set of variables is tested for reliability by Cronbach's alpha. CFA is also employed to confirm the results of EFA and ascertain the respective dimensions. The results provide evidence that the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance are multidimensional.

The extent of ABC use is composed of three factors: namely, cost analysis (CA), cost strategy (CS), and cost evaluation (CE). The extent of ISO 9000 implementation is composed of two constructs: namely, management principle (MP), and cooperation principle (CP). Organisational performance is composed of two constructs: namely, operational performance (OPP), and financial performance (FP). Then, the mediation analysis occurs because there are two dimensions of organisational performance.

Model 1 and Model 2 use the data from the same respondents (organisations-group 1) that adopted both ABC and ISO 9000. Model 1 examines the impact of CA, CS, and CE on both FP and OPP, whereas Model 2 investigates the impact of MP and CP on FP and OPP. As concluded in Table 4.125, the results of the SEM provide evidence that CA (0.25, $P<0.05$), CS (0.28, $P<0.01$), and CE (0.23, $P<0.05$) have positive direct impact on OPP. In addition, they have indirect impact on FP through OPP (CA =0.18, $P<0.05$, CA =0.20, $P<0.01$, and CA =0.16, $P<0.05$, respectively). However, there is no evidence that these three constructs have direct impact on FP. In Model 2, MP has a positive impact on both FP (0.37, $P<0.05$) and OPP (0.38, $P<0.05$), whereas CP does not have any impact on either FP or OPP. In addition, there is evidence of indirect impact of MP on FP through OPP (0.12, $P<0.05$).

In contrast to Models 1 and 2, Model 3 employs the data from organisations-group 2 that adopted only ISO 9000. The findings are contradictory with Model 2. There is no evidence that MP and CP has a positive impact on FP and OPP.

Overall, Model 4 combines the impact of the extent of ISO 9000 implementation on OP from data of respondent groups 1 and 2. In other words, this model includes organisations that adopted both ABC and ISO 9000 (Model 2), and organisations that adopted only ISO 9000 (Model 3). Table 4.125 reports that MP has a positive impact on OPP (0.22, $P<0.001$) and it consequently impacts indirectly on FP via OPP (0.06, $P<0.001$). Conversely, there is no evidence that CP has a positive impact on both FP and OPP.

In addition, the results from multi-group analysis reveal that there are statically significant differences between organisations that adopted both ABC and ISO 9000 (Model 2) and organisations with only ISO 9000 (Model 3), namely: 1) factor loading from MP to ISO-X4, 2) the direct impact of MP and CP on FP, and 3) the direct impact of MP and CP on OPP. It implies organisations that adopted both ABC and ISO 9000 have a much stronger positive impact on OP than those only adopting ISO 9000.

Multi-group analysis also provides evidence that only the age of ABC moderates the impact of the extent of ABC use on OPP, whereas others (type of business, size of business, age of ABC, age of ISO 9000, and frequency of use of ABC) do not. It implies that in organisations that used ABC for longer than average ABC has a much stronger impact on OPP than those that adopted ABC less.

Table 4.125: Hypothesised relationships of four models

Model	Hypotheses	Direct impact on FP		Direct impact on OPP		Indirect impact on FP via OPP	
		Path	**Path coefficient and P-value**	**Path**	**Path coefficient and P-value**	**Path**	**Path coefficient and P-value**
1	H1a, ***H2a, H3a***	CA --> FP	(0.14, P=0.156)	***CA --> OPP***	***(0.25, P=0.019*)***	***CA --> OPP--> FP***	***0.18****
	H1b, ***H2b, H3b***	CS --> FP	(0.02, P=0.837)	***CS --> OPP***	***(0.28, P=0.005**)***	***CS --> OPP--> FP***	***0.20*****
	H1c, ***H2c, H3c***	CE --> FP	(-0.02, P=0.822)	***CE --> OPP***	***(0.23, P=0.036*)***	***CE --> OPP--> FP***	***0.16****
2	***H4a***, ***H5a***, ***H6a***	***MP --> FP***	***(0.37, P=0.025*)***	***MP --> OPP***	***(0.38, P=0.023*)***	***MP --> OPP--> FP***	***0.12****
	H4b, H5b, H6b	CP --> FP	(0.11, P=0.454)	CP --> OPP	(0.05, P=0.741)	CP --> OPP--> FP	0.02
3	H7a, H8a, H9a	MP --> FP	(0.01, P=0.904)	MP --> OPP	(0.14, P=0.056)	MP --> OPP--> FP	0.03
	H7b, H8b, H9b	CP --> FP	(0.19, P=0.053^{w})	CP --> OPP	(0.10, P=0.151)	CP --> OPP--> FP	0.03
4	H10a, ***H11a, H12a***	MP --> FP	(0.12, P=0.128)	***MP --> OPP***	***(0.22, P=0.001***)***	***MP --> OPP--> FP***	***0.06******
	H10b, H11b, H12b	CP --> FP	(0.16, P=0.053)	CP --> OPP	(0.08, P=0.218)	CP --> OPP--> FP	0.02

Note: *** significant at the 0.001, ** significant at the 0.01, *significant at the 0.05

Chapter 5: Discussion of Findings

Introduction

This chapter discusses the current study results in comparison with results of previous studies and relevant theories. These research results are interpreted in relation to the following objectives. Firstly, the study objective was to discover the factorial structure of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance. Secondly, it examined the impact of the extent of ABC use on organisational performance as well as the impact of the extent of ISO 9000 implementation on organisational performance. Lastly, it investigated the difference in organisational performance between organisations that adopted both ABC and ISO 9000, and organisations that adopted only ISO 9000. The moderating impacts of ABC and ISO 9000 on organisational performance were also studied.

5.1 The factorial structure of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance

The current study operationalised the three constructs (the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance) by identifying the valid and reliable indicators that were previously applied in the literature of ABC and ISO 9000. The study further considers whether these constructs are unidimensional or multidimensional, as follows.

The extent of ABC use

The results from EFA and CFA provide evidence that the extent of ABC use is multidimensional. It is composed of three constructs: namely, cost analysis (CA), cost strategy (CS), and cost evaluation (CE). One of the nine indicators has been removed from this study because of the EFA results. In addition to testing dimensionality by CFA, this study also compares the goodness-of-fit (GOF) indices results between the one factor model (Model I) and the first-order factors model (Model II). The results indicate that the first-order factors model fits data better than the one factor model. It provides evidence that the extent of ABC use is a multidimensional construct.

Cronbach's alpha and the corrected item-total correlation (CITC) give evidence of internal reliability. In addition, CFA provides evidence of convergent validity and discriminant validity. In each construct, all factor loadings are higher than 0.50, the average variance extracted (AVE) is greater than 0.50, construct reliability (CR) exceeds 0.60, all of which show the convergent validity. Furthermore, average AVE exceeds the squared correlation estimate, which provides evidence of discriminant validity. A post hoc Harman one factor analysis and comparing model fit of the one factor model and the first-order factors model were employed for detecting common method variance (CMV). The results show that CMV biases do not affect this research result.

Regarding statistical evidence, the extent of ABC use is multidimensional. The result is not surprising as the applications of ABC techniques were relatively varied (Swenson, 1995). The differences among the three factors are distinct and are related to the analysis, strategy, and evaluation of ABC. However, this finding contradicts previous assumptions, such as those of Maiga and Jacobs (2008), who assumed the extent of ABC use as a unidimensional construct consisting of four indicators: namely, design manufacturing, manufacturing engineering, product management, and plantwide, without providing evidence. Similarly, this study employed the same nine indicators in measuring the extent of ABC use as Cagwin and Bouwman (2002). Cagwin and Bouwman (2002) applied nine indicators in terms of the "application construct" and assumed this construct was a unidimensional construct without testing dimensionality.

Further, it is noted that some studies investigated the association and impact of ABC and performance by measuring ABC in a category scale (1, 0), namely, ABC-adopter and non-ABC adopter, such as the studies of Ittner et al. (2002), Cagwin and Ortiz (2005), Banker et al. (2008), and Hardan and Shatnawi (2013). ABC was also measured on a continuum of ABC adoption levels by applying only one indicator, namely, frequency of ABC use (Jankala & Silvola, 2012). However, few studies measured ABC in terms of a construct but without testing dimensionality (Cagwin & Bouwman, 2002; Maiga & Jacobs, 2008). Based only on EFA results, Zaman (2009) found ABC was composed of three dimensions (strategic cost allocation method, increased efficiency, and increased effectiveness). At present, few have measured

ABC in terms of a construct, and in particular, there is an absence of clarity concerning testing the dimensional structure of ABC.

This is the first study that examines the dimensionality and produces multidimensional results of the extent of an ABC use construct in the context of the nine purposes of using ABC, by employing EFA and further by CFA, and by testing the goodness-of-fit (GOF) indices of the two models (Models I and II). The result confirms three dimensions of the extent of ABC use. Specifying this construct as unidimensional would impact the research results and may produce contradictory results due to measuring the extent of ABC use in different dimensions. Specifically, this study confirms the dimensionality of the extent of ABC use in relation to the purposes of using ABC.

The extent of ISO 9000 implementation

The results of EFA and CFA provide evidence that the extent of ISO 9000 implementation is multidimensional. It is composed of two dimensions: namely, management principle (MP), and cooperation principle (CP). This study also compares the goodness-of-fit (GOF) indices results between the one factor model (Model I) and the first-order factors model (Model II). The results indicate that the first-order factors model fits data better than the one factor model. It provides evidence that the extent of ISO 9000 implementation is a multidimensional construct. The result is not surprising as ISO 9004 provides a wider focus on quality management in terms of different principles. The first factor (MP) seems related to activities in operations management, while the latter (CP) is related to cooperation (with humans), such as communicating and sharing information.

The Cronbach's alpha, CITC and CFA results provide evidence of internal reliability, convergent validity and discriminant validity. Each construct shows factor loadings exceed 0.50; AVE and CR surpass 0.50 and 0.60, respectively, which give evidence of convergent validity. Additionally, the average AVE exceeds the squared correlation estimate, which provides evidence of discriminant validity. A *post hoc* Harman one factor analysis result and the GOF indices results of two models indicate that CMV biases do not affect these research results.

The result of the current study is consistent with the study of Elshaer and Augustyn (2016), indicating the quality management (QM) construct was a multi-dimensional construct composed of six practices, based on EFA and CFA results. These practices were embedded within ISO 9000 principles, the EFQM Excellence Model and Baldrige framework for performance excellence. Conversely, regarding EFA and CFA results, Jang and Lin (2008) indicated the level/ extent of ISO 9000 implementation was unidimensional, consisting of eight indicators namely identification of quality aspects, defining standards procedures, documentation, training, top management support, employee involvement, periodic auditing, and corrective action.

To the best of the researcher's knowledge, this is the first study that examines the dimensionality of the extent of ISO 9000 implementation (with regard to eight principles as ISO 9004: 2009), by employing EFA and further by CFA, by testing the goodness-of-fit (GOF) indices of the two models (Model I and II). The result identifies two dimensions of the extent of ISO 9000 implementation. Specifying this construct as the unidimensional construct would affect research results and may produce contradictory results due to measuring the extent of ISO 9000 implementation in different dimensions. Specifically, this study confirms the dimensionality of the extent of ISO 9000 implementation in relation to the quality management principles.

Organisational performance

The organisational performance construct is reported as a multidimensional construct. Organisational performance is composed of two dimensions: namely, financial performance (FP) and operational performance (OPP). As mentioned for the previous two constructs, Cronbach's alpha, CITC and CFA provide the evidence of internal reliability, convergent validity and discriminant validity. CMV biases do not affect research results. The result is consistent with expectation, as this study assumed organisational performance as consisting of financial performance and operational performance, as Neely (2007) suggested. Multidimensional systems of performance measurement were proposed because of the limitations of single indicator measure (Rogers & Wright, 1998).

In relation to association studies, in the ABC literature, some researchers such as Cagwin and Bouwman (2002), Cagwin and Ortiz (2005), and Jankala and Silvola (2012) used only a single indicator in measuring organisational performance. On the other hand, in terms of a construct in relation to association studies, Maiga and Jacobs (2008) applied market share (MS), return on sales (ROS), turnover on assets (TOA), and return on assets (ROA) in order to measure a performance construct. However, this was without testing the dimensionality. Ittner et al. (2002) assumed performance was composed of three dimensions: cost, quality, and time, but without evidence of statistical testing. In the impact studies, Zaman (2009) asserted the overall performance was unidimensional based on EFA results only. Conversely, Banker et al. (2008) assumed the performance was multidimensional but without testing the dimensionality.

In relation to association studies, in the ISO 9000 literature, some researchers such as Naveh and Marcus (2005) indicated that performance was multidimensional (operating performance and business performance) based on CFA results only. Similarly, Feng et al. (2008) indicated that performance was multidimensional with regard to EFA results only. Fatima (2014) indicated business performance consists of different variables without statistical evidence. In the impact studies, Psomas et al. (2013) organised the performance into three dimensions, such as financial performance, operational performance, and product/service quality, using EFA only. Jang and Lin (2008) viewed performance as divided into four dimensions (namely, operational performance, market performance, market share, and business performance) by testing each single dimension of performance.

To the best of the researcher’s knowledge, this is the first study that examines the dimensionality of seven performance indicators drawn from the prior ABC and ISO 9000 literature, by employing EFA and further CFA, and by testing the goodness-of-fits (GOF) indices of the two models (Model I and II). Identifying organisational performance in different dimensions could lead to different results and different implications for management accounting practice, in particular ABC, and quality management practice and ISO 9000. This study provides evidence of two dimensions of organisational performance in relation to the potential implication of ABC and ISO 9000.

5.2 The impact of the extent of ABC use on organisational performance

Model I was employed to test the impact of the extent of ABC use and organisational performance. As discussed in section 5.1, the extent of ABC use was composed of three constructs: namely, cost analysis (CA), cost strategy (CS), and cost evaluation (CE). In addition, organisational performance had two dimensions: namely, financial performance (FP) and operational performance (OPP). Therefore, this study examines the direct impact of the extent of ABC use on FP and OPP and the indirect impact on FP of three dimensions (CA, CS, and CE).

SEM results provide evidence of the extent of ABC use (CA, CS, and CE) impact on operational performance (OPP). The empirical analysis shows all the purposes of using ABC, such as cost analysis (CA), cost strategy (CS), and cost evaluation (CE), could contribute to improving operational performance, especially in cost strategy (CS), which has the strongest significant impact on OPP (0.28, $P<0.01$) relative to other factors.

It is noted that in the association studies, Ittner et al. (2002) found that ABC was associated with improvement of quality and time. Similarly, Maiga and Jacobs (2008) indicated the extent of ABC use had a significant positive relationship with cost, quality and time. This current study extends the association analysis to the impact analysis and provides evidence of direct impact on OPP. The result (the direct impact of ABC on OPP) is consistent with the study of Banker et al. (2008), which found ABC had a positive impact on operational performance such as cost and time.

However, there is no evidence that the extent of ABC use has a direct impact on FP ($P>0.05$). This result is similar to association studies; ABC was found to have no association with financial performance, such as return on assets (ROA), return on investment (ROI), and profitability (Cagwin & Bouwman, 2002; Ittner et al., 2002; Cagwin & Ortiz, 2005; Maiga & Jacobs, 2008). This is in contrast with the impact study of Zaman (2009), which found that ABC's impact on overall performance consisted of creating more value for the customer, and improving overall revenue, profitability, and financial return indicators. The different results might be because Zaman (2009) employed a different data analysis technique and a different sample from the current study.

Besides the direct impact results of the extent of ABC use on FP and OPP, this current study found an indirect impact of the extent of ABC use on FP through OPP. The study of Maiga and Jacobs (2008) also indicated the extent of ABC use had a positive indirect association on FP through OPP: namely, cost improvement, quality improvement, and cycle-time improvement. The current result corroborates the association study of Maiga and Jacobs (2008). It is noted that CS has the strongest significant indirect impact on FP, relative to other factors (CA and CE).

In summary, the extent of ABC use impacted organisational performance, particularly operational performance (OPP) as expected; and, it impacted indirectly on financial performance (FP) through operational performance (OPP). Within cost accounting theory, ABC is viewed as a process improvement and part of cost management. During ABC analysis, organisations gain a deeper understanding of their business processes, cost behaviour (Drury, 2005), and cost structure (Mansor et al., 2012). The result shows the ability of ABC at a theoretical level to improve organisational performance, as Langfield-Smith et al. (2009) mentioned, management accounting may improve the organisation's performance through process improvement and cost management. Moreover, the result is consistent with the general systems theory (GST), which explains a basic thinking model of inputs, processes, outputs, and a feedback loop (Bertalanffy, 1968) in the context of scarce resource theory (Swanson, 1999). The outputs of a system are presented in the form of goods or services, which are normally measured in quantity, time, and quality feature measures (Swanson, 1999). Thus, when the organisation is viewed as a system, and each activity a sub-system, ABC focuses on cost-related activities, which allows the evaluation of whether those activities add value or not (Maiga & Jacobs, 2008). The benefit of ABC is dependent on the extent to which it becomes incorporated into a sub-system (Cagwin & Bouwman, 2002). Hence, ABC is expected to be beneficial in processing activities and subsequently contribute to performance improvement.

To the best of the researcher's knowledge, this is the first study that examines the impact of the extent of ABC use (as a multidimensional construct) on both financial performance and operational performance by using cost accounting theory, general systems theory (GST), and scarce resources theory to explain of the impact of the extent of ABC use on organisational performance. This study also advances our understanding of the association between ABC and performance and provides evidence that cost analysis (CA), cost strategy (CS), and cost evaluation (CE) can improve operational performance (OPP) and subsequently improve financial performance (FP) through OPP.

5.3 The impact of the extent of ISO 9000 implementation on organisational performance

As discussed in section 5.1, the impact of the extent of ISO 9000 implementation on organisational performance was investigated by the three different models (different sample groups): namely, Models 2, 3, and 4. Model 2 investigated the impact of the extent of ISO 9000 implementation on the performance of organisations that adopted both ABC and ISO 9000, whereas Model 3 examines the impact of the extent of ISO 9000 implementation on organisations that adopted only ISO 9000. The significant differences between Model 2 and Model 3 are also discussed in the next section regarding the multi-group analysis results. Lastly, Model 4 tested the impact of the extent of ISO 9000 implementation of all the organisations studied.

In section 5.1, the extent of ISO 9000 implementation was composed of two dimensions (namely, management principle (MP) and cooperation principle (CP)) and organisational performance was composed of two dimensions (namely, financial performance (FP) and operational performance (OPP)). Therefore, this study examines the direct impact on FP and OPP and indirect impact on FP of the two dimensions.

With Model 4 (all organisations studied), the empirical evidence indicates that management principle (MP) has a direct impact on OPP (0.22, $P \leq 0.001$), which is consistent with the result of organisations that adopted both ABC and ISO 9000 (Model 2). Conversely, there is no evidence that management principle (MP) has a direct impact on OPP in organisations that adopted only ISO 9000 implementation (Model 3). The result also shows evidence that cooperation principle (CP) does not have a significant impact on OPP among any of all three models. The contradictory results among the three models might be due to different sample groups and sample sizes in relation to a synergy effect.

The result (the direct impact of ISO 9000 on OPP) is consistent with previous studies, namely Jang and Lin (2008), which reported that the depth of ISO 9000 implementation had an impact on operational performance. Similarly, Psomas et al. (2013) found operational performance was directly affected by ISO 9001. This result also advances our understanding in the association studies of Naveh and Marcus (2005) and Feng et al. (2008), which found ISO 9000 had a positive association with operational performance.

In terms of financial performance (the direct impact of ISO 9000 on FP), there was no evidence indicating the extent of ISO 9000 implementation impacting on the FP of organisations that adopted only ISO 9000 implementation (Model 3) and all organisations studied (Model 4). It contrasts with the result of organisations that adopted both ABC and ISO 9000 (Model 2), which found a direct impact of management principle (MP) on FP. The contradictory results among the three models might be due to different sample groups particularly the synergy effect. That is, ABC and ISO 9000 might be viewed as having a complementary or a synergy effect on organisational performance. As expected, “many organisations have found the pursuit of performance can best be achieved by implementing ABC systems” (Maiga & Jacobs, 2003: 285). For example, Kennedy and Affleck-Graves (2001) reported that ABC organisations achieve around 27% higher abnormal return than non-ABC organisations.

The result (the direct impact of ISO 9000 on FP) advances our understanding of the association studies of Naveh and Marcus (2005), Feng et al. (2008) and Fatima (2014) and indicates that management principle (MP) has a direct impact on FP. However, this result contrasts with the study of Psomas et al. (2013), which employed multiple linear regression. The different results might be due to employing different data analysis techniques.

Furthermore, this study also found that management principle (MP) has an indirect impact on FP through OPP in all organisations studied (Model 4) and the organisations that adopted ABC and ISO 9000 (Model 2). However, there is no evidence of indirect impact on FP within organisations that adopted only ISO 9000 implementation (Model 3). The contradictory results among three models might be due to different sample groups. The indirect impact of ISO 9000 on FP through OPP is also significant. This result is consistent with the studies of Jang and Lin (2008) and Psomas et al. (2013). It corroborates the association study of Naveh and Marcus (2005) which found an indirect association between ISO 9000 and FP through OPP are also significant.

Turning to the direct impact of ISO 9000 on OPP, the comparative analysis of the path coefficients indicates that the extent of ISO 9000 implementation of organisations that adopted ABC and ISO 9000 had a much stronger impact on OPP (0.38, $P \leq 0.05$) than all organisations studied (0.22, $P \leq 0.001$) but at the lower-significance level. Similarly, in the indirect impact on FP through OPP, the extent of ISO 9000 implementation of organisations that adopted ABC and ISO 9000 has a much stronger indirect impact on FP (0.12, $P \leq 0.05$) than all organisations studied (0.06, $P \leq 0.001$).

In terms of ISO 9000, quality management theory is viewed as a process improvement (Gershon, 2010). It provides a sound basis for a quality management system (QMS) and could lead to improving performance (Munro-Faure et al., 1993). Even though both management principle (MP) and cooperation principle (CP) provide the direction for systematic and continual improvement leading to performance improvement as ISO 9004:2009 mentioned, this study found only management principle (MP) impacted on organisational performance. This might be due to MP including principles that directly relate to activities in operations management. ISO 9000 at a theoretical level has potential to improve the activities (sub-systems). So, ISO 9000 will benefit the company and improve performance depending on the extent to which it becomes an incorporated sub-system. The potential transformation of input to output leads to a more valuable set of results. The result of this current study is consistent with the explanation of general systems theory (GST). In contrast, cooperation principle (CP) did not have a powerful direct impact on either OPP or FP among all three models. One explanation is that cooperation with people who work an organisation and suppliers might not relate directly to the transformation of input to output. Consequently, it is insufficient to improve the organisation’s activities (sub-system) and performance. It can be concluded that organisations that implemented ISO 9000, particularly in the context CP, may not improve OPP or FP.

To the best of the researcher's knowledge, this is the first study that examines the impact of the extent of ISO 9000 implementation (as a multidimensional construct) on both financial performance and operational performance by using quality management theory, general systems theory (GST), and scarce resource theory to explain the impact of the extent of ISO 9000 implementation on organisational performance. This study advances our understanding of the association between ISO 9000 and performance and provides evidence that management principles (MP) can improve both financial performance (FP) and operational performance (OPP), particularly in organisations that have adopted both ABC and ISO 9000.

5.4 The significant differences between organisations that adopted both ABC and ISO 9000 and organisations that adopted only ISO 9000

In order to test the significant differences between organisations that adopted both ABC and ISO 9000 and organisations that adopted only ISO 9000, organisations that adopted both ABC and ISO 9000 (Model 2) are compared with organisations that adopted only ISO 9000 (Model 3). These two models are subjected to multi-group analysis in SEM. The multi-group analysis aims to find out whether the two groups are different at a statically significant level and, which factor loadings or path coefficients are subject of significant difference. Moreover, it provides evidence if there is a synergy effect between ABC and ISO 9000 on organisational performance.

The $\chi 2$ difference value and the ΔCFI value provide evidence that the null hypothesis of invariance across the two models (Model 2 and 3) of interest is rejected. It means there are one or more paths that are not identifying equivalently across the two models. As a result, multi-group analysis reveals that there are statistically significant differences between organisations that adopted both ABC and ISO 9000 (Model 2) and organisations that adopted only ISO 9000 (Model 3). Firstly, management principles (MP) of organisations that adopted both ABC and ISO 9000 have direct impact on FP and OPP; subsequently, they have an indirect impact on FP through OPP. Conversely, there is no evidence that the extent of ISO 9000 implementation of organisations that adopted only ISO 9000 has any impact on FP and OPP ($P>0.05$). Secondly, Cooperation principles (CP) have a direct impact on financial performance improvement in Model 3 but with a weak significance (path coefficient=0.19, P=0.053<0.10) while no relationship exists within organisations that adopted both ABC and ISO 9000 (Model 2).

With the information given, the extent of ISO 9000 implementation of organisations that extensively use ABC and ISO 9000 has a much stronger positive impact on organisational performance than organisations that adopted only ISO 9000. It implies that employing ABC complementarily with ISO 9000 can generate greater financial performance and operational performance. In other words, adopting only ISO 9000 might not be a sufficient contribution to organisational performance improvement. The current result is consistent with expectations because all indicators in measuring organisational performance were previously used in both the ABC and ISO 9000 literature; therefore, organisations that adopted both ABC and ISO 9000 should gain better organisational performance than organisations that adopted only ISO 9000.

ABC and ISO 9000 support the process management, horizontal orientation of activities in operations management. As with general system theory (GST), the organisation is viewed as a system and all activities are sub-systems. Hence, ABC and ISO 9000 are assumed to improve an organisation’s processes, with the potential of the ABC and ISO 9000 on a theoretical level, subsequently contributing to the organisation’s improvement. The multi-group analysis result produces strong evidence that adopting both ABC and ISO 9000 creates a much stronger positive impact on organisational performance than adopting only ISO 9000.

This current result contrasts markedly with the study of Larson and Kerr (2002), which found ISO-9000-only organisations displayed better performance than organisations that adopted both ABC and ISO 9000. This previous study (Larson & Kerr, 2002) concluded that ABC and ISO 9000 were not complementary on performance (as measured by customer service, efficiency, flexibility, on-time delivery, and productivity). The contradictory results may be due to Larson and Kerr (2002) measuring ABC and ISO 9000 with a category scale (ABC- adopter, ISO 9000-adopter, non-adopter), whereas this study employed a multidimensional construct and measured the extent of ABC use and the extent of ISO 9000 implementation, in other words, greater sophistication. Furthermore, Larson and Kerr (2002) applied different data analysis techniques and a different sample from this current study.

Besides ISO 9000, previous studies found a synergy between ABC and other initiatives such as TQM, business process reengineering (BPR), computer-integrated manufacturing (CIM), JIT, flexible manufacturing systems (FMS), theory of constraints (TOC), value chain analysis (VCA), balance scorecard (BSC), technology integration (TI), and supply chain management (SCM) (Cagwin & Bouwman, 2002; Maiga & Jacobs, 2003; Cagwin & Ortiz, 2005). However, in an impact study, Banker et al. (2008) found no evidence of a synergy impact between ABC and world-class manufacturing (WCM). To the best of the researcher's knowledge, this study is the first study that examines the synergy effect of ABC and ISO 9000 by employing multi-group analysis in SEM. The results provide strong evidence of a synergy effect of ABC and ISO 9000.

5.5 The moderating impacts of the initiatives on organisational performance.

As discussed in Chapter 2, and regarding contingency theory, previous studies indicated that some factors could moderate the impact of the extent of ABC use, and the extent of ISO 9000 implementation on organisational performance, such as type of business, size of business, age of ABC, age of ISO 9000, and frequency of use of ABC. Multi-group analysis was employed to find out which moderating variables moderate the direct impact on FP and OPP.

From the statistical results, there is no evidence that the moderating variables moderate the impact of independent constructs on organisational performance (except age of ABC). As reported in section 4.6.2, this result is surprising; it contrasts with contingency theory and previous expectation. This might be due to the type of business, both non-manufacturing and manufacturing organisations, that have adopted ABC and ISO 9000 in a similar way, even given that ABC and ISO 9000 were first introduced into manufacturing. Additionally, classifying organisations into only two groups might not be sufficient, so distributing organisations into different industries (more than two groups) might be considered. Similarly, in size of business, it is possible that small and medium organisations have similar operational management systems and sufficient resources to adopt ABC and ISO 9000, the same as the large organisations.

Regarding age of ISO 9000, there is no evidence indicating age of ISO 9000 moderates the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance. This result is not expected, as increasing experience with ISO 9000 seems to help organisations increase quality, fulfil customer needs, and achieve competitiveness (Anderson et al., 1999; Docking & Dowen, 1999; Santos & Escanciano, 2002). However, it might be because this study classified the age of ISO into two groups (adopted ISO 9000 less than average and adopted ISO 9000 greater or equal to average). Identifying the age of ISO 9000 by using the average years might not be sufficient.

In terms of the frequency of ABC use, the result is not in line with experience. This might be due to this study classifying the frequency use of ABC into two groups (frequently used ABC less than average, and frequently used ABC greater or equal to average). It might be insufficient to identify frequency of ABC use by using the average. In addition, even though each sample size is statistically adequate, some samples are small. It might affect the results of these moderating variables.

Only age of ABC was found to moderate the impact of the extent of ABC use on organisational performance, particularly in operational performance. With the multi-group analysis results, it implies that organisations that used ABC for more than the average years have a much stronger impact on OPP than organisations that adopted ABC for less time. The result is not surprising, as Kennedy and Affleck-Graves (2001) found that the superior performance of organisations adopting ABC did not occur immediately. More experiences in using ABC overtime seems to gain more organisational performance improvement.

In summary, only the age of ABC moderated the strength of the impact of the extent of ABC use on organisational performance. It implies that not all organisations that adopted ABC can gain the same organisational performance boost regarding the length of using ABC. This result is consistent with the explanation of contingency theory (Venkatraman, 1989), ie various environmental variables affecting the results between independent variable and dependent variable.

A comprehensive summary of the current findings and their relationship to previous studies concerning ABC, ISO and OP are shown in Tables 5.1 to 5.6 which follow.

Table 5.1: The current study findings in relation to the previous studies (ABC and FP)

Association	The findings of this current study		The findings from the association studies		Responses and Methods
	Rejected *H* *null*	**Accepted *H* *null***	**Rejected *H* *null***	**Accepted *H* *null***	
ABC --> FP				Cagwin and Bouwman (2002) FB-ROI (path coefficient = 0.05, P> 0.10)	204 members of Institute of Internal auditors (IIA) in U.S. Using Structural Equation Modeling (Lisrel)
			Jankala and Silvola (2012) FB-Sales (path coefficient = 0.137, P <0.10)		1,000 small Finish firms. Using Structural Equation Modeling (Amos)
				Ittner et al. (2002) FB- ROA (beta coefficient = -1.263, P> 0.10)	2,789 US manufacturing plants Using ordinary least squares (OLS)
				Maiga and Jacobs (2008) FB-Profitability (path coefficient = 0.05, P> 0.10) **Note:** Profitability includes MS, ROS, TOA and ROA	691 manufacturing plants across the US. Using Structural Equation Modeling
				Cagwin and Ortiz (2005) FB-ROA (beta coefficient = 0.004, P> 0.10)	305 firms in the motor carrier industry Using multiple regression analysis
			Hardan and Shatnawi (2013) financial performance (P<0.001)		27 firms in the telecom industry in Jordan (Quantitative and Qualitative approaches) Using t-test analysis
impact	**The findings of this current study**		**The findings from the impact study**		**Responses and Methods**
	Rejected *H* *null*	**Accepted *H* *null***	**Rejected *H* *null***	**Accepted *H* *null***	
ABC --> FP		(CA, 0.14, P> 0.05) (CS, 0.02, P>0.05) (CE, -0.02, P> 0.05)	Zaman (2009) FB-overall performance (P<0.05) Note: overall performance includes create more value for customer, improved overall revenue, profitability, and financial return.		82 respondents through 17 organisations Using regression model by SPSS

Note: H_{null}: Null Hypothesis, in this study if P<0.05, then the null hypothesis is rejected.

Table 5.2: The current study findings in relation to the previous studies (ABC and OPP)

Association	**The findings of this current study**		**The findings from the association studies**		**Responses and Methods**
	Rejected H_{null}	**Accepted H_{null}**	**Rejected H_{null}**	**Accepted H_{null}**	
ABC --> OPP			Ittner et al. (2002) OPP-quality level (beta coefficient = 0.70, P <0.10) OPP-cycle time (beta coefficient = 2.018, P < 0.01)		2,789 manufacturing plants across the US. Using ordinary least squares (OLS) regressions
			Maiga and Jacobs (2008) OPP-cost improvement (path coefficient = 0.171, P = P <0.05) OPP-quality improvement (path coefficient = 0.205, P = P < 0.001) OPP-cycle-time improvement (path coefficient = 0.190, P < 0.001)		691 manufacturing plants across the US. Using Structural Equation Modeling
Impact	**The findings of this current study**		**The findings from the impact studies**		**Responses and Methods**
	Rejected H_{null}	**Rejected H_{null}**	**Rejected H_{null}**	**Accepted H_{null}**	
ABC --> OPP	(CA, 0.25, P<0.05) (CS, 0.28, P<0.01) (CE, 0.23, P<0.05)		Banker et al. (2008) OPP-costs (beta coefficient = 0.22 = P <0.05) OPP-time (beta coefficient = 0.11 = P <0.10)		1250 manufacturing plants across the US. Using ordinary least squares (OLS) regressions

Note: H_{null}: Null Hypothesis, in this study, if P<0.05, then the null hypothesis is rejected.

Table 5.3: The current study findings in relation to the previous studies (ABC, OPP, and FP)

Association	The findings of this current study		The findings from the association study		Responses and Methods
	Rejected H_{null}	**Accepted H_{null}**	**Rejected H_{null}**	**Accepted H_{null}**	
Mediation = *OPP* ABC --> OPP--> FP			Maiga and Jacobs (2008) Mediation = *cost improvement* FP-Profitability (P <0.05) Mediation = *quality improvement* FP-Profitability (P <0.05) Mediation = *cycle-time improvement* FP-Profitability (P <0.05) **Note:** Profitability construct consists of MS, ROS, TOA and ROA		691 manufacturing plants across the US. Using Structural Equation Modeling
Impact	**The findings of this current study**		**The findings from the impact study**		**Responses and Methods**
	Rejected H_{null}	**Rejected H_{null}**	**Rejected H_{null}**	**Accepted H_{null}**	
ABC --> OPP--> FP	(CA, 0.18, P<0.05) (CS, 0.20, P<0.01) (CE, 0.16, P<0.05)				

Note: H_{null}: Null Hypothesis, in this study if P<0.05, then the null hypothesis is rejected.

Table 5.4: The current study findings in relation to the previous studies (ISO 9000 and FP)

Association	The findings of this current study		The findings from the association studies		Responses and Methods
	Rejected H_{null}	**Accepted H_{null}**	**Rejected H_{null}**	**Accepted H_{null}**	
ISO 9000 --> FP			Naveh and Marcus (2005) FP (P<0.05) **Note:** FP consists of sales and profit margin		1,150 respondents in 924 organisations Using hierarchical linear models (HLM)
			Feng et al. (2008) ISO-Factor 1: FP (beta coefficient = 0.13, P<0.05) ISO-Factor 2: FP (beta coefficient = 0.15, P<0.05) ISO-Factor 3: FP (beta coefficient = 0.08, P<0.10) **Note:** FP consists of market share, corporate image, competitive advantage, access to global market and profit		613 companies in Australia and New Zealand Using multiple regressions
			Fatima (2014) FP-sales (P<0.001) FP-gross profit (P<0.01) FP-Net profit before tax (NPBT) (P<0.05) FP- Net profit after tax (NPAT) (P<0.05)		95 companies in Karachi Stock Exchange (KSE) Using paired t-test procedure for normal distribution and Wilcoxon Signed Rank (WSR) test for abnormal distribution
Impact	**The findings of this current study**		**The findings from the impact study**		**Responses and Methods**
	Rejected H_{null}	**Rejected H_{null}**	**Rejected H_{null}**	**Accepted H_{null}**	
ISO 9000 --> FP	**Model 2** **(**MP, 0.37, P<0.05)	**Model 2** (CP, 0.11, P>0.05) **Model 3** (MP, 0.01, P>0.05) (CP, 0.19, P>0.05) **Model 4** (MP, 0.12, P>0.05) (CP, 0.16, P>0.05)		Psomas et al. (2013) FP (P>0.05) **Note:** FP consists of net profit, company, financial results, profitability, cash flow from operations, and sales growth	100 Greek service companies Using Multiple linear regression

Note: H_{null}: Null Hypothesis, in this study if P<0.05, then the null hypothesis is rejected.

Table 5.5: The current study findings in relation to the previous studies (ISO 9000 and OPP)

Association	**The findings of this current study**		**The findings from the association studies**		**Responses and Methods**
	Rejected *H* *null*	**Accepted *H* *null***	**Rejected *H* *null***	**Accepted *H* *null***	
ISO 9000 --> OPP			Naveh and Marcus (2005) OPP (P<0.05) **Note:** OPP consists of lower defect rates, lower defect rates, reduced cost of quality, higher productivity, and on time delivery		1,150 respondents in 924 organisations Using hierarchical linear models (HLM)
			Feng et al. (2008) ISO-Factor 1: OPP (beta coefficient = 0.27, P<0.05) ISO-Factor 2: OPP (beta coefficient = 0.23, P<0.05) ISO-Factor 3: OPP (beta coefficient = 0.23, P<0.05) Note: OPP consists of cost reduction, increased productivity, quality improvement, improved internal procedures, improved employee morale, improved competitive advantage		613 companies in Australia and New Zealand Using multiple regressions
Impact	**The findings of this current study**		**The findings from the impact studies**		**Responses and Methods**
	Rejected *H* *null*	**Rejected *H* *null***	**Rejected *H* *null***	**Accepted *H* *null***	
ISO 9000 --> OPP	**Model 2** (MP, 0.38, P<0.05) **Model 4** (MP, 0.22, P<0.001)	**Model 2** (CP, 0.05, P>0.05) **Model 3** (MP, 0.14, P>0.05) (CP, 0.10, P>0.05) **Model 4** (CP, 0.08, P>0.05)	Jang and Lin (2008) OPP (path coefficient = 0.25, P<0.05) **Note:** OPP consists of increased productivity, cost reductions, improved internal procedures, improved employees' morale		441 companies in Taiwan Using Structural Equation Modeling
			Psomas et al. (2013) OPP (beta coefficient = 0.55, P<0.05) **Note:** OPP consists of company efficiency, company productivity, process effectiveness,		100 Greek service companies Using Multiple linear regression

Note: *H* *null*: Null Hypothesis, in this study if P<0.05, then the null hypothesis is rejected.

Table 5.6: The current study findings in relation to the previous studies (ISO 9000, OPP, and FP)

Association	The findings of this current study		The findings from the association study		Responses and Methods
	Rejected H_{null}	Accepted H_{null}	Rejected H_{null}	Accepted H_{null}	
Mediation = *OPP* ISO 9000 --> OPP--> FP			Naveh and Marcus (2005) Mediation = operational performance (OPP) FP (P<0.05) **Note:** FP consists of sales and profit margin		1,150 respondents in 924 organisations Using hierarchical linear models (HLM)
Impact	**The findings of this current study**		**The findings from the impact studies**		**Responses and Methods**
	Rejected H_{null}	**Rejected H_{null}**	**Rejected H_{null}**	**Accepted H_{null}**	
ISO 9000 --> OPP--> FP	**Model 2** (MP, 0.12, P<0.05) **Model D** (MP, 0.06, P<0.001)	**Model 2** (CP, 0.02, P>0.05) **Model 3** (MP, 0.03, P>0.05) (CP, 0.03, P>0.05) **Model 4** (CP= 0.02, P>0.05)	Jang and Lin (2008) Mediation = operational performance (OPP) FP-increased profitability (path coefficient = 0.09, P<0.05)		441 companies in Taiwan Using Structural Equation Modeling
			Psomas et al. (2013) Mediation = operational performance (OPP) FP (P<0.001) **Note:** FP consists of net profit, company, financial results, profitability, cash flow from operations, and sales growth		100 Greek service companies Multiple linear regression

Note: H_{null}: Null Hypothesis, in this study if P<0.05, then the null hypothesis is rejected.

Chapter 6: Conclusion, Limitations and Recommendations

Introduction

The findings of this thesis reports the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance. The dimensional structure of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance were tested first. It also tested any differential impact between organisations that adopted both ABC and ISO 9000, and organisations that adopted only ISO 9000. All results have been compared with previous studies to improve the understanding of the relationship among ABC, ISO 9000 and organisational performance.

The chapter provides a conclusion of all findings in relation to the study aims, objectives and hypotheses, as illustrated in section 6.1. The research contribution is presented in section 6.2, followed by the limitations and recommendations for further research in the last section.

6.1 Conclusion

The study aimed to investigate the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance. ABC, one of the most-studied management accounting fields in developed countries (Fei & Isa, 2010), is viewed as a theory of cost accounting (Malmi & Granlund, 2009). It is illustrative of an approach to aspects of management accounting that potentially improves organisational operation (Cooper & Kaplan, 1992). Even though improving organisational performance seems to be a positive role for ABC as illustrated in the literature (Askarany & Yazdifar, 2012), the studies on ABC and its impacts on organisational performance were still insufficient (Elhamma, 2015) and contradictory.

Many of the previous studies investigated the association (Ittner et al., 2002; Cagwin & Ortiz, 2005; Hardan & Shatnawi, 2013) and the impact (Banker et al., 2008) of ABC and organisational performance by measuring ABC in a category scale (a 0–1 variable), namely ABC-adopter and non-ABC adopter; or in a continuum of ABC adoption levels by applying only one indicator (Jankala & Silvola, 2012): or in the three dimensions of ABC implementation (Zaman, 2009). Banker et al. (2008) suggested that employing a more granular scale in measuring the extent of ABC implementation might give a greater insight into the causal relationship between ABC and performance. A feature of this research is that ABC is measured as a theoretical construct, which cannot be observed directly, rather than as a single observed variable. However, few studies such as Cagwin and Bouwman (2002) and Maiga and Jacobs (2008) measured ABC in terms of a construct. At present, little is known about measuring ABC in term of a construct, and related to this in particular, there is an absence of clarity concerning the dimensional structure of ABC.

From a management accounting perspective, ABC might improve performance when it is used concurrently with other initiatives (Cagwin & Bouwman, 2002; Jankala & Silvola, 2012) as ABC adoption by itself might not be as effective in improving performance (Banker et al., 2008). Some previous studies found a synergy effect of ABC and other initiatives on performance (Cagwin & Bouwman, 2002; Maiga & Jacobs, 2003; Cagwin & Ortiz, 2005), whereas others found no evidence indicating a complementarity in adoption (Larson & Kerr, 2002; Banker et al., 2008). A case has been made for a synergy effect of ABC and ISO 9000 processes in relation to the general system theory (GST), it is possible that both ABC and ISO 9000 are complementary (see section 2.4).

The principles of ISO 9000 are broadly accepted as necessary to effective quality management (Munting & Cruywagen, 2008). These principles could lead to organisational performance improvement (ISO 9004, 2009). Previous studies have focused on the requirements of implementing ISO 9001 and the association between ISO 9000 and performance. Little is known about measuring the ISO 9000 in terms of a construct; in particular, there is an absence of studying ISO 9000 in the context of ISO principles and the impact of this on organisational performance.

In order to achieve the objectives of this study, it commenced by extensively reviewing the literature in order to clarify the definition of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance (operational performance and financial performance). The extent of ABC use is defined as the degree to which ABC is used. The extent of ISO 9000 implementation is defined as the degree of putting ISO 9000 into effect. This study defines operational performance as the outcomes of an organisation relating to the organisation's processes. Financial performance is defined as the outcomes of an organisation relating to its financial situation.

In contrast to prior studies that have focused on the association and the impact of only ABC on organisational performance (Ittner et al., 2002; Maiga & Jacobs, 2008; Zaman, 2009; Jankala & Silvola, 2012; Hardan & Shatnawi, 2013). This study examines the impact of ABC in terms of the extent of ABC use on organisational performance, and the impact of the extent of ISO 9000 implementation on organisational performance in the absence of ABC. It also tests the significant differences between organisations that have adopted both ABC and ISO 9000, and organisations that adopted only ISO 9000.

The conceptual models were presented in Chapter 2 (see section 2.6) based on reviews of the literature and relevant theories: namely, general system theory (GST), scarce resources theory, and contingency theory. The synergy effect concept and the ceteris paribus tautology are also used to underpin the models in the study. These models depict the interrelation between the extent of ABC use, the extent of ISO 9000 implementation, and operational performance (OPP) and financial performance (FP), including various moderating variables (type of business, size of business, age of ABC, age of ISO 9000, and frequency of ABC use). They also guide the hypotheses that are tested in this study. The main hypotheses were: that the extent of ABC use/the extent of ISO 9000 implementation has a direct impact on FP and OPP; the extent of ABC use/the extent of ISO 9000 implementation has an indirect impact on FP through OPP; and the strength of the impact of the extent of ABC use/the extent of ISO 9000 implementation on FP and OPP depends on moderating variables.

In Chapter 3 (research methodology), the questionnaire design is discussed. In this study, all Thai ISO-9001-registered organisations were selected as a sample representation for the whole population. Three constructs (the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance) are operationalised by critically reviewing the previous studies in order to find valid measures for them. Firstly, the extent of ABC use was measured by nine purposes (indicators). Secondly, the extent of ISO 9000 implementation was measured by eight principles (indicators). Lastly, organisational performance was measured by seven indicators, which were previously applied in the ABC and ISO 9000 literature. A continuous scale of 1-7 was employed to measure the three constructs based on the results of a pre-test and pilot study.

601 (or 19.36 percent) out of 3,105 ISO-9001-registered organisations satisfactorily completed the questionnaire. All organisations were classified into two groups: organisations that adopted both ABC and ISO 9000 (191 cases), and organisations that adopted only ISO 9000 (410 cases). The first group was used to examine the impact of the extent of ABC use on organisational performance (Model 1), and investigate the impact of the extent of ISO 9000 implementation on organisational performance (Model 2). On the other hand, Model 3 employed data of the second group to test the impact of the extent of ISO 9000 implementation on organisational performance. Finally, Model 4 examines the impact of the extent of ISO 9000 implementation on organisational performance of all organisations studied.

The results of the screening the data (namely: sample size, missing data, outliers, normality, multicollinearity, linearity, and homoscedasticity) provided evidence that all the important conditions for employing EFA, CFA, and SEM, were met. The EFA result suggested that the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance are multidimensional. Each construct met the internal consistency requirements based on Cronbach's alpha and the corrected item-total correlation (CITC) results. In the CFA process, two models were specified: I) a one factor model with all indicators; and II) the first-order factors model. The CFA result provided evidence that the first-order factors model (Model II) fits the data better than a one-factor model (Model I), which affirms that these three constructs are multidimensional as EFA previously suggested. CFA also gave evidence of convergent validity and discriminant validity.

The extent of ABC use is composed of three dimensions: namely, cost analysis (CA), cost strategy (CS), and cost evaluation (CE). The extent of ISO 9000 implementation is composed of two dimensions: namely, management principle (MP), and cooperation principle (CP). Similarly, organisational performance is composed of two dimensions: namely, operational performance (OPP) and financial performance (FP). According to the different sample groups (Models 1, 2, 3, and 4) and results of factor analysis, the proposed hypotheses (in Chapter 2) are modified as shown in Tables 6.1-6.6. These tables also provide a complete summary of the findings of the thesis in the context of the hypotheses developed.

SEM first tested the impact of the extent of ABC use on organisational performance (Model 1). The results indicate that cost analysis (CA), cost strategy (CS), and cost evaluation (CE) directly improve operational performance (OPP), which is consistent with the study of Banker et al. (2008), which also found ABC had a positive impact on OPP improvement. The results also advance our understanding in the positive association between ABC and OPP in supporting the findings of Ittner et al. (2002) and Maiga and Jacobs (2008). However, the results show cost analysis (CA), cost strategy (CS), and cost evaluation (CE) does not directly improve financial performance (FP), but indirectly improves FP through OPP.

Three different models (Models 2, 3, and 4) further tested the impact of the extent of ISO 9000 implementation on organisational performance. The result of organisations that adopted both ABC and ISO 9000 (Model 2) indicates that management principle (MP) directly improves both operational performance (OPP) and financial performance (FP). In addition, MP indirectly improves FP through OPP. The result (direct impact on OPP) is consistent with Jang and Lin (2008) and Psomas et al. (2013). This result also advances our understanding of the association between ISO 9000 and OPP in supporting the findings of Naveh and Marcus (2005) and Feng et al. (2008). The result (the MP direct impact on FP) corroborates our understanding of the positive association between ISO 9000 and FP of Naveh and Marcus (2005), Feng et al. (2008) and Fatima (2014).

In Model 3, related to organisations that adopted only ISO 9000, there was no evidence of the direct or indirect impact on financial performance (FP) or operational performance (OPP). In contrast, for all the organisations studied (Model 4), the results show that management principle (MP) directly improves operational performance (OPP), in addition to indirectly improving FP through OPP. It is noted that cooperation principle (CP) is not shown to improve organisational performance among the three models (2, 3, and 4). It implies that CP would be ineffective in improving organisational performance.

The multi-group analysis result shows that the extent of ISO 9000 implementation of organisations that adopted both ABC and ISO 9000 has a much stronger impact on organisational performance than organisations that adopted only ISO 9000. It implies that there was complementarity or a synergy effect of ABC and ISO 9000. This result contradicts the finding of Larson and Kerr (2002), who found that ISO-9000 only organisations had better performances than organisations that adopted both ABC and ISO 9000. The multi-group analysis results also indicated the age of ABC moderates the impact of the extent of ABC use on organisational performance. There were no other statistically significant moderating impacts and this is at variance with expectations dictated by contingency theory and previous studies. This might be due to the limitation of sample sizes in testing multi-group analysis in this research etc (see sections 5.5 and 6.3).

6.2 Research contributions

This study contributes to the body of knowledge in relation to the development of performance improvement theory by investigating the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance. Additionally, it demonstrates a synergy effect between ABC and ISO 9000 in relation to general systems theory (GST) by demonstrating significant difference in impact between organisations that adopted both ABC and ISO 9000, and organisations that adopted only ISO 9000. Moderating impacts on organisational performance are also examined related to several contingency factors.

The contribution can be analysed into three levels: theoretical, methodological and empirical level, as follows.

6.2.1 Theoretical level

The study contributes to a theory of cost accounting and a theory of quality management. In ABC, little was known about measuring ABC in terms of a construct, and in particular, there was a lack of studies examining the impact of the extent of ABC use on organisational performance, especially an absence of clarity concerning the dimensional structure of ABC and organisational performance. This study provides evidence for management accounting research that advances our knowledge of the causal relationship between the extent of ABC use and organisational performance, as shown in the proposed model. The SEM result provides evidence to improve our understanding of the direct and indirect relationships between the extent of ABC use and financial performance. Consequently, similar studies can use these models in further research.

Regarding ISO 9000, most studies investigated the relationship between ISO 9000 and performance by focusing on the requirements of implementing ISO 9001. Little was known about measuring the ISO 9000 in term of ISO 9000 principles (ISO 9004, 2009) and as a construct, and in particular there was a lack of studies examining the impact of the extent of ISO 9000 implementation on organisational performance, especially an absence of clarity concerning the dimensional structure of ISO 9000 and organisational performance. This study provides evidence for quality management research by improving our knowledge of the causal relationship between the extent of ISO 9000 implementation and organisational performance, as shown in the proposed model. The SEM result provides evidence to improve our understanding of the direct and indirect relationships between the extent of ISO 9000 implementation and financial performance. Finally, the model presented here can be employed in similar studies in further research.

The multi-group analysis provides evidence that the extent of ISO 9000 implementation in organisations that adopted both ABC and ISO 9000 have a much stronger impact on organisational performance than organisations that adopted only ISO 9000. It implies a potential synergy effect between ABC and ISO 9000, which extends the body of knowledge for two different streams: management accounting research, and quality management research. In the light of a new complementary adoption of ABC and ISO 9000, this study is cross-disciplinary, which few previous studies have attempted. Thus, the results of this study contribute to the development of performance improvement theory.

6.2.2 Methodological level

As the first objective of this study was to test the dimensionality of the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance. The study employed EFA and CFA in order to test the dimensional construct. This is the first study that examined the dimensionality of the extent of ABC use construct in terms of purposes, the extent of ISO 9000 implementation in terms of the principles, and organisational performance by employing EFA and further CFA, by testing the goodness-of-fit (GOF) indices of the two models (Model I and II).

The key contribution at the methodological level is the use of Cronbach's alpha, CITC, EFA, and CFA, testing the dimensional nature of the constructs employed, in addition to testing the hypotheses using SEM. SEM provides greater credibility to the findings, especially in the large sample size because it deals with a system of simultaneous regression equations and manages measurement error. It is also flexible for analysing complex relationships among multiple variables in order to test both direct effects and indirect effects. The study also validated the models by using the bootstrap technique, by considering the Cross validation index (ECVI), Bayesian information criterion (BIC) and Akaike information criterion (AIC). Thus, the models can be replicated in subsequent research.

Most previous studies in the management accounting literature and quality management literature commonly used the regression analysis technique. However, with regard to measurement error, regression analysis technique will tend to underestimate the findings. Therefore, in the light of encouragement to adopt more sophisticated techniques, SEM, especially in covariance structural analysis, might be recommended in management accounting and quality management researches as an alternative and improved manner in which to explain relationships.

To the best of the researcher's knowledge, this study employed multi-group analysis for the first time in testing the significant differences between two groups (organisations that adopted both ABC and ISO 9000, and organisation that adopted only ISO 9000) in order to determine a synergy effect between ABC and ISO 9000. In addition to examining moderating impacts on the relationship between ABC and ISO 9000 and organisational performance, which no previous studies in ABC and ISO 9000 research has employed before.

6.2.3 Practical level

The results of the study provide evidence that the extent of ABC use in terms of cost analysis (CA), cost strategy (CS), and cost evaluation (CE) can positively impact operational performance, subsequently leading to financial performance improvement. It may help an organisation in considering more extensive use of ABC for cost analysis (CA), cost strategy (CS), and cost evaluation (CE). The findings show the extensive use of ABC for various purposes has the benefit in improving both operational and financial performance.

In ISO 9000, conversely, there is no evidence indicating the extent of ISO 9000 implementation (MP: management principle, and CP: cooperation principle) impacts on organisational performance in organisations that adopted only ISO 9000. However, for organisations that adopted both ABC and ISO 9000, this study provides evidence that management principle (MP) can directly improve both operational performance and financial performance.

These results raise two important questions for organisations concerning the ISO 9000 implementation. Firstly, if an organisation adopted only ISO 9000 without using ABC, it might not be sufficient in improving organisational performance. ABC highlights value-adding and non-value-adding activities, which motivate and justify the need for ISO 9000 practice. Likewise, ISO 9000 elaborates in much more detail about each process in product/service activities, which helps ABC to specify cost drivers. Hence, a better outcome may come from implementing the two cross-disciplinary practices. Secondly, the cooperation principle (CP) does not appear to improve organisational performance in this study. It is possible that this principle might offer benefit in other aspects, but improving organisational is not detected. It is possible that future research could give greater attention to this variable and develop more appropriate and robust construct.

In summary, the study findings may motivate organisations concerning extensively using ABC and implementing ISO 9000 principles to achieve organisational performance improvement as the optional strategy in running the business.

6.3 Limitations and recommendations for further research

This study examined the impact of the extent of ABC use and the extent of ISO 9000 implementation on organisational performance. However, the effect of other variables (apart from ABC and ISO 9000) might impact on performance, such as inflation rate, government policy, and other organisational initiatives/ practices. Typically, the research adopted the ceteris paribus assumption that all other things remain the same, except those under immediate consideration. The effect of these independent constructs on dependent constructs was assumed in isolation. Hence, further study may consider other factors that influence organisational performance.

The survey used perceptual measures to assess the impact of the extent of ABC use and the extent of ISO 9000 implementation on financial performance (FP). In future research, measuring financial performance by using actual published financial data would be helpful and complementary to the results shown here. The research focused on all ISO 9000 registered companies in Thailand. Although the principles of ISO 9000 are international, extending these results to all ISO 9000 registered companies should be undertaken with care.

One limitation is sample size of each group in testing the moderating impacts. Even though sample size was adequate in testing multi-group analysis, some samples were small, further study is suggested to employ an even larger sample. Additionally, a quantitative approach was employed in this current study for investigating causal relationships. Further research may as a step towards advancing in-depth understanding, be undertaken by conducting case studies or interview. Finally, because of time limitation, this study was conducted using a cross-sectional method. Future studies could consider the use of longitudinal data, as it would be valuable over time to demonstrate a continued causal relationship between the extent of ABC use, the extent of ISO 9000 implementation, and organisational performance.

Notwithstanding the limitations mentioned above, the research represented a significant study of organisational performance in the context of ABC and ISO 9000. Further, it used sophisticated techniques to identify constructs related to these items and incorporate them in a SEM analysis, which revealed significant findings, which have theoretical, methodological, and practical contributions.

Table 6.1: Summary of all hypotheses (direct impact on FP and OPP, and indirect impact on FP)

Model	Direct impact on FP		Direct impact on OPP		Indirect impact on FP through OPP	
	Alternative Hypothesis (H_{alt})	**Results**	**Alternative Hypothesis (H_{alt})**	**Results**	**Alternative Hypothesis (H_{alt})**	**Results**
1	H1a:CA has positive impact on FP	Fail to Reject H_{Null}	H2a:CA has positive impact on OPP	***Rejected H_{Null}***	H3a:CA has positive impact on FP through OPP	***Rejected H_{Null}***
	H1b:CS has positive impact on FP	Fail to Reject H_{Null}	H2b:CS has positive impact on OPP	***Rejected H_{Null}***	H3b:CS has positive impact on FP through OPP	***Rejected H_{Null}***
	H1c:CE has positive impact on FP	Fail to Reject H_{Null}	H2c:CE has positive impact on OPP	***Rejected H_{Null}***	H3c:CE has positive impact on FP through OPP	***Rejected H_{Null}***
2	H4a:MP has positive impact on FP	***Rejected H_{Null}***	H5a:MP has positive impact on OPP	***Rejected H_{Null}***	H6a:MP has positive impact on FP through OPP	***Rejected H_{Null}***
	H4b:CP has positive impact on FP	Fail to Reject H_{Null}	H5b:CP has positive impact on OPP	Fail to Reject H_{Null}	H6b:CP has positive impact on FP through OPP	Fail to Reject H_{Null}
3	H7a:MP has positive impact on FP	Fail to Reject H_{Null}	H8a:MP has positive impact on OPP	Fail to Reject H_{Null}	H9a:MP has positive impact on FP through OPP	Fail to Reject H_{Null}
	H7b:CP has positive impact on FP	Fail to Reject H_{Null}	H8b:CP has positive impact on OPP	Fail to Reject H_{Null}	H9b:CP has positive impact on FP through OPP	Fail to Reject H_{Null}
4	H10a:MP has positive impact on FP	Fail to Reject H_{Null}	H11a:MP has positive impact on OPP	***Rejected H_{Null}***	H12a:MP has positive impact on FP through OPP	***Rejected H_{Null}***
	H10b:CP has positive impact on FP	Fail to Reject H_{Null}	H11b:CP has positive impact on OPP	Fail to Reject H_{Null}	H12b:CP has positive impact on FP through OPP	Fail to Reject H_{Null}

Note: FP: Financial Performance, OPP: Operational performance, CA: Cost analysis, CS: Cost strategy, CE: Cost evaluation, MP: Management principle, CP: Cooperation principle. In this study, if $P < 0.05$, then the Null hypothesis (H_{Null}) is rejected.

Hypothesis 13 is not included in the Table. It is hypothesized that there are significant differences between organisations that adopted both ABC and ISO 9000 (Model 2) and organisations that adopted only ISO 9000 (Model 3)

Table 6.2: Summary of all hypotheses (moderating factor: type of business)

Model	Direct impact on FP		Direct impact on OPP	
	Alternative Hypothesis (H_{alt})	**Results**	**Alternative Hypothesis (H_{alt})**	**Results**
1	H14a:The strength of the impact of CA on FP depends on type of business	Fail to Reject H_{Null}	H15a:The strength of the impact of CA on OPP depends on type of business	Fail to Reject H_{Null}
	H14b:The strength of the impact of CS on FP depends on type of business	Fail to Reject H_{Null}	H15b:The strength of the impact of CS on OPP depends on type of business	Fail to Reject H_{Null}
	H14a:The strength of the impact of CE on FP depends on type of business	Fail to Reject H_{Null}	H15a:The strength of the impact of CE on OPP depends on type of business	Fail to Reject H_{Null}
2	H16a:The strength of the impact of MP on FP depends on type of business	Fail to Reject H_{Null}	H17a:The strength of the impact of MP on OPP depends on type of business	Fail to Reject H_{Null}
	H16b:The strength of the impact of CP on FP depends on type of business	Fail to Reject H_{Null}	H17b:The strength of the impact of CP on OPP depends on type of business	Fail to Reject H_{Null}
3	H18a:The strength of the impact of MP on FP depends on type of business	Fail to Reject H_{Null}	H19a:The strength of the impact of MP on OPP depends on type of business	Fail to Reject H_{Null}
	H18b:The strength of the impact of CP on FP depends on type of business	Fail to Reject H_{Null}	H19b:The strength of the impact of CP on OPP depends on type of business	Fail to Reject H_{Null}
4	H20a:The strength of the impact of MP on FP depends on type of business	Fail to Reject H_{Null}	H21a:The strength of the impact of MP on OPP depends on type of business	Fail to Reject H_{Null}
	H20b:The strength of the impact of CP on FP depends on type of business	Fail to Reject H_{Null}	H21b:The strength of the impact of CP on OPP depends on type of business	Fail to Reject H_{Null}

Note: FP: Financial Performance, OPP: Operational performance, CA: Cost analysis, CS: Cost strategy, CE: Cost evaluation, MP: Management principle, CP: Cooperation principle. In this study, if $P < 0.05$, then the Null hypothesis (H_{Null}) is rejected.

Table 6.3: Summary of all hypotheses (moderating factor: size of business)

Model	Direct impact on FP		Direct impact on OPP	
	Alternative Hypothesis (H_{alt})	**Results**	**Alternative Hypothesis (H_{alt})**	**Results**
1	H22a:The strength of the impact of CA on FP depends on size of business	Fail to Reject H_{Null}	H23a:The strength of the impact of CA on OPP depends on size of business	Fail to Reject H_{Null}
	H22b:The strength of the impact of CS on FP depends on size of business	Fail to Reject H_{Null}	H23b:The strength of the impact of CS on OPP depends on size of business	Fail to Reject H_{Null}
	H22a:The strength of the impact of CE on FP depends on size of business	Fail to Reject H_{Null}	H23a:The strength of the impact of CE on OPP depends on size of business	Fail to Reject H_{Null}
2	H24a:The strength of the impact of MP on FP depends on size of business	Fail to Reject H_{Null}	H25a:The strength of the impact of MP on OPP depends on size of business	Fail to Reject H_{Null}
	H24b:The strength of the impact of CP on FP depends on size of business	Fail to Reject H_{Null}	H25b:The strength of the impact of CP on OPP depends on size of business	Fail to Reject H_{Null}
3	H26a:The strength of the impact of MP on FP depends on size of business	Fail to Reject H_{Null}	H27a:The strength of the impact of MP on OPP depends on size of business	Fail to Reject H_{Null}
	H26b:The strength of the impact of CP on FP depends on size of business	Fail to Reject H_{Null}	H27b:The strength of the impact of CP on OPP depends on size of business	Fail to Reject H_{Null}
4	H28a:The strength of the impact of MP on FP depends on size of business	Fail to Reject H_{Null}	H29a:The strength of the impact of MP on OPP depends on size of business	Fail to Reject H_{Null}
	H28b:The strength of the impact of CP on FP depends on size of business	Fail to Reject H_{Null}	H29b:The strength of the impact of CP on OPP depends on size of business	Fail to Reject H_{Null}

Note: FP: Financial Performance, OPP: Operational performance, CA: Cost analysis, CS: Cost strategy, CE: Cost evaluation, MP: Management principle, CP: Cooperation principle. In this study, if $P < 0.05$, then the Null hypothesis (H_{Null}) is rejected.

Table 6.4 Summary of all hypotheses (moderating factor: age of ABC)

Model	Direct impact on FP		Direct impact on OPP	
	Alternative Hypothesis (*H_{alt}*)	**Results**	**Alternative Hypothesis (*H_{alt}*)**	**Results**
1	H30a:The strength of the impact of CA on FP depends on age of ABC	Fail to Reject H_{Null}	H31a:The strength of the impact of CA on OPP depends on age of ABC	**Rejected *H_{Null}***
	H30b:The strength of the impact of CS on FP depends on age of ABC	Fail to Reject H_{Null}	H31b:The strength of the impact of CS on OPP depends on age of ABC	**Rejected *H_{Null}***
	H30a:The strength of the impact of CE on FP depends on age of ABC	Fail to Reject H_{Null}	H31a:The strength of the impact of CE on OPP depends on age of ABC	Fail to Reject H_{Null}
2	H32a:The strength of the impact of MP on FP depends on age of ABC	Fail to Reject H_{Null}	H33a:The strength of the impact of MP on OPP depends on age of ABC	Fail to Reject H_{Null}
	H32b:The strength of the impact of CP on FP depends on age of ABC	Fail to Reject H_{Null}	H33b:The strength of the impact of CP on OPP depends on age of ABC	Fail to Reject H_{Null}
3	N/A		N/A	
4	N/A		N/A	

Note: FP: Financial Performance, OPP: Operational performance, CA: Cost analysis, CS: Cost strategy, CE: Cost evaluation, MP: Management principle, CP: Cooperation principle. In this study, if $P < 0.05$, then the Null hypothesis (*H_{Null}*) is rejected.

Table 6.5: Summary of all hypotheses (moderating factor: age of ISO 9000)

Model	Direct impact on FP		Direct impact on OPP	
	Alternative Hypothesis (H_{alt})	Results	Alternative Hypothesis (H_{alt})	Results
1	H34a:The strength of the impact of CA on FP depends on age of ISO 9000	Fail to Reject H_{Null}	H35a:The strength of the impact of CA on OPP depends on age of ISO 9000	Fail to Reject H_{Null}
	H34b:The strength of the impact of CS on FP depends on age of ISO 9000	Fail to Reject H_{Null}	H35b:The strength of the impact of CS on OPP depends on age of ISO 9000	Fail to Reject H_{Null}
	H34a:The strength of the impact of CE on FP depends on age of ISO 9000	Fail to Reject H_{Null}	H35a:The strength of the impact of CE on OPP depends on age of ISO 9000	Fail to Reject H_{Null}
2	H36a:The strength of the impact of MP on FP depends on age of ISO 9000	Fail to Reject H_{Null}	H37a:The strength of the impact of MP on OPP depends on age of ISO 9000	Fail to Reject H_{Null}
	H36b:The strength of the impact of CP on FP depends on age of ISO 9000	Fail to Reject H_{Null}	H37b:The strength of the impact of CP on OPP depends on age of ISO 9000	Fail to Reject H_{Null}
3	H38a:The strength of the impact of MP on FP depends on age of ISO 9000	Fail to Reject H_{Null}	H39a:The strength of the impact of MP on OPP depends on age of ISO 9000	Fail to Reject H_{Null}
	H38b:The strength of the impact of CP on FP depends on age of ISO 9000	Fail to Reject H_{Null}	H39b:The strength of the impact of CP on OPP depends on age of ISO 9000	Fail to Reject H_{Null}
4	H40a:The strength of the impact of MP on FP depends on age of ISO 9000	Fail to Reject H_{Null}	H41a:The strength of the impact of MP on OPP depends on age of ISO 9000	Fail to Reject H_{Null}
	H40b:The strength of the impact of CP on FP depends on age of ISO 9000	Fail to Reject H_{Null}	H41b:The strength of the impact of CP on OPP depends on age of ISO 9000	Fail to Reject H_{Null}

Note: FP: Financial Performance, OPP: Operational performance, CA: Cost analysis, CS: Cost strategy, CE: Cost evaluation, MP: Management principle, CP: Cooperation principle. In current study, if $P < 0.05$, then the Null hypothesis (H_{Null}) is rejected.

Table 6.6: Summary of all hypotheses (moderating factor: frequency use of ABC)

Model	Direct impact on FP		Direct impact on OPP	
	Alternative Hypothesis (H_{alt})	**Results**	**Alternative Hypothesis (H_{alt})**	**Results**
1	H42a:The strength of the impact of CA on FP depends on the frequency use of ABC H42b:The strength of the impact of CS on FP depends on the frequency use of ABC H43a:The strength of the impact of CE on FP depends on the frequency use of ABC	Fail to Reject H_{Null} Fail to Reject H_{Null} Fail to Reject H_{Null}	H43a:The strength of the impact of CA on OPP depends on frequency use of ABC H43b:The strength of the impact of CS on OPP depends on frequency use of ABC H43a:The strength of the impact of CE on OPP depends on frequency use of ABC	Fail to Reject H_{Null} Fail to Reject H_{Null} Fail to Reject H_{Null}
2	H44a:The strength of the impact of MP on FP depends on the frequency use of ABC H44b:The strength of the impact of CP on FP depends on the frequency use of ABC	Fail to Reject H_{Null} Fail to Reject H_{Null}	H45a:The strength of the impact of MP on OPP depends on frequency use of ABC H45b:The strength of the impact of CP on OPP depends on frequency use of ABC	Fail to Reject H_{Null} Fail to Reject H_{Null}
3	N/A		N/A	
4	N/A		N/A	

Note: FP: Financial Performance, OPP: Operational performance, CA: Cost analysis, CS: Cost strategy, CE: Cost evaluation, MP: Management principle, CP: Cooperation principle. In this study, if $P < 0.05$, then the Null hypothesis (H_{Null}) is rejected.

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Appendices

Appendix A: The questionnaire

The questionnaire for the

STUDY OF ISO 9000 and ACTIVITY-BASED COSTING in Thailand

Thank you for taking your time to complete this questionnaire. I am a doctoral student at University of Hull, in the UK, pursuing a degree entitled “The Impact of ISO 9000 and Activity-Based Costing on Organisational Performance”. The purpose of this study is to examine “The Impact of ISO 9000 and Activity-Based Costing on Organisational Performance”. This investigation is required understanding “The Impact of ISO 9000 certification and Activity-Based Costing” as both a separate initiative and combined initiatives.

If you would like to participate in the prize draw of £150 and receive a summary report of the study results, please provide your information in the space below or enclose a business card. I will be delighted to provide you with this information. Additionally, if you have any concerns or questions related to this survey, please contact my supervisor, Dr Marcjanna Augustyn, Hull University Business School, The University of Hull, Scarborough Campus, Filey Road, Scarborough, YO11 3AZ, United Kingdom, email: m.augustyn@hull.ac.uk. All responses to this survey will be kept confidential and secure. The results will be used only for academic purposes with no specific individuals or firms identified. ***Please return the completed questionnaire using the self-addressed envelope enclosed within ten days.***

Name………………………………………...

Position …………………………………………...……...........................

Organisation Name………………………………………………………………………….…...................

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Questionnaire our reference.........

The Impact of ISO 9000 and Activity-Based Costing on Organisational Performance

Before answering a question that contains a reference number (1-18), please read the definition of the relevant term in glossary on page 5.

Section A: ISO 9000 Certification

1. How many years has the organisation had ISO 9001 certification[1]? Please indicate the number of years.

- ○ …………………….. year(s)

2. Please indicate the extent to which you agree or disagree with the following statements about the implementation of ISO 9000 principles in your organisation by circling a number on the scale from 1 representing "strongly disagree" to 7 representing "strongly agree".

Our organisation fully implements ISO 9000 principles (as defined in 9004:2009) of :	**Strongly disagree**						**Strongly agree**
2.1 Customer focus[2]	1	2	3	4	5	6	7
2.2 Leadership[3]	1	2	3	4	5	6	7
2.3 Involvement of people[4]	1	2	3	4	5	6	7
2.4 Process approach[5]	1	2	3	4	5	6	7
2.5 System approach to management[6]	1	2	3	4	5	6	7
2.6 Continual improvement[7]	1	2	3	4	5	6	7
2.7 Factual approach to decision making[8]	1	2	3	4	5	6	7
2.8 Mutually beneficial supplier relationship[9]	1	2	3	4	5	6	7

3. Please indicate the extent to which you agree or disagree with the following statements about the organisational performance of your organisation by circling a number on the scale from 1 representing "strongly disagree" to 7 representing "strongly agree".

I believe that since obtaining the ISO 9001 certification..........	**Strongly disagree**						**Strongly agree**
3.1 our sales[12] have increased	1	2	3	4	5	6	7
3.2 our ROA[13] has increased	1	2	3	4	5	6	7
3.3 our total costs[14] have decreased	1	2	3	4	5	6	7
3.4 our product/service quality[15] has improved	1	2	3	4	5	6	7
3.5 our delivery reliability[16] has improved	1	2	3	4	5	6	7
3.6 our process efficiency[17] has improved	1	2	3	4	5	6	7
3.7 our process effectiveness[18] has improved	1	2	3	4	5	6	7

Section B: Activity-Based Costing (ABC)[11]

4. Has your organisation adopted Activity-Based Costing (ABC)?
- ○ Yes (*Please go to question 5,6, 7 and section C,D)*
- ○ No (*Please skip to section C, D)*

5. Please indicate the extent to which you agree or disagree with the following statements about the extent of ABC use in your organisation by circling a number on the scale from 1 representing "strongly disagree" to 7 representing "strongly agree".

The extent of ABC use	**Strongly disagree**						**Strongly agree**
5.1 ABC is consistently used for the following purposes:							
a. Product[10] costing	1	2	3	4	5	6	7
b. Cost management	1	2	3	4	5	6	7
c. Pricing decisions	1	2	3	4	5	6	7
d. Product[10] mix decisions	1	2	3	4	5	6	7
e. Determine customer profitability	1	2	3	4	5	6	7
f. Budgeting	1	2	3	4	5	6	7
g. As an off-line analytic tool	1	2	3	4	5	6	7
h. Outsourcing decisions	1	2	3	4	5	6	7
i. Performance measurement	1	2	3	4	5	6	7
5.2 ABC is used systematically as a part of our normal routines	1	2	3	4	5	6	7

6. Please indicate the extent to which you agree or disagree with the following statements about the organisational performance of your organisation by circling a number on the scale from 1 representing "strongly disagree" to 7 representing "strongly agree".

I believe that since obtaining Activity-Based Costing..........	**Strongly disagree**						**Strongly agree**
6.1 our sales[12] have increased	1	2	3	4	5	6	7
6.2 our ROA[13] has increased	1	2	3	4	5	6	7
6.3 our total costs[14] have decreased	1	2	3	4	5	6	7
6.4 our product/service quality[15] has improved	1	2	3	4	5	6	7
6.5 our delivery reliability[16] has improved	1	2	3	4	5	6	7
6.6 our process efficiency[17] has improved	1	2	3	4	5	6	7
6.7 our process effectiveness[18] has improved	1	2	3	4	5	6	7

7. How many years has the organisation used ABC? Please indicate the number of years.
- ○ …………………….. year(s)

Section C: Organisation Characteristics

8. Please classify your organisation's main activity according to the following type of business (Please choose only one answer).
    - o Manufacturing
    - o Non-Manufacturing

9. Please indicate the number of employees (full-time equivalent) in your organisation.
    - o …………………….. employees(s)

10. Please indicate the annual revenues of your organisation.
    - o …………………….. baht(s)

Section D: Demography

11. Please select your position in your organisation:
    - o Chief Executive Officer
    - o Managing Director
    - o Others, please specify…………………………

12. How long have you worked in this organisation? Please indicate the number of years.
    - o …………………….. year(s)

13. How long have you been in this position? (As you selected in question 11) Please indicate the number of years.
    - o …………………….. year(s)

14. How long have you been involved in ISO 9001? Please indicate the number of years.
    - o …………………….. year(s)

15. How long have you been involved in Activity-Based costing? Please indicate the number of years. (Based on your own experience even if your organisation has not adopted ABC)
    - o …………………….. year(s)

Thank you for your time and for sharing experiences

Glossary-ISO 9000 Certification

[1]**ISO 9000 (ISO)** is the internationally recognized standard for the quality management of businesses. It is applied to the processes that create and control the products, services and organisation supplies. Additionally, it prescribes systematic control of activities to ensure that the needs and expectations of customers are met. ISO 9001 is designed and intended to apply virtually to any product made by any process anywhere in the world.

[2]**Customer focus** Organisations depend on their customers and therefore should understand current and future customer needs, meet customer requirements and strive to exceed customer expectations.

[3]**Leadership** Leaders establish unity of purpose and direction of the organisation. They should create and maintain the internal environment in which people can become fully involved in achieving the organisation's objectives.

[4]**Involvement of people** People at all levels are the essence of an organisation and their full involvement enables their abilities to be used for the organisation's benefit.

[5]**Process approach** A desired result is achieved more efficiently when activities and related resources are managed as a process

[6]**System approach to management** Identifying, understanding and managing interrelated processes as a system contributes to the organisation's effectiveness and efficiency in achieving its objectives.

[7]**Continual improvement** Continual improvement of the organisation's overall performance should be a permanent objective of the organisation.

[8]**Factual approach to decision making** Effective decisions are based on the analysis of data and information.

[9]**Mutually beneficial supplier relationship** An organisation and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

[10]**Product** is a) product intended for, or required by, a customer, b) any intended output resulting from the product realization processes. Wherever the term “product” occurs, it can also mean “service”.

Glossary-Activity-Based Costing

[11]**Activity-Based Costing (ABC)** is an information system that maintains and processes data on an organisation’s activities and products/services. ABC identifies the activities performed, traces cost to these activities and then traces the cost of activities to products/services according to the activities consumed.

Glossary-Organisational Performance

[12]**Sales** main income received from selling goods or services

[13]**Return on assets (ROA)** net income before corporate tax divided by total assets.

[14]**Total costs** include all four categories of costs: 1) direct material costs (materials that are directly traceable to the goods or services being produced), 2) direct labour costs (the labours that are directly traceable to the goods or service being produced), 3) overhead costs (all production costs other than direct materials and direct labour) and 4) period costs (all costs that are not product costs/service costs, for example, advertising costs, office supplies costs, research and development costs and CEOs' salaries).

[15]**Product/service quality** is the degree to which a set of inherent characteristics fulfils requirements. Requirement is need or expectation that is stated, generally implied.

[16]**Delivery reliability** is the ability to deliver consistently on the promised due date.

[17]**Process efficiency** is the maximum possible output has been achieved with the smallest possible resources used.

[18]**Process effectiveness** is the extent to which planned activities are realized and planned results achieved.

Appendix B: Levene's Test for Equality of Variances

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ISO-X1	Equal variances assumed	.536	.467	-.374	58	.710	-.067	.178	-.424	.290
	Equal variances not assumed			-.374	57.773	.710	-.067	.178	-.424	.290
ISO-X2	Equal variances assumed	.338	.563	-.687	58	.495	-.167	.243	-.652	.319
	Equal variances not assumed			-.687	57.556	.495	-.167	.243	-.653	.319
ISO-X3	Equal variances assumed	.088	.767	.889	58	.378	.167	.187	-.209	.542
	Equal variances not assumed			.889	57.998	.378	.167	.187	-.209	.542
ISO-X4	Equal variances assumed	.015	.904	.628	58	.532	.100	.159	-.219	.419
	Equal variances not assumed			.628	57.375	.532	.100	.159	-.219	.419
ISO-X5	Equal variances assumed	2.173	.146	-.226	58	.822	-.033	.148	-.329	.262
	Equal variances not assumed			-.226	55.491	.822	-.033	.148	-.329	.263
ISO-X6	Equal variances assumed	.605	.440	.000	58	1.000	.000	.197	-.393	.393
	Equal variances not assumed			.000	51.439	1.000	.000	.197	-.394	.394
ISO-X7	Equal variances assumed	.596	.443	1.147	58	.256	.233	.204	-.174	.641
	Equal variances not assumed			1.147	56.772	.256	.233	.204	-.174	.641
ISO-X8	Equal variances assumed	.065	.799	1.105	58	.274	.267	.241	-.216	.750
	Equal variances not assumed			1.105	56.496	.274	.267	.241	-.217	.750

Note: Significant level is less than 0.05

(Appendix B)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ISO-Y1	Equal variances assumed	.663	.419	-.475	58	.637	-.133	.281	-.696	.429
	Equal variances not assumed			-.475	54.374	.637	-.133	.281	-.696	.430
ISO-Y2	Equal variances assumed	.114	.737	1.284	58	.204	.300	.234	-.168	.768
	Equal variances not assumed			1.284	57.119	.204	.300	.234	-.168	.768
ISO-Y3	Equal variances assumed	.099	.754	2.986	58	.004	.833	.279	.275	1.392
	Equal variances not assumed			2.986	56.804	.004	.833	.279	.274	1.392
ISO-Y4	Equal variances assumed	1.442	.235	.430	58	.669	.133	.310	-.488	.754
	Equal variances not assumed			.430	55.957	.669	.133	.310	-.488	.755
ISO-Y5	Equal variances assumed	3.102	.083	-.894	58	.375	-.267	.298	-.863	.330
	Equal variances not assumed			-.894	53.510	.375	-.267	.298	-.865	.331
ISO-Y6	Equal variances assumed	.331	.567	1.266	58	.211	.333	.263	-.194	.860
	Equal variances not assumed			1.266	57.746	.211	.333	.263	-.194	.861
ISO-Y7	Equal variances assumed	.309	.581	.294	58	.770	.067	.227	-.388	.521
	Equal variances not assumed			.294	57.900	.770	.067	.227	-.388	.521

Note: Significant level is less than 0.05

(Appendix B)

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ABC-X1	Equal variances assumed	.286	.600	.422	18	.678	.162	.383	-.643	.966
	Equal variances not assumed			.428	17.922	.673	.162	.377	-.631	.954
ABC-X2	Equal variances assumed	.323	.577	1.262	18	.223	.525	.416	-.349	1.400
	Equal variances not assumed			1.262	17.196	.224	.525	.416	-.352	1.403
ABC-X3	Equal variances assumed	1.474	.240	.112	18	.912	.030	.271	-.539	.600
	Equal variances not assumed			.115	17.870	.910	.030	.263	-.522	.583
ABC-X4	Equal variances assumed	.613	.444	.573	18	.574	.273	.476	-.727	1.273
	Equal variances not assumed			.579	17.771	.570	.273	.471	-.718	1.263
ABC-X5	Equal variances assumed	.044	.837	-.094	18	.926	-.051	.537	-1.180	1.079
	Equal variances not assumed			-.094	17.158	.926	-.051	.538	-1.185	1.084
ABC-X6	Equal variances assumed	.372	.549	-.032	18	.975	-.020	.634	-1.352	1.311
	Equal variances not assumed			-.031	15.786	.975	-.020	.645	-1.389	1.349
ABC-X7	Equal variances assumed	.002	.962	.501	18	.623	.222	.444	-.710	1.155
	Equal variances not assumed			.502	17.411	.622	.222	.443	-.710	1.154
ABC-X8	Equal variances assumed	.241	.629	-.521	18	.609	-.323	.620	-1.626	.980
	Equal variances not assumed			-.520	17.087	.610	-.323	.622	-1.634	.988
ABC–X9	Equal variances assumed	.479	.498	-.352	18	.729	-.111	.316	-.775	.552
	Equal variances not assumed			-.361	17.969	.722	-.111	.308	-.758	.535
ABC-X10	Equal variances assumed	.274	.607	-.031	18	.976	-.020	.651	-1.389	1.348
	Equal variances not assumed			-.031	17.189	.976	-.020	.652	-1.394	1.354

Note: Significant level is less than 0.05

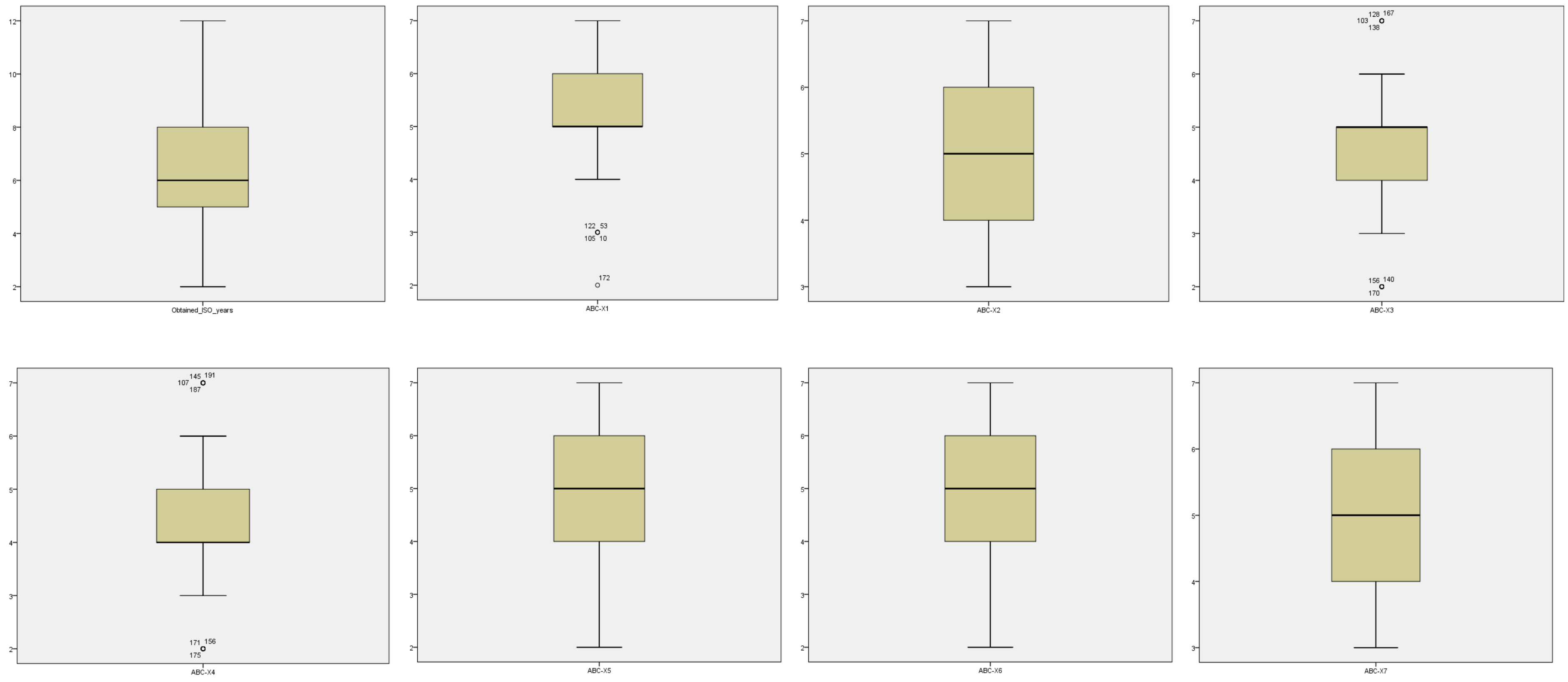
(Appendix B)

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ABC-Y1	Equal variances assumed	.295	.594	.068	18	.946	.040	.592	-1.203	1.283
	Equal variances not assumed			.068	16.334	.947	.040	.598	-1.226	1.307
ABC-Y2	Equal variances assumed	.298	.592	-.116	18	.909	-.061	.521	-1.155	1.034
	Equal variances not assumed			-.117	17.608	.908	-.061	.518	-1.150	1.028
ABC-Y3	Equal variances assumed	.536	.474	.420	18	.679	.141	.337	-.566	.849
	Equal variances not assumed			.411	15.343	.687	.141	.344	-.591	.874
ABC-Y4	Equal variances assumed	.212	.651	.609	18	.550	.202	.332	-.495	.899
	Equal variances not assumed			.602	16.329	.555	.202	.335	-.508	.912
ABC-Y5	Equal variances assumed	.003	.956	.787	18	.442	.333	.424	-.557	1.224
	Equal variances not assumed			.799	17.917	.435	.333	.417	-.544	1.211
ABC-Y6	Equal variances assumed	.000	.989	.461	18	.651	.152	.329	-.539	.842
	Equal variances not assumed			.464	17.591	.649	.152	.327	-.536	.839
ABC-Y7	Equal variances assumed	.722	.407	.153	18	.880	.051	.331	-.644	.745
	Equal variances not assumed			.155	17.961	.878	.051	.325	-.632	.733

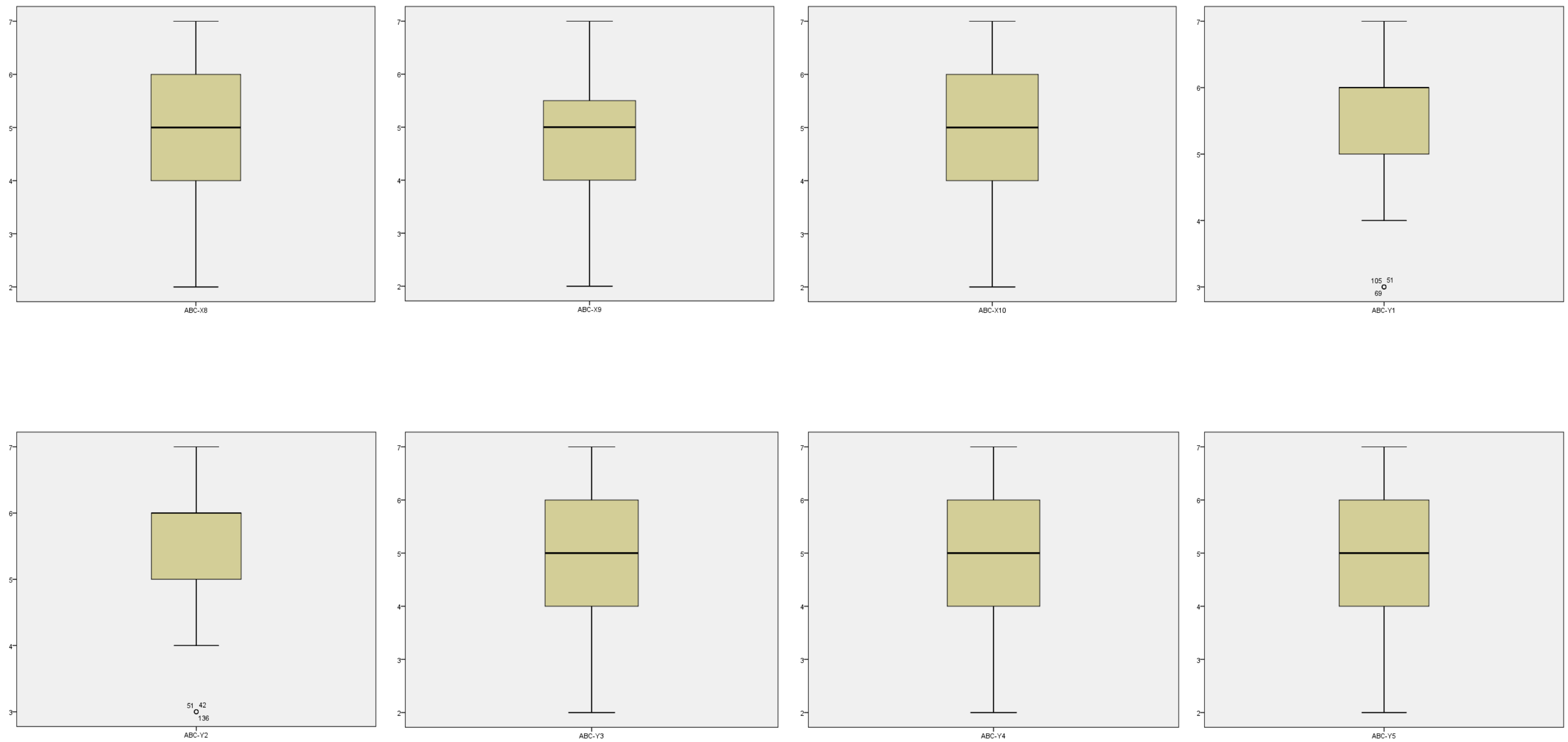
Note: Significant level is less than 0.05

Appendix C: Outliers test

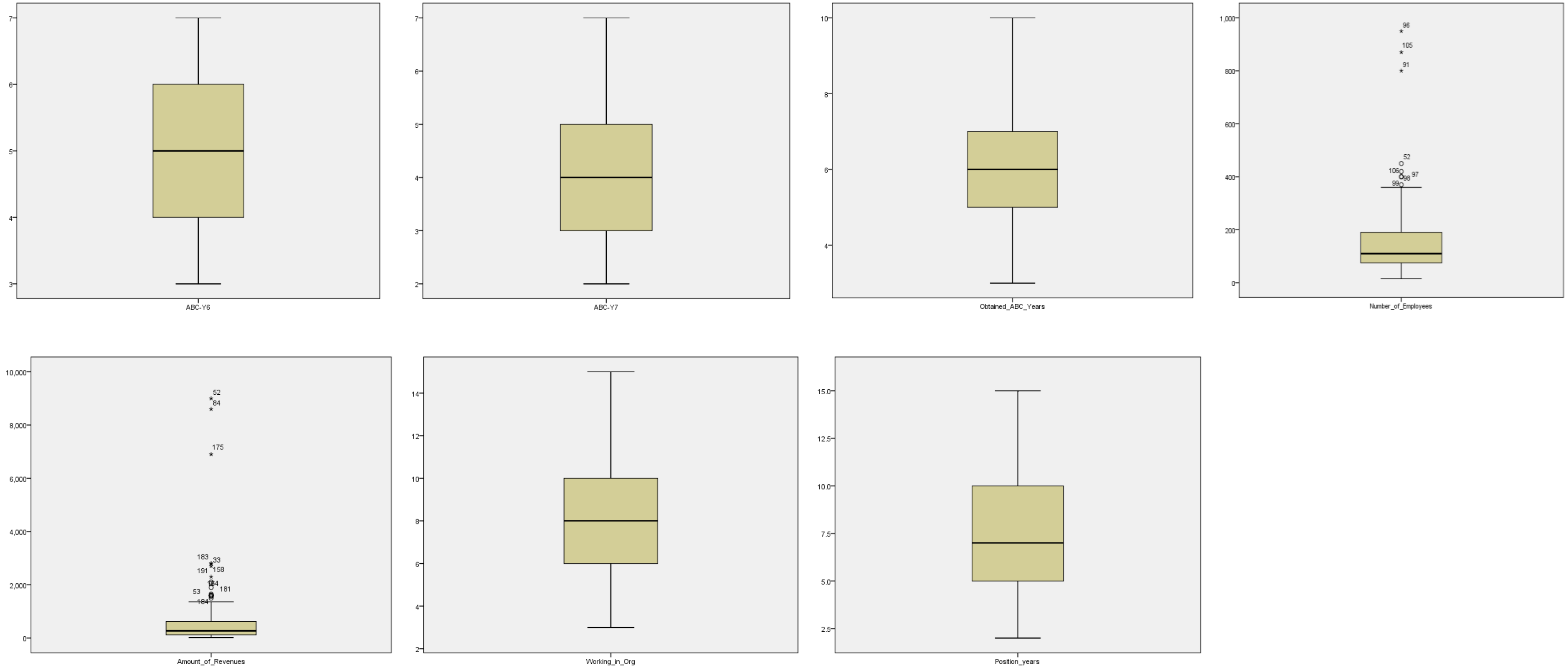
Appendix C-1: Outliers (Model 1)



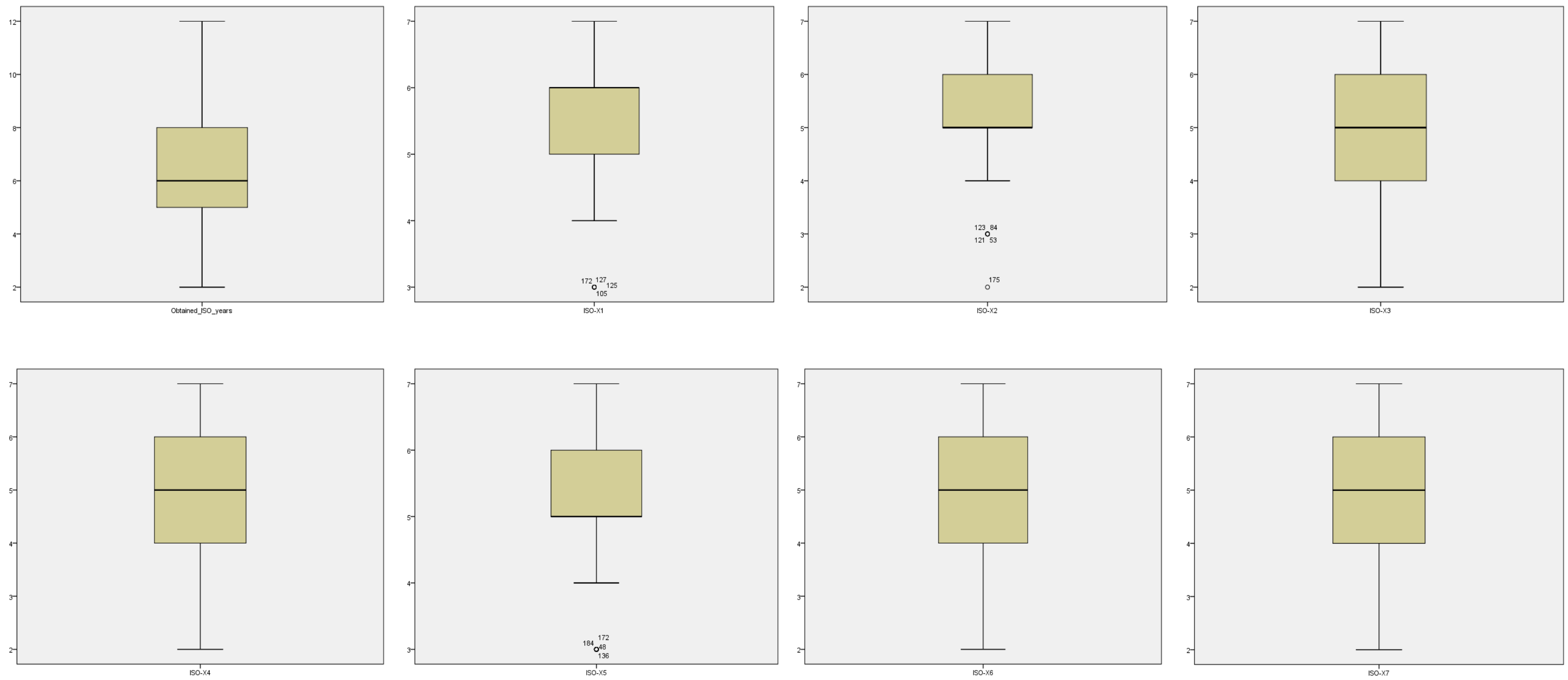
(Appendix C-1)


ABC-X8
ABC-X9
ABC-X10
105
51
69
ABC-Y1
51
42
136
ABC-Y2
ABC-Y3
ABC-Y4
ABC-Y5

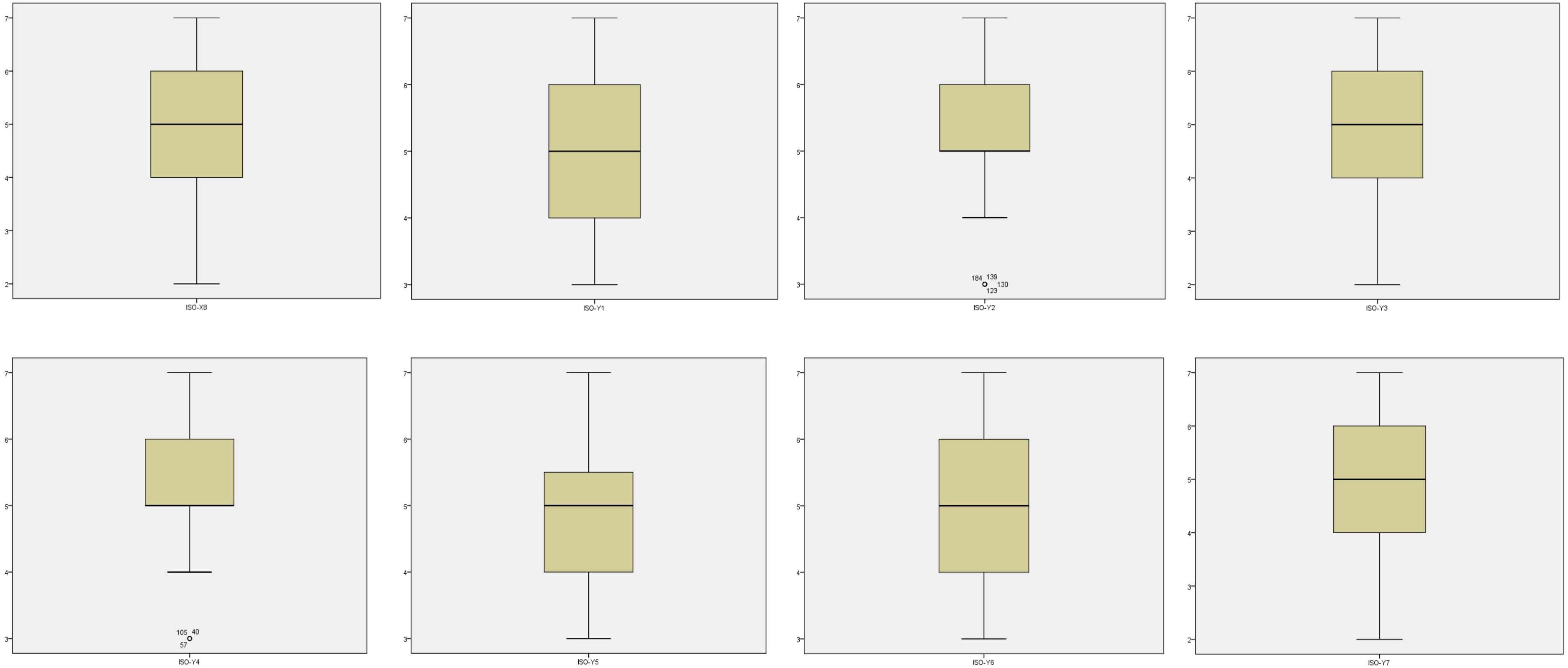
(Appendix C-1)


ABC-Y6
ABC-Y7
Obtained_ABC_Years
Number_of_Employees
Amount_of_Revenues
Working_in_Org
Position_years

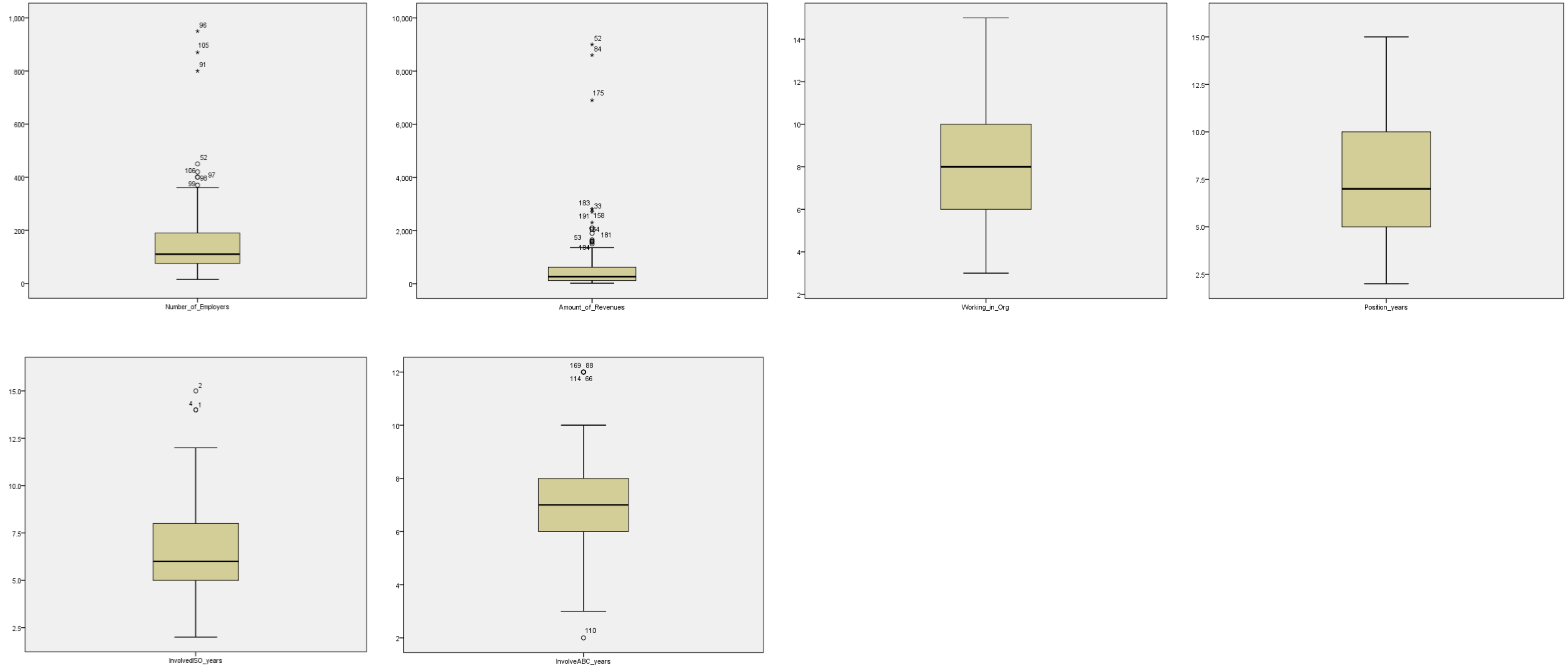
Appendix C-2: Outliers (Model 2)



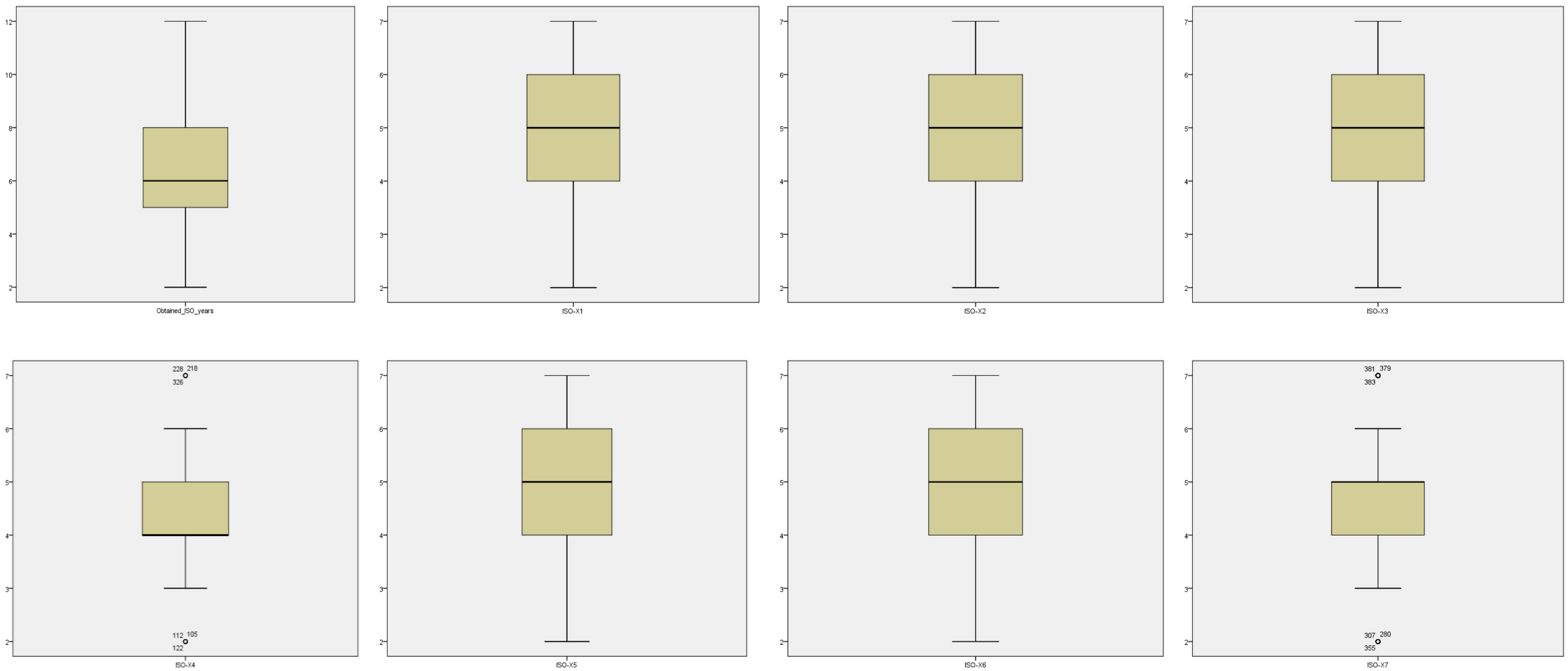
(Appendix C-2)


ISO-X8
ISO-Y1
184 139 130 123
ISO-Y2
ISO-Y3
105 40 57
ISO-Y4
ISO-Y5
ISO-Y6
ISO-Y7

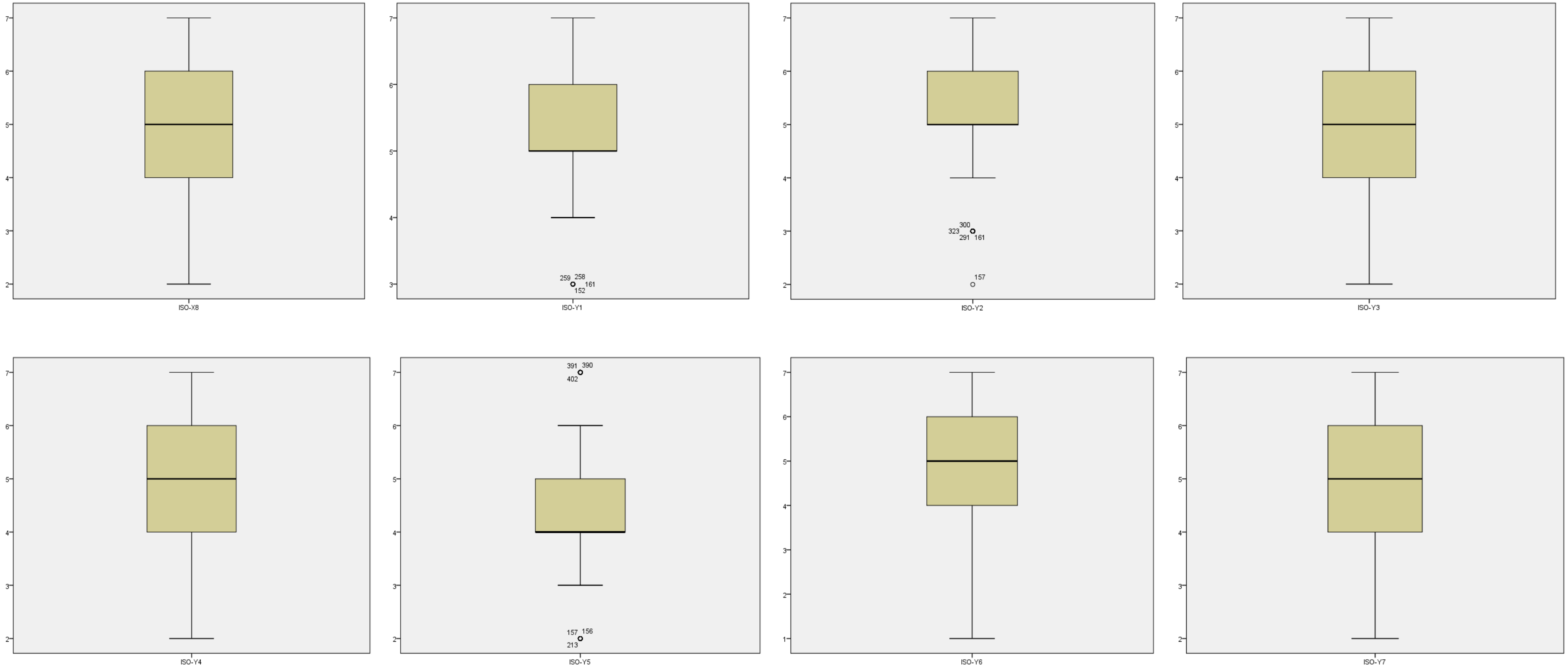
(Appendix C-2)


Number_of_Employers
Amount_of_Revenues
Working_in_Org
Position_years
InvolvedISO_years
InvolveABC_years

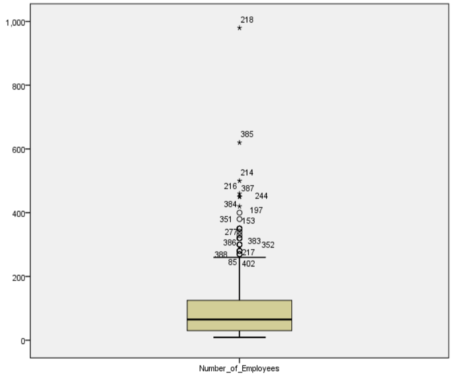
Appendix C-3: Outliers (Model 3)



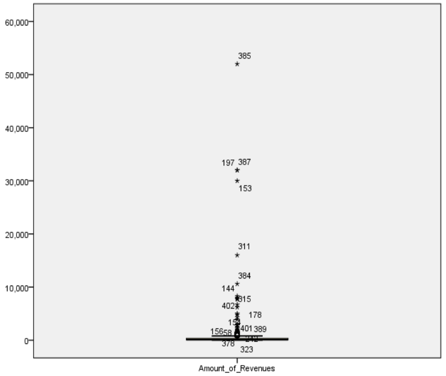
(Appendix C-3)



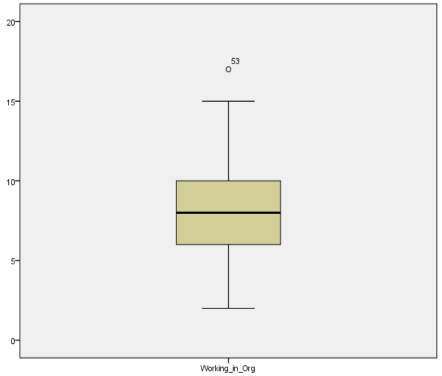
(Appendix C-3)



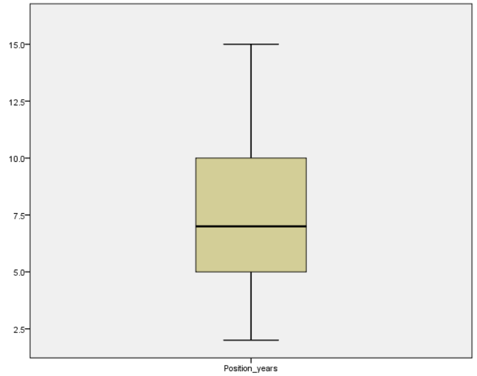
1,000
800
600
400
200
0
Number_of_Employees



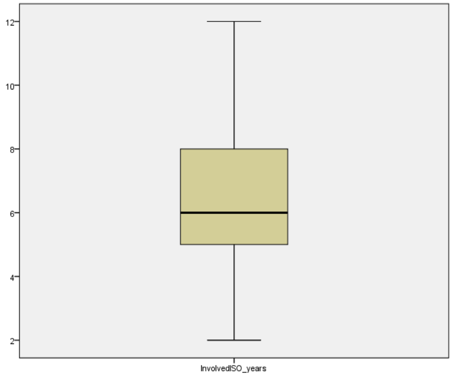
60,000
50,000
40,000
30,000
20,000
10,000
0
Amount_of_Revenues



20
15
10
5
0
Working_in_Org

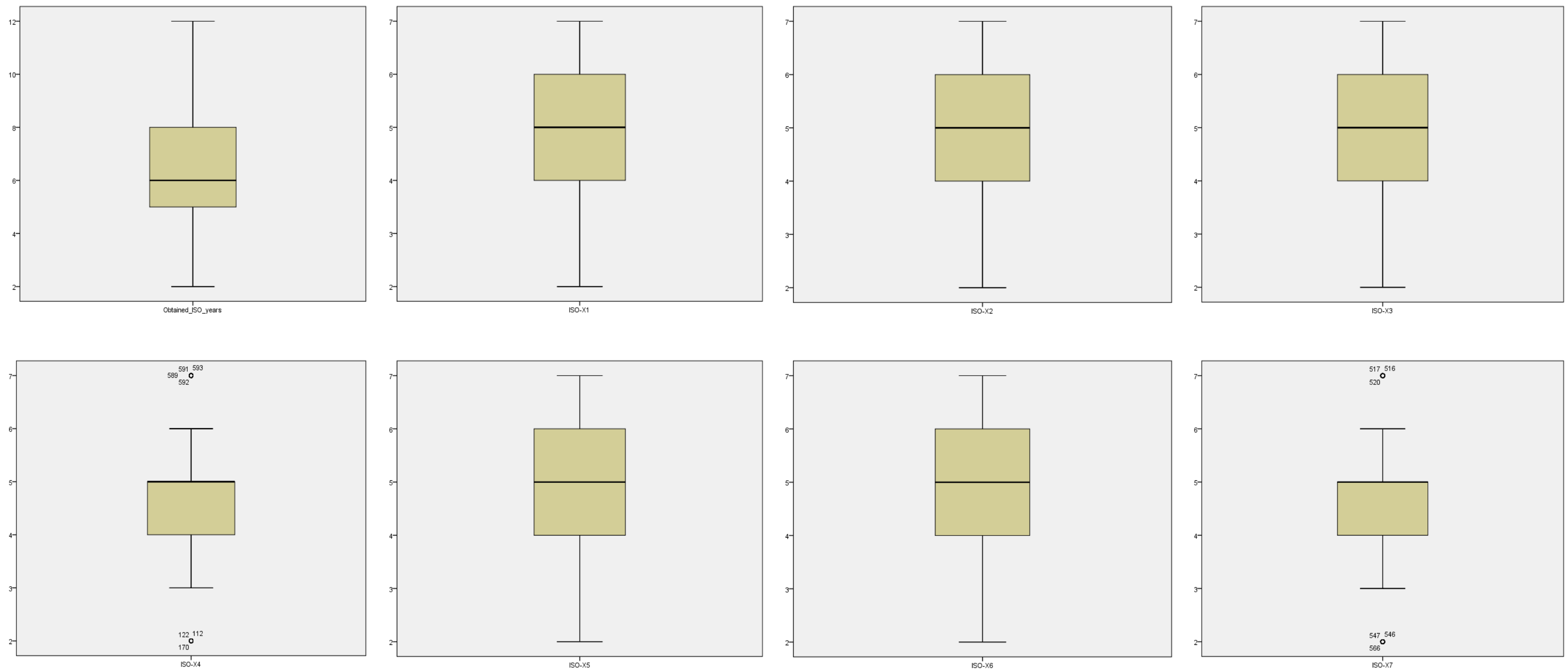


15.0
12.5
10.0
7.5
5.0
2.5
Position_years

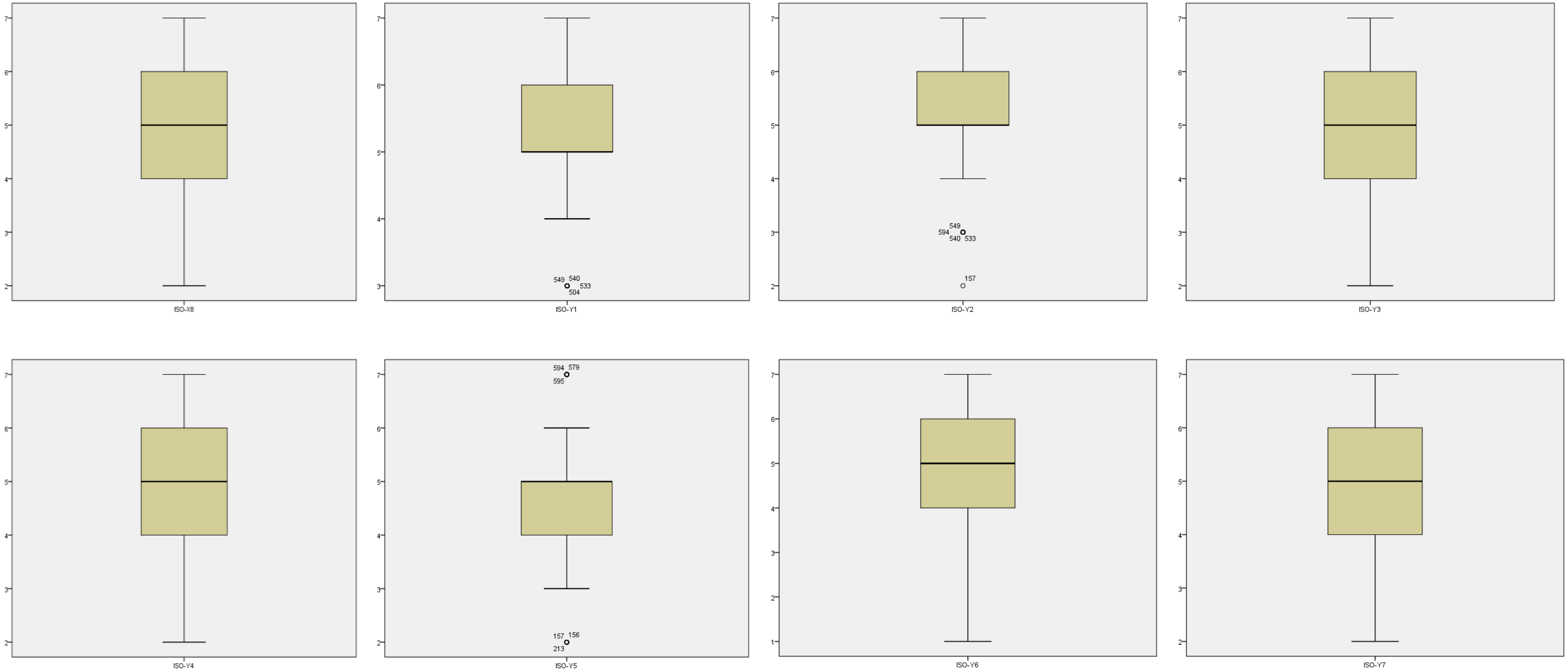


12
10
8
6
4
2
InvolvedISO_years

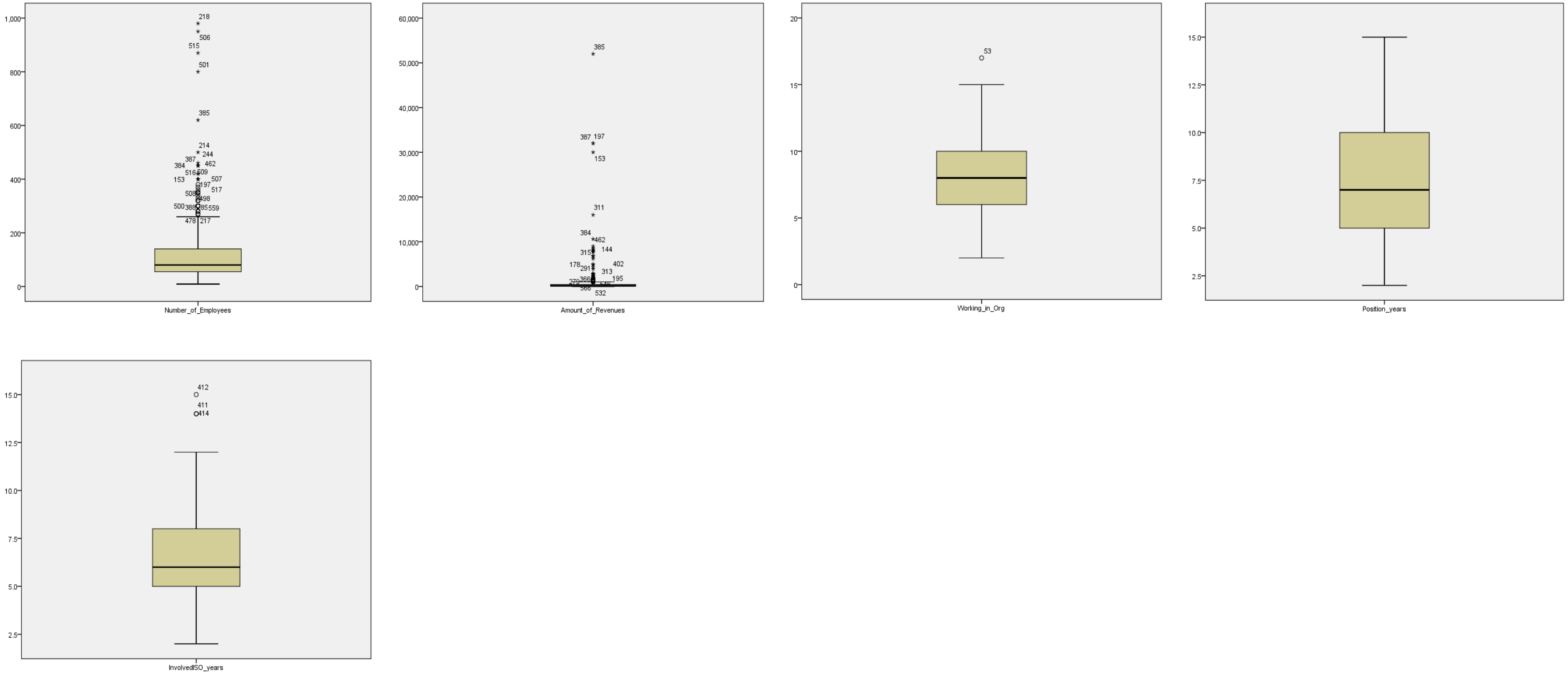
Appendix C-4: Outliers (Model 4)



(Appendix C-4)

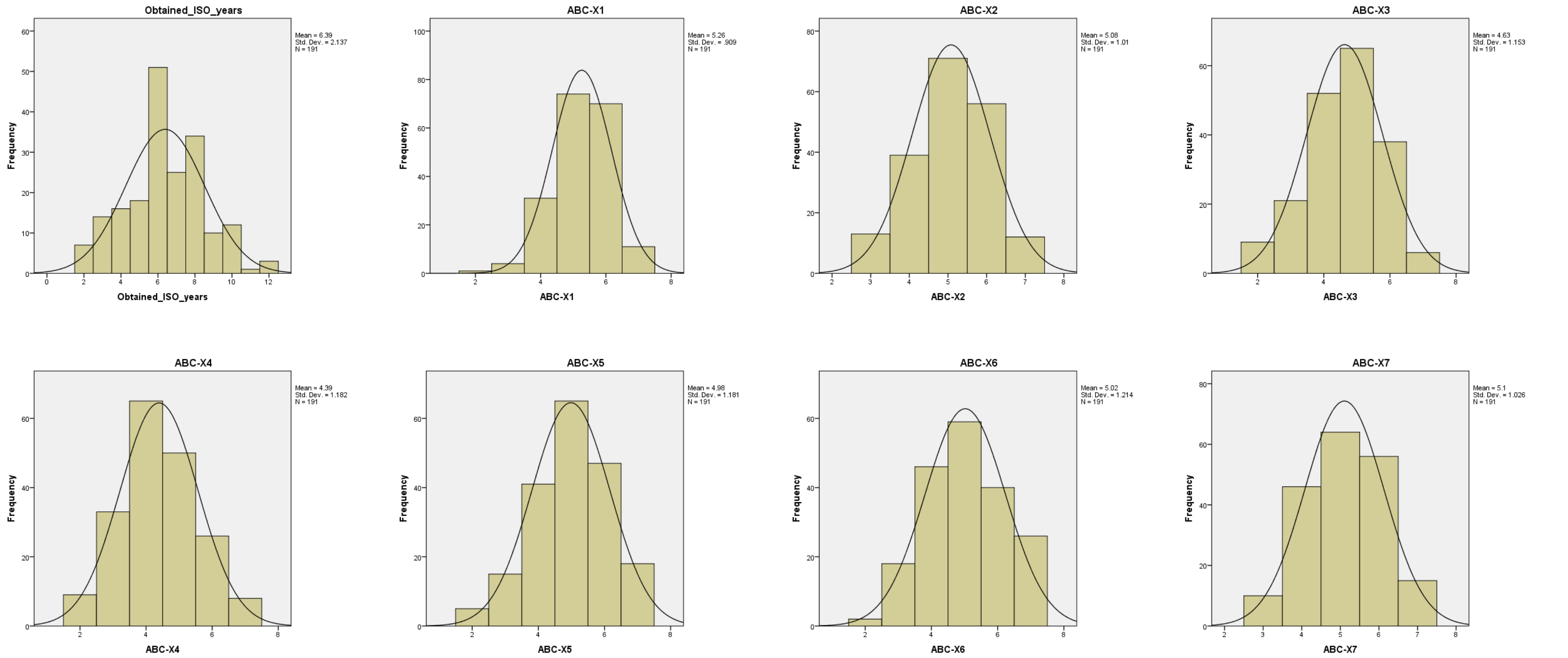

ISO-X8
ISO-Y1
549 540
533
504
ISO-Y2
549
594
540 533
157
ISO-Y3
ISO-Y4
ISO-Y5
594 579
595
157 156
213
ISO-Y6
ISO-Y7

(Appendix C-4)

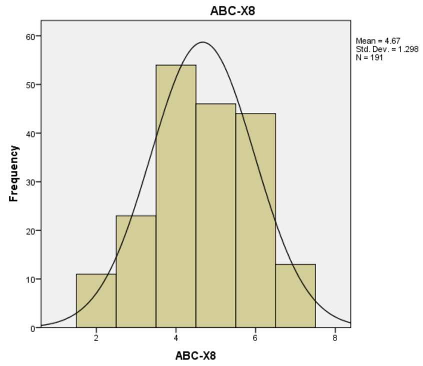

Number_of_Employees
Amount_of_Revenues
Working_in_Org
Position_years
InvolvedISO_years

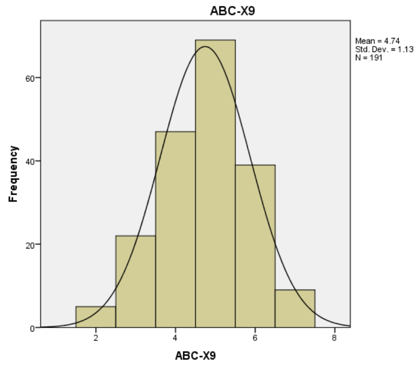
Appendix D: Histogram for testing normality

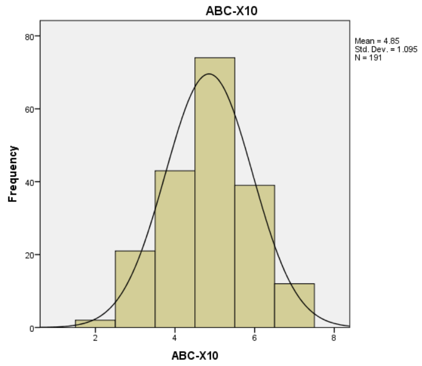
Appendix D-1: Histogram (Model 1)

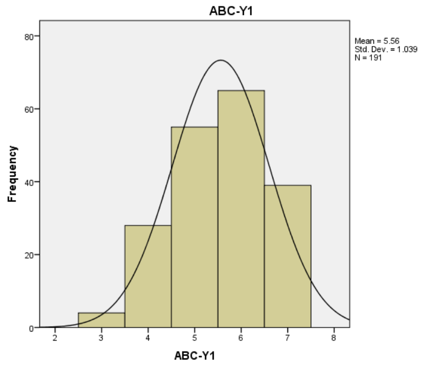


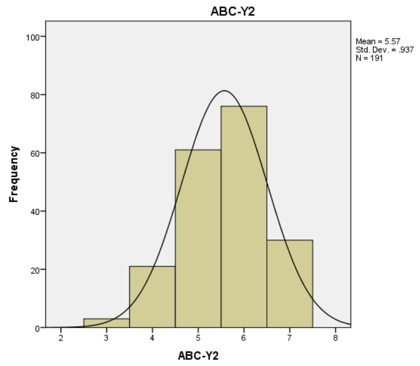
(Appendix D-1)

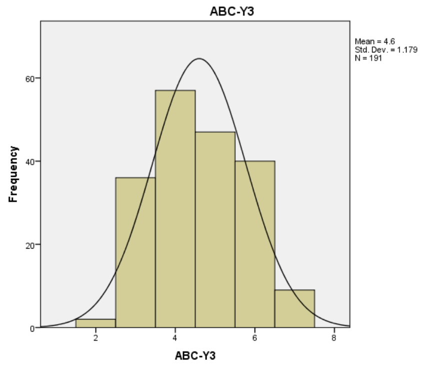

ABC-X8
Mean = 4.67
Std. Dev. = 1.298
N = 191
Frequency
ABC-X8

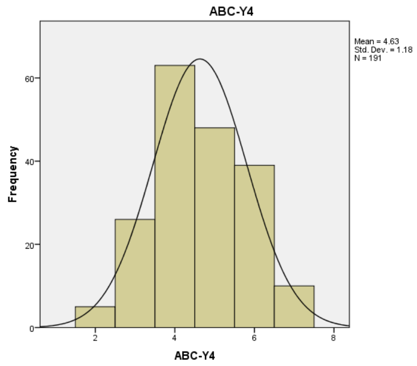

ABC-X9
Mean = 4.74
Std. Dev. = 1.13
N = 191
Frequency
ABC-X9

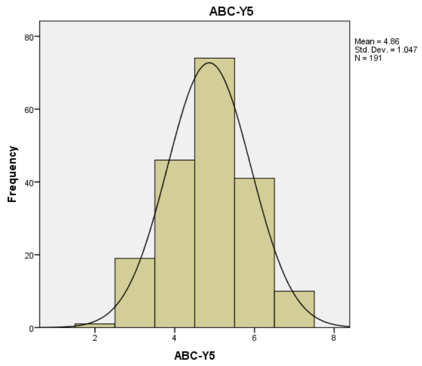

ABC-X10
Mean = 4.85
Std. Dev. = 1.095
N = 191
Frequency
ABC-X10


ABC-Y1
Mean = 5.56
Std. Dev. = 1.039
N = 191
Frequency
ABC-Y1

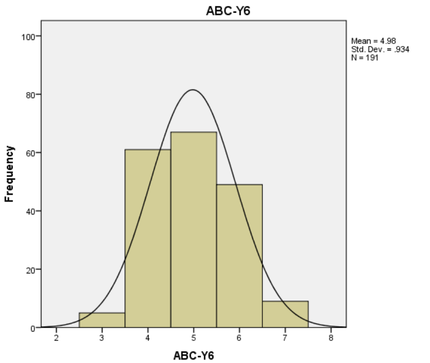

ABC-Y2
Mean = 5.57
Std. Dev. = .937
N = 191
Frequency
ABC-Y2

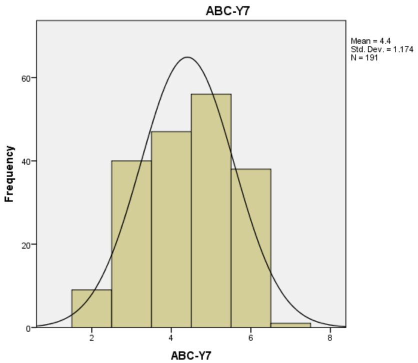

ABC-Y3
Mean = 4.6
Std. Dev. = 1.179
N = 191
Frequency
ABC-Y3

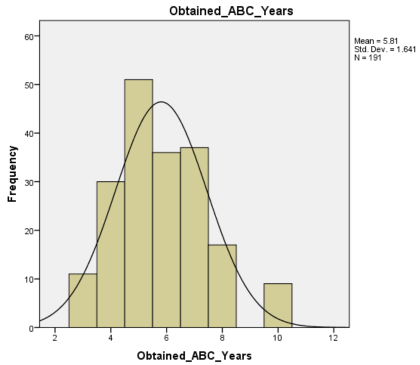

ABC-Y4
Mean = 4.63
Std. Dev. = 1.18
N = 191
Frequency
ABC-Y4

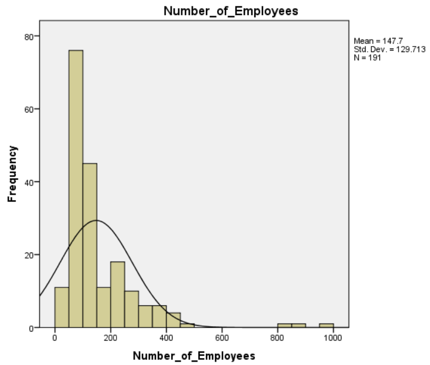

ABC-Y5
Mean = 4.86
Std. Dev. = 1.047
N = 191
Frequency
ABC-Y5

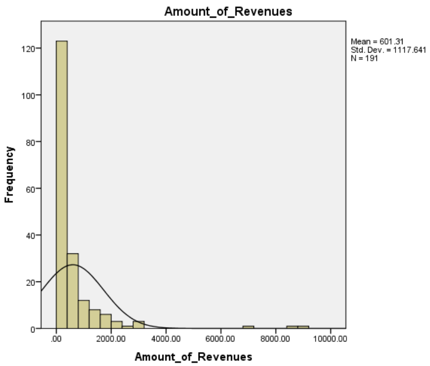
(Appendix D-1)

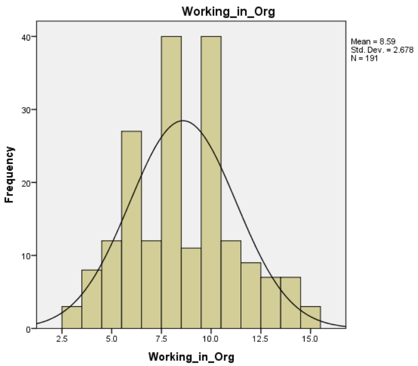

ABC-Y6
Mean = 4.98
Std. Dev. = .934
N = 191
Frequency
ABC-Y6

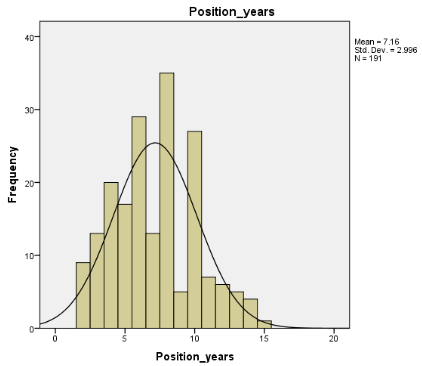

ABC-Y7
Mean = 4.4
Std. Dev. = 1.174
N = 191
Frequency
ABC-Y7

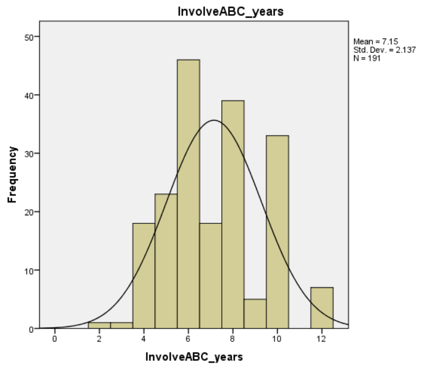

Obtained_ABC_Years
Mean = 5.81
Std. Dev. = 1.641
N = 191
Frequency
Obtained_ABC_Years


Number_of_Employees
Mean = 147.7
Std. Dev. = 129.713
N = 191
Frequency
Number_of_Employees

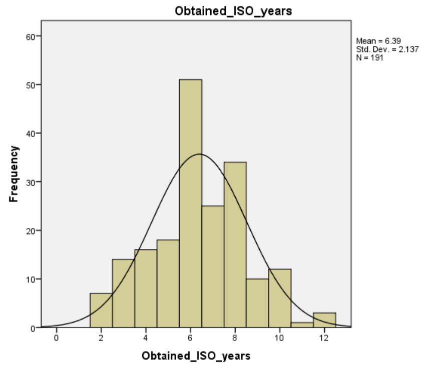

Amount_of_Revenues
Mean = 601.31
Std. Dev. = 1117.641
N = 191
Frequency
Amount_of_Revenues

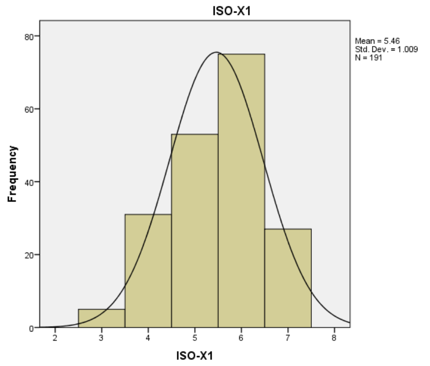

Working_in_Org
Mean = 8.59
Std. Dev. = 2.678
N = 191
Frequency
Working_in_Org

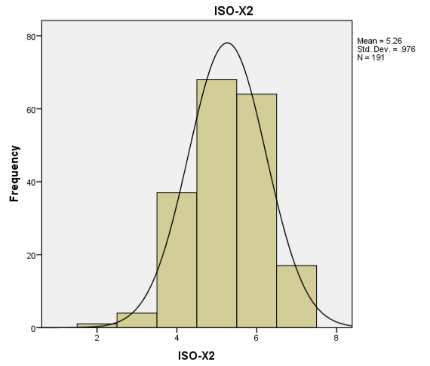

Position_years
Mean = 7.16
Std. Dev. = 2.996
N = 191
Frequency
Position_years

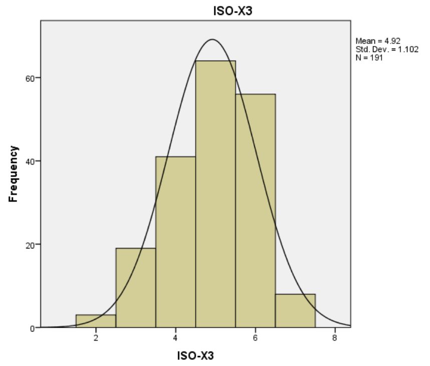

InvolveABC_years
Mean = 7.15
Std. Dev. = 2.137
N = 191
Frequency
InvolveABC_years

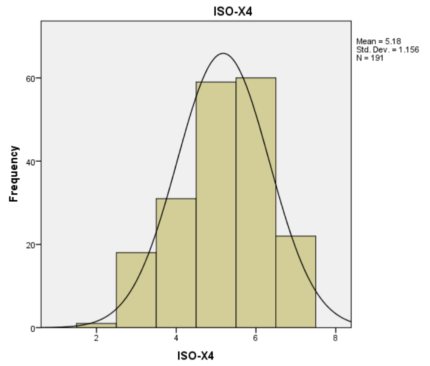
Appendix D-2: Histogram (Model 2)

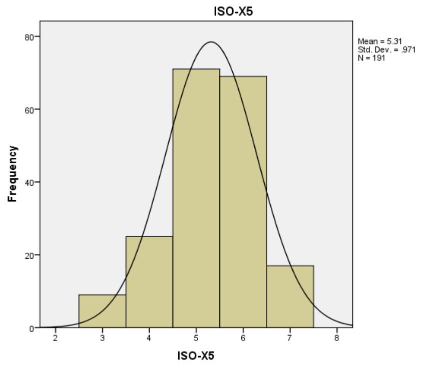


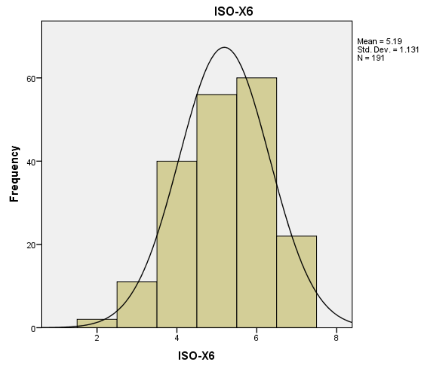


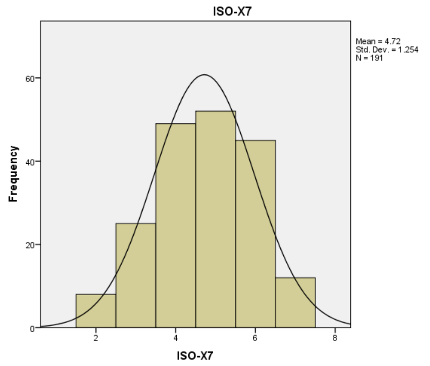




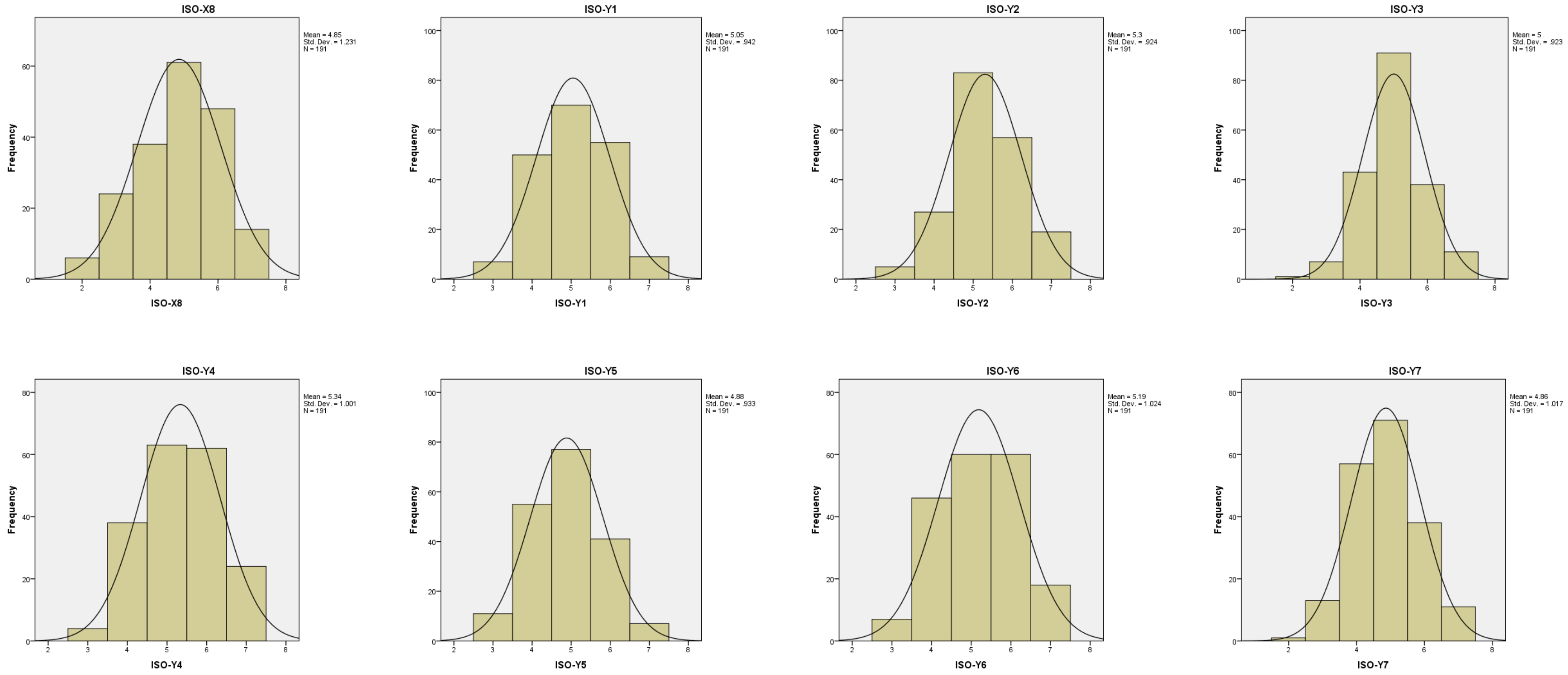




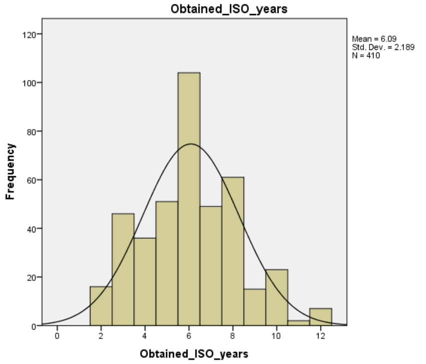


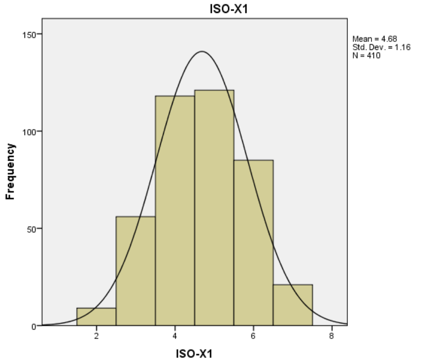


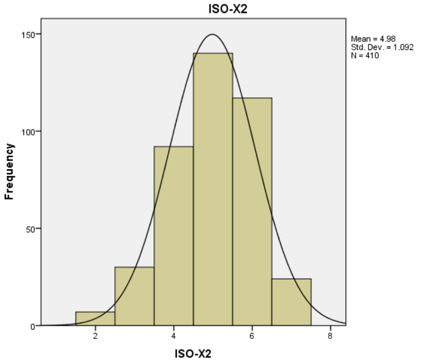
(Appendix D-2)

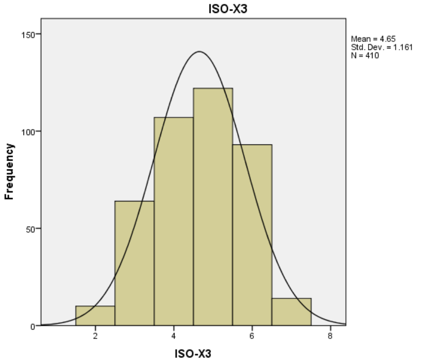

ISO-X8
Mean = 4.85
Std. Dev. = 1.231
N = 191
Frequency
ISO-X8
ISO-Y1
Mean = 5.05
Std. Dev. = .942
N = 191
Frequency
ISO-Y1
ISO-Y2
Mean = 5.3
Std. Dev. = .924
N = 191
Frequency
ISO-Y2
ISO-Y3
Mean = 5
Std. Dev. = .923
N = 191
Frequency
ISO-Y3
ISO-Y4
Mean = 5.34
Std. Dev. = 1.001
N = 191
Frequency
ISO-Y4
ISO-Y5
Mean = 4.88
Std. Dev. = .933
N = 191
Frequency
ISO-Y5
ISO-Y6
Mean = 5.19
Std. Dev. = 1.024
N = 191
Frequency
ISO-Y6
ISO-Y7
Mean = 4.86
Std. Dev. = 1.017
N = 191
Frequency
ISO-Y7

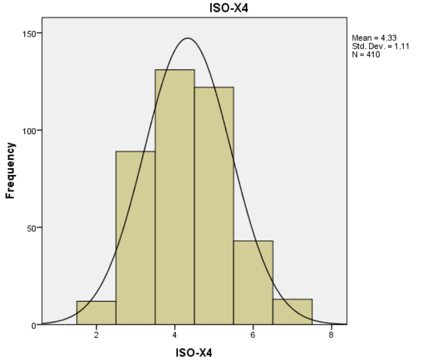
Appendix D-3: Histogram (Model 3)

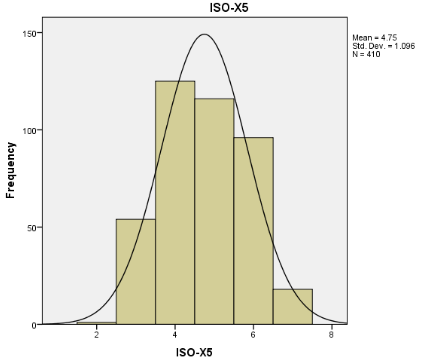


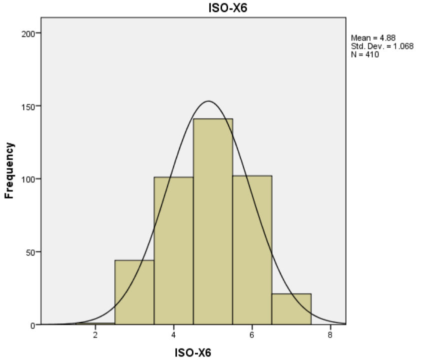


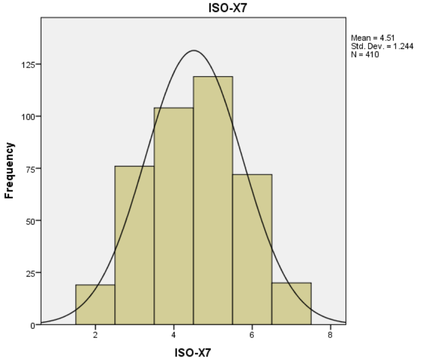




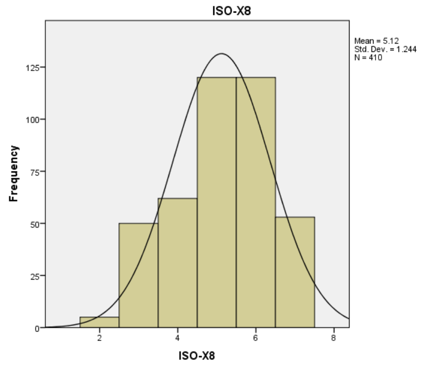


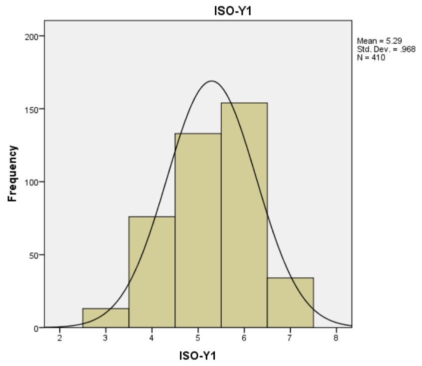


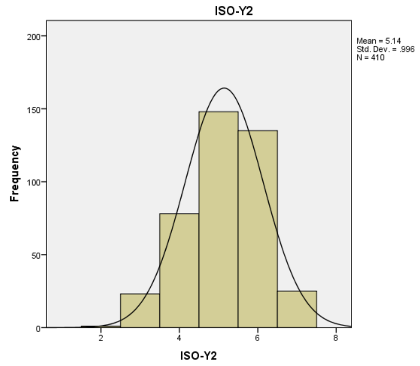


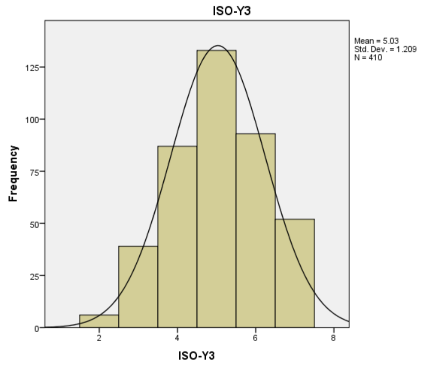


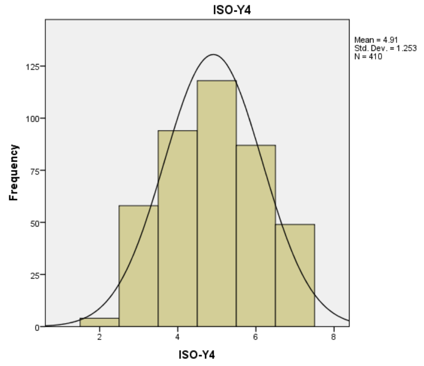
(Appendix D-3)

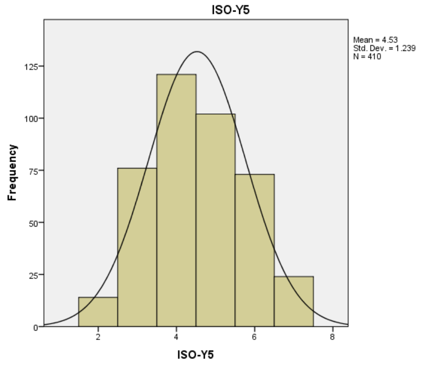

ISO-X8
Mean = 5.12
Std. Dev. = 1.244
N = 410
Frequency
ISO-X8

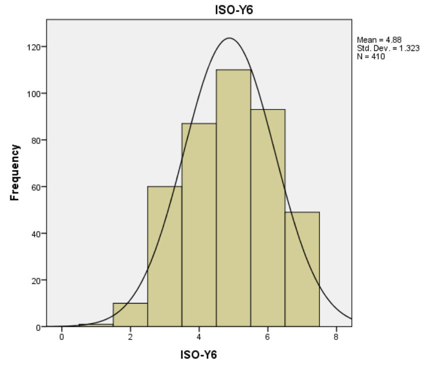

ISO-Y1
Mean = 5.29
Std. Dev. = .968
N = 410
Frequency
ISO-Y1

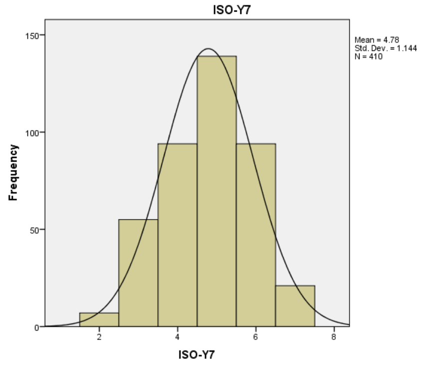

ISO-Y2
Mean = 5.14
Std. Dev. = .996
N = 410
Frequency
ISO-Y2


ISO-Y3
Mean = 5.03
Std. Dev. = 1.209
N = 410
Frequency
ISO-Y3

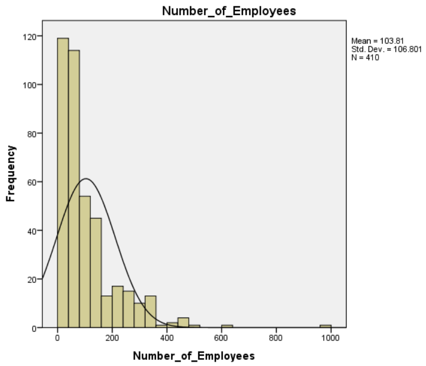

ISO-Y4
Mean = 4.91
Std. Dev. = 1.253
N = 410
Frequency
ISO-Y4

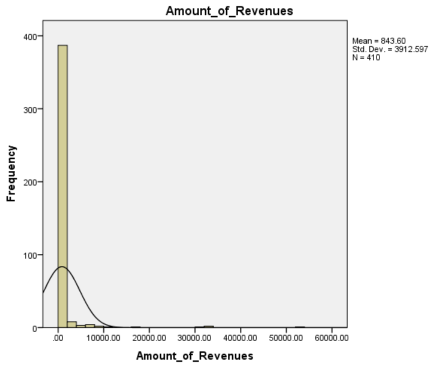

ISO-Y5
Mean = 4.53
Std. Dev. = 1.239
N = 410
Frequency
ISO-Y5

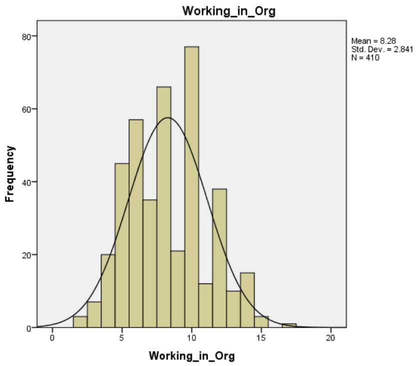

ISO-Y6
Mean = 4.88
Std. Dev. = 1.323
N = 410
Frequency
ISO-Y6

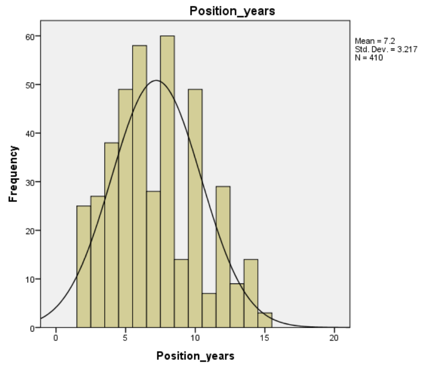

ISO-Y7
Mean = 4.78
Std. Dev. = 1.144
N = 410
Frequency
ISO-Y7

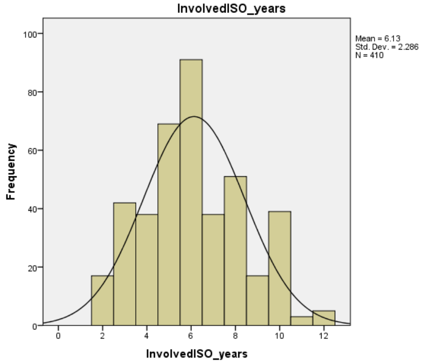
(Appendix D-3)


Number_of_Employees
Mean = 103.81
Std. Dev. = 106.801
N = 410
Frequency
0
20
40
60
80
100
120
0
200
400
600
800
1000
Number_of_Employees

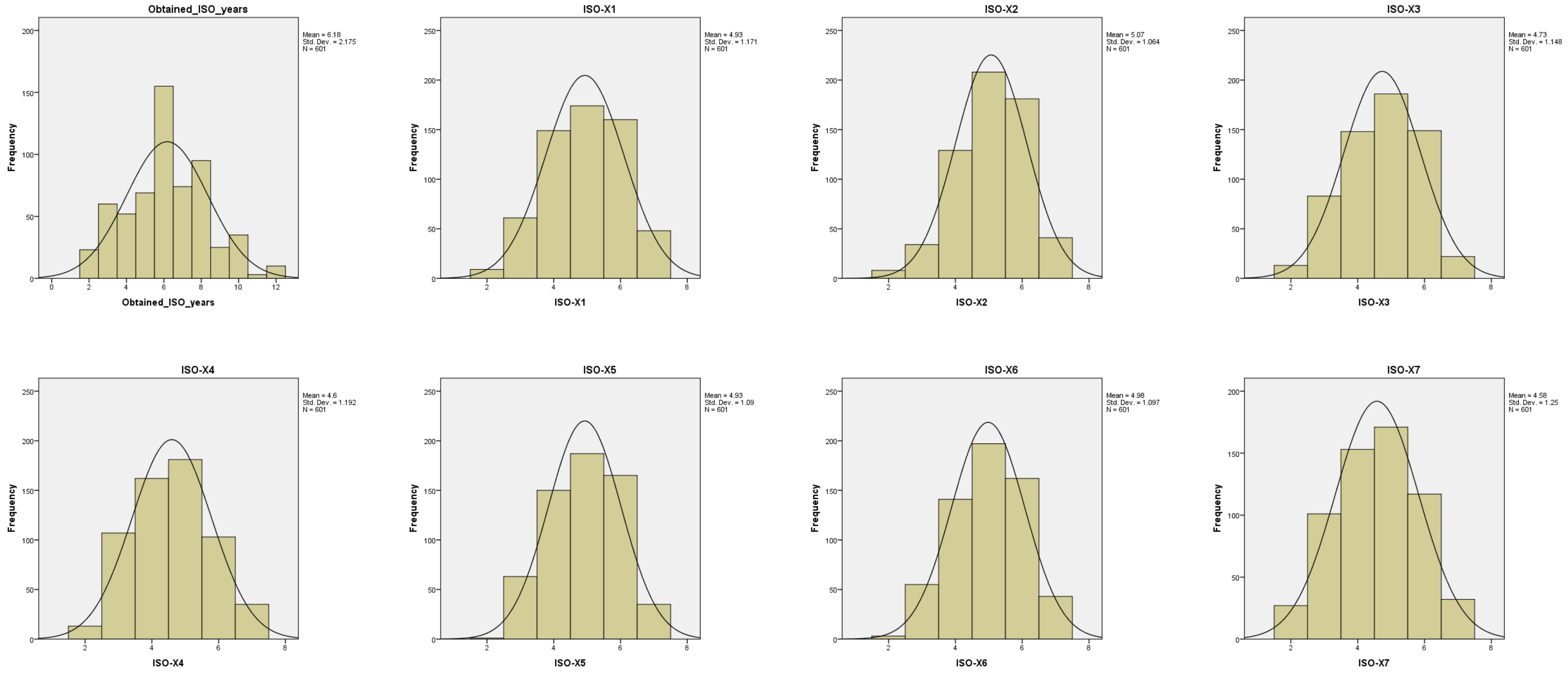

Amount_of_Revenues
Mean = 843.60
Std. Dev. = 3912.597
N = 410
Frequency
0
100
200
300
400
.00
10000.00
20000.00
30000.00
40000.00
50000.00
60000.00
Amount_of_Revenues


Working_in_Org
Mean = 8.28
Std. Dev. = 2.841
N = 410
Frequency
0
20
40
60
80
0
5
10
15
20
Working_in_Org

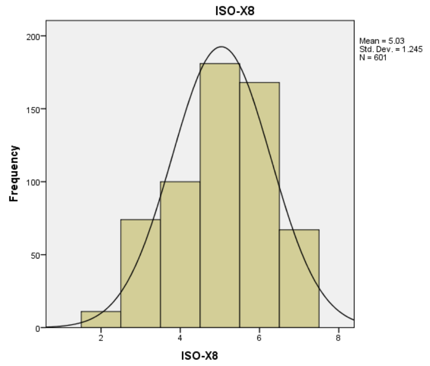

Position_years
Mean = 7.2
Std. Dev. = 3.217
N = 410
Frequency
0
10
20
30
40
50
60
0
5
10
15
20
Position_years

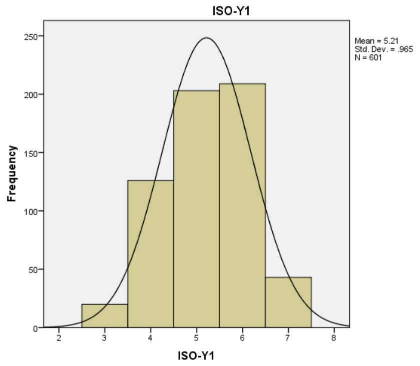

InvolvedISO_years
Mean = 6.13
Std. Dev. = 2.286
N = 410
Frequency
0
20
40
60
80
100
0
2
4
6
8
10
12
InvolvedISO_years

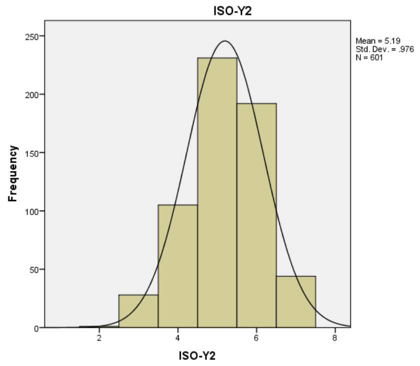
Appendix D-4: Histogram (Model 4)

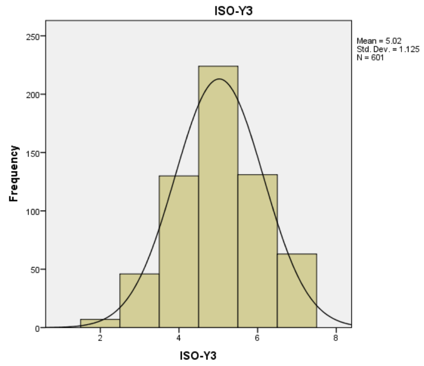


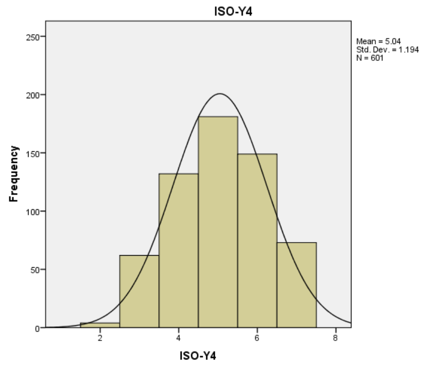
(Appendix D-4)

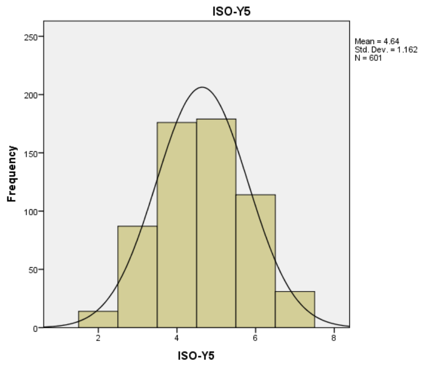

ISO-X8
Mean = 5.03
Std. Dev. = 1.245
N = 601
Frequency
ISO-X8

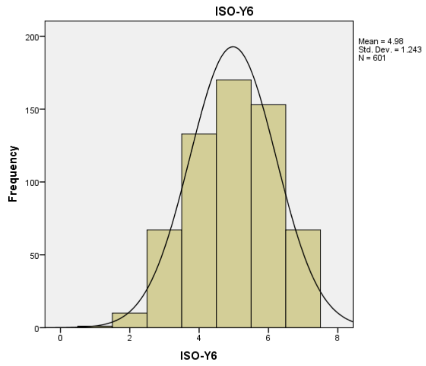

ISO-Y1
Mean = 5.21
Std. Dev. = .965
N = 601
Frequency
ISO-Y1

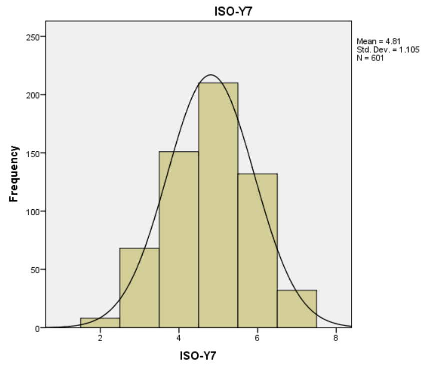

ISO-Y2
Mean = 5.19
Std. Dev. = .976
N = 601
Frequency
ISO-Y2


ISO-Y3
Mean = 5.02
Std. Dev. = 1.125
N = 601
Frequency
ISO-Y3

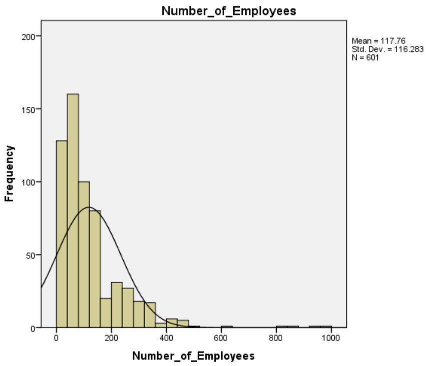

ISO-Y4
Mean = 5.04
Std. Dev. = 1.194
N = 601
Frequency
ISO-Y4

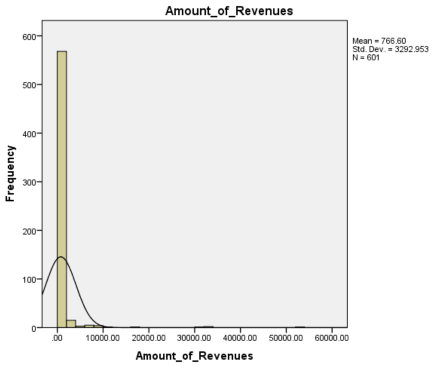

ISO-Y5
Mean = 4.64
Std. Dev. = 1.162
N = 601
Frequency
ISO-Y5

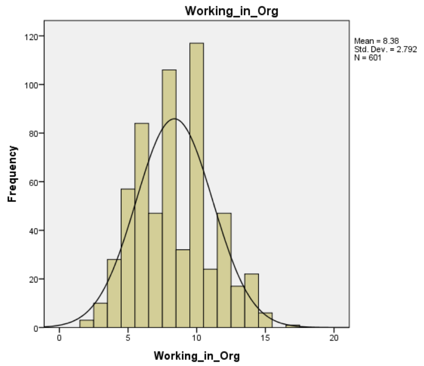

ISO-Y6
Mean = 4.98
Std. Dev. = 1.243
N = 601
Frequency
ISO-Y6

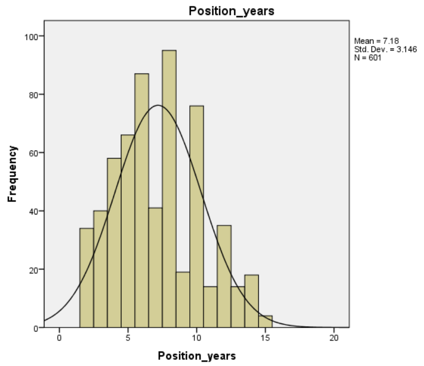

ISO-Y7
Mean = 4.81
Std. Dev. = 1.105
N = 601
Frequency
ISO-Y7

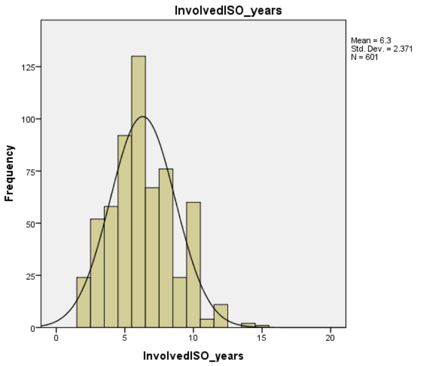
(Appendix D-4)


Number_of_Employees
Mean = 117.76
Std. Dev. = 116.283
N = 601
Frequency
Number_of_Employees


Amount_of_Revenues
Mean = 766.60
Std. Dev. = 3292.953
N = 601
Frequency
Amount_of_Revenues


Working_in_Org
Mean = 8.38
Std. Dev. = 2.792
N = 601
Frequency
Working_in_Org


Position_years
Mean = 7.18
Std. Dev. = 3.146
N = 601
Frequency
Position_years


InvolvedISO_years
Mean = 6.3
Std. Dev. = 2.371
N = 601
Frequency
InvolvedISO_years

Appendix E: Linearity tested by statistic

Appendix E-1: Linearity checked by statistic (Model 1)

ANOVA Table					
			Mean Square	F	Sig.
ABC-Y1 * ABC-X1	Between Groups	Deviation from Linearity	1.524	1.609	.174
	Within Groups		.947		
ABC-Y2 * ABC-X1	Between Groups	Deviation from Linearity	1.145	1.386	.240
	Within Groups		.826		
ABC-Y3 * ABC-X1	Between Groups	Deviation from Linearity	1.739	1.342	.256
	Within Groups		1.295		
ABC-Y4 * ABC-X1	Between Groups	Deviation from Linearity	.997	.791	.532
	Within Groups		1.261		
ABC-Y5 * ABC-X1	Between Groups	Deviation from Linearity	.670	.619	.650
	Within Groups		1.082		
ABC-Y6 * ABC-X1	Between Groups	Deviation from Linearity	.730	.904	.463
	Within Groups		.808		
ABC-Y7 * ABC-X1	Between Groups	Deviation from Linearity	1.328	1.026	.395
	Within Groups		1.295		

(Appendix E-1)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ABC-Y1 * ABC-X2	Between Groups	Deviation from Linearity	1.238	1.322	.269
	Within Groups		.936		
ABC-Y2 * ABC-X2	Between Groups	Deviation from Linearity	.318	.388	.762
	Within Groups		.821		
ABC-Y3 * ABC-X2	Between Groups	Deviation from Linearity	2.651	2.188	.091
	Within Groups		1.212		
ABC-Y4 * ABC-X2	Between Groups	Deviation from Linearity	1.555	1.197	.312
	Within Groups		1.299		
ABC-Y5 * ABC-X2	Between Groups	Deviation from Linearity	1.936	1.938	.125
	Within Groups		.999		
ABC-Y6 * ABC-X2	Between Groups	Deviation from Linearity	.364	.452	.716
	Within Groups		.804		
ABC-Y7 * ABC-X2	Between Groups	Deviation from Linearity	.846	.660	.578
	Within Groups		1.281		

(Appendix E-1)

ANOVA Table					
			Mean Square	F	Sig.
ABC-Y1 * ABC-X3	Between Groups	Deviation from Linearity	.282	.283	.889
	Within Groups		.998		
ABC-Y2 * ABC-X3	Between Groups	Deviation from Linearity	.486	.602	.662
	Within Groups		.807		
ABC-Y3 * ABC-X3	Between Groups	Deviation from Linearity	.590	.473	.755
	Within Groups		1.247		
ABC-Y4 * ABC-X3	Between Groups	Deviation from Linearity	.707	.562	.691
	Within Groups		1.258		
ABC-Y5 * ABC-X3	Between Groups	Deviation from Linearity	1.173	1.112	.352
	Within Groups		1.056		
ABC-Y6 * ABC-X3	Between Groups	Deviation from Linearity	.758	.902	.464
	Within Groups		.840		
ABC-Y7 * ABC-X3	Between Groups	Deviation from Linearity	2.556	1.958	.103
	Within Groups		1.306		

(Appendix E-1)

ANOVA Table					
			Mean Square	F	Sig.
ABC-Y1 * ABC-X4	Between Groups	Deviation from Linearity	.577	.596	.666
	Within Groups		.969		
	Total				
ABC-Y2 * ABC-X4	Between Groups	Deviation from Linearity	1.185	1.456	.218
	Within Groups		.814		
	Total				
ABC-Y3 * ABC-X4	Between Groups	Deviation from Linearity	1.323	1.209	.309
	Within Groups		1.094		
	Total				
ABC-Y4 * ABC-X4	Between Groups	Deviation from Linearity	.753	.655	.624
	Within Groups		1.150		
	Total				
ABC-Y5 * ABC-X4	Between Groups	Deviation from Linearity	3.017	3.032	***.019***
	Within Groups		.995		
	Total				
ABC-Y6 * ABC-X4	Between Groups	Deviation from Linearity	1.928	2.549	***.041***
	Within Groups		.757		
	Total				
ABC-Y7 * ABC-X4	Between Groups	Deviation from Linearity	2.726	2.065	.087
	Within Groups		1.320		
	Total				

(Appendix E-1)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ABC-Y1 * ABC-X5	Between Groups	Deviation from Linearity	1.332	1.438	.223
	Within Groups		.926		
ABC-Y2 * ABC-X5	Between Groups	Deviation from Linearity	.571	.766	.549
	Within Groups		.746		
ABC-Y3 * ABC-X5	Between Groups	Deviation from Linearity	.572	.465	.762
	Within Groups		1.231		
ABC-Y4 * ABC-X5	Between Groups	Deviation from Linearity	1.533	1.220	.304
	Within Groups		1.257		
ABC-Y5 * ABC-X5	Between Groups	Deviation from Linearity	1.586	1.513	.200
	Within Groups		1.048		
ABC-Y6 * ABC-X5	Between Groups	Deviation from Linearity	2.141	2.698	***.032***
	Within Groups		.793		
ABC-Y7 * ABC-X5	Between Groups	Deviation from Linearity	1.493	1.171	.325
	Within Groups		1.274		

(Appendix E-1)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ABC-Y1 * ABC-X6	Between Groups	Deviation from Linearity	2.137	2.162	.075
	Within Groups		.989		
ABC-Y2 * ABC-X6	Between Groups	Deviation from Linearity	2.344	2.873	***.024***
	Within Groups		.816		
ABC-Y3 * ABC-X6	Between Groups	Deviation from Linearity	1.097	.865	.486
	Within Groups		1.268		
ABC-Y4 * ABC-X6	Between Groups	Deviation from Linearity	1.028	.774	.543
	Within Groups		1.328		
ABC-Y5 * ABC-X6	Between Groups	Deviation from Linearity	2.381	2.262	.064
	Within Groups		1.052		
ABC-Y6 * ABC-X6	Between Groups	Deviation from Linearity	.213	.239	.916
	Within Groups		.890		
ABC-Y7 * ABC-X6	Between Groups	Deviation from Linearity	2.814	2.157	.076
	Within Groups		1.304		

(Appendix E-1)

ANOVA Table					
			Mean Square	F	Sig.
ABC-Y1 * ABC-X7	Between Groups	Deviation from Linearity	1.353	1.474	.223
	Within Groups		.918		
ABC-Y2 * ABC-X7	Between Groups	Deviation from Linearity	.279	.386	.763
	Within Groups		.722		
ABC-Y3 * ABC-X7	Between Groups	Deviation from Linearity	1.007	.925	.430
	Within Groups		1.089		
ABC-Y4 * ABC-X7	Between Groups	Deviation from Linearity	1.418	1.269	.286
	Within Groups		1.118		
ABC-Y5 * ABC-X7	Between Groups	Deviation from Linearity	.669	.610	.609
	Within Groups		1.097		
ABC-Y6 * ABC-X7	Between Groups	Deviation from Linearity	.332	.421	.738
	Within Groups		.788		
ABC-Y7 * ABC-X7	Between Groups	Deviation from Linearity	.959	.785	.503
	Within Groups		1.221		

(Appendix E-1)

ANOVA Table					
			Mean Square	F	Sig.
ABC-Y1 * ABC-X8	Between Groups	Deviation from Linearity	.423	.404	.805
	Within Groups		1.046		
ABC-Y2 * ABC-X8	Between Groups	Deviation from Linearity	.054	.065	.992
	Within Groups		.829		
ABC-Y3 * ABC-X8	Between Groups	Deviation from Linearity	.788	.603	.661
	Within Groups		1.308		
ABC-Y4 * ABC-X8	Between Groups	Deviation from Linearity	.875	.701	.592
	Within Groups		1.247		
ABC-Y5 * ABC-X8	Between Groups	Deviation from Linearity	.777	.731	.572
	Within Groups		1.064		
ABC-Y6 * ABC-X8	Between Groups	Deviation from Linearity	.557	.680	.607
	Within Groups		.818		
ABC-Y7 * ABC-X8	Between Groups	Deviation from Linearity	1.545	1.141	.339
	Within Groups		1.354		

(Appendix E-1)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ABC-Y1 * ABC-X9	Between Groups	Deviation from Linearity	.357	.363	.835
	Within Groups		.984		
ABC-Y2 * ABC-X9	Between Groups	Deviation from Linearity	.593	.718	.580
	Within Groups		.826		
ABC-Y3 * ABC-X9	Between Groups	Deviation from Linearity	1.358	1.128	.345
	Within Groups		1.204		
ABC-Y4 * ABC-X9	Between Groups	Deviation from Linearity	1.405	1.094	.361
	Within Groups		1.285		
ABC-Y5 * ABC-X9	Between Groups	Deviation from Linearity	.224	.214	.930
	Within Groups		1.046		
ABC-Y6 * ABC-X9	Between Groups	Deviation from Linearity	1.161	1.367	.247
	Within Groups		.849		
ABC-Y7 * ABC-X9	Between Groups	Deviation from Linearity	1.505	1.183	.320
	Within Groups		1.272		

Appendix E-2: Linearity checked by statistic (Model 2)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X1	Between Groups	Deviation from Linearity	.212	.256	.857
	Within Groups		.831		
ISO-Y2 * ISO-X1	Between Groups	Deviation from Linearity	.507	.639	.591
	Within Groups		.795		
ISO-Y3 * ISO-X1	Between Groups	Deviation from Linearity	.620	.742	.529
	Within Groups		.836		
ISO-Y4 * ISO-X1	Between Groups	Deviation from Linearity	1.789	1.845	.140
	Within Groups		.970		
ISO-Y5 * ISO-X1	Between Groups	Deviation from Linearity	.984	1.177	.320
	Within Groups		.835		
ISO-Y6 * ISO-X1	Between Groups	Deviation from Linearity	.770	.771	.512
	Within Groups		.999		
ISO-Y7 * ISO-X1	Between Groups	Deviation from Linearity	.708	.692	.558
	Within Groups		1.023		

(Appendix E-2)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X2	Between Groups	Deviation from Linearity	1.143	1.324	.263
	Within Groups		.864		
ISO-Y2 * ISO-X2	Between Groups	Deviation from Linearity	1.372	1.759	.139
	Within Groups		.780		
ISO-Y3 * ISO-X2	Between Groups	Deviation from Linearity	.512	.632	.640
	Within Groups		.809		
ISO-Y4 * ISO-X2	Between Groups	Deviation from Linearity	1.161	1.176	.323
	Within Groups		.987		
ISO-Y5 * ISO-X2	Between Groups	Deviation from Linearity	.334	.394	.813
	Within Groups		.847		
ISO-Y6 * ISO-X2	Between Groups	Deviation from Linearity	.655	.635	.638
	Within Groups		1.031		
ISO-Y7 * ISO-X2	Between Groups	Deviation from Linearity	.304	.305	.875
	Within Groups		.998		

(Appendix E-2)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X3	Between Groups	Deviation from Linearity	.670	.770	.546
	Within Groups		.870		
ISO-Y2 * ISO-X3	Between Groups	Deviation from Linearity	1.204	1.526	.196
	Within Groups		.789		
ISO-Y3 * ISO-X3	Between Groups	Deviation from Linearity	.910	1.081	.367
	Within Groups		.841		
ISO-Y4 * ISO-X3	Between Groups	Deviation from Linearity	1.169	1.165	.328
	Within Groups		1.004		
ISO-Y5 * ISO-X3	Between Groups	Deviation from Linearity	1.651	1.954	.103
	Within Groups		.845		
ISO-Y6 * ISO-X3	Between Groups	Deviation from Linearity	1.995	1.978	.100
	Within Groups		1.008		
ISO-Y7 * ISO-X3	Between Groups	Deviation from Linearity	.826	.793	.531
	Within Groups		1.042		

(Appendix E-2)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X4	Between Groups	Deviation from Linearity	1.486	1.893	.113
	Within Groups		.785		
ISO-Y2 * ISO-X4	Between Groups	Deviation from Linearity	.820	1.052	.382
	Within Groups		.779		
ISO-Y3 * ISO-X4	Between Groups	Deviation from Linearity	.712	.853	.493
	Within Groups		.834		
ISO-Y4 * ISO-X4	Between Groups	Deviation from Linearity	.779	.777	.542
	Within Groups		1.003		
ISO-Y5 * ISO-X4	Between Groups	Deviation from Linearity	1.219	1.468	.214
	Within Groups		.831		
ISO-Y6 * ISO-X4	Between Groups	Deviation from Linearity	1.661	1.814	.128
	Within Groups		.916		
ISO-Y7 * ISO-X4	Between Groups	Deviation from Linearity	.178	.172	.953
	Within Groups		1.037		

(Appendix E-2)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X5	Between Groups	Deviation from Linearity	.281	.326	.806
	Within Groups		.860		
ISO-Y2 * ISO-X5	Between Groups	Deviation from Linearity	.410	.531	.662
	Within Groups		.773		
ISO-Y3 * ISO-X5	Between Groups	Deviation from Linearity	.984	1.200	.311
	Within Groups		.820		
ISO-Y4 * ISO-X5	Between Groups	Deviation from Linearity	1.506	1.545	.204
	Within Groups		.975		
ISO-Y5 * ISO-X5	Between Groups	Deviation from Linearity	.835	1.017	.386
	Within Groups		.821		
ISO-Y6 * ISO-X5	Between Groups	Deviation from Linearity	.146	.143	.934
	Within Groups		1.017		
ISO-Y7 * ISO-X5	Between Groups	Deviation from Linearity	.962	.952	.416
	Within Groups		1.010		

(Appendix E-2)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X6	Between Groups	Deviation from Linearity	1.257	1.445	.221
	Within Groups		.870		
ISO-Y2 * ISO-X6	Between Groups	Deviation from Linearity	.456	.614	.653
	Within Groups		.743		
ISO-Y3 * ISO-X6	Between Groups	Deviation from Linearity	1.524	2.006	.095
	Within Groups		.760		
ISO-Y4 * ISO-X6	Between Groups	Deviation from Linearity	1.155	1.198	.313
	Within Groups		.964		
ISO-Y5 * ISO-X6	Between Groups	Deviation from Linearity	1.353	1.659	.161
	Within Groups		.816		
ISO-Y6 * ISO-X6	Between Groups	Deviation from Linearity	3.790	4.057	***.004***
	Within Groups		.934		
ISO-Y7 * ISO-X6	Between Groups	Deviation from Linearity	2.715	2.816	***.027***
	Within Groups		.964		

(Appendix E-2)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X7	Between Groups	Deviation from Linearity	.923	1.065	.375
	Within Groups		.867		
ISO-Y2 * ISO-X7	Between Groups	Deviation from Linearity	.435	.581	.677
	Within Groups		.748		
ISO-Y3 * ISO-X7	Between Groups	Deviation from Linearity	.912	1.076	.370
	Within Groups		.848		
ISO-Y4 * ISO-X7	Between Groups	Deviation from Linearity	1.999	2.051	.089
	Within Groups		.974		
ISO-Y5 * ISO-X7	Between Groups	Deviation from Linearity	1.562	1.850	.121
	Within Groups		.845		
ISO-Y6 * ISO-X7	Between Groups	Deviation from Linearity	.958	.914	.457
	Within Groups		1.049		
ISO-Y7 * ISO-X7	Between Groups	Deviation from Linearity	1.084	1.067	.374
	Within Groups		1.016		

(Appendix E-2)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ISO-Y1 * ISO–X8	Between Groups	Deviation from Linearity	.409	.475	.754
	Within Groups		.862		
ISO-Y2 * ISO-X8	Between Groups	Deviation from Linearity	.535	.690	.600
	Within Groups		.775		
ISO-Y3 * ISO-X8	Between Groups	Deviation from Linearity	.620	.733	.570
	Within Groups		.845		
ISO-Y4 * ISO-X8	Between Groups	Deviation from Linearity	1.144	1.172	.325
	Within Groups		.976		
ISO-Y5 * ISO-X8	Between Groups	Deviation from Linearity	.121	.143	.966
	Within Groups		.851		
ISO-Y6 * ISO-X8	Between Groups	Deviation from Linearity	.821	.829	.508
	Within Groups		.991		
ISO-Y7 * ISO-X8	Between Groups	Deviation from Linearity	2.046	2.045	.090
	Within Groups		1.001		

Appendix E-3: Linearity checked by statistic (Model 3)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X1	Between Groups	Deviation from Linearity	.954	1.029	.392
	Within Groups		.927		
ISO-Y2 * ISO-X1	Between Groups	Deviation from Linearity	.611	.615	.652
	Within Groups		.993		
ISO-Y3 * ISO-X1	Between Groups	Deviation from Linearity	3.846	2.702	***.030***
	Within Groups		1.423		
ISO-Y4 * ISO-X1	Between Groups	Deviation from Linearity	3.312	2.135	.076
	Within Groups		1.552		
ISO-Y5 * ISO-X1	Between Groups	Deviation from Linearity	3.596	2.428	.047
	Within Groups		1.481		
ISO-Y6 * ISO-X1	Between Groups	Deviation from Linearity	1.073	.617	.651
	Within Groups		1.739		
ISO-Y7 * ISO-X1	Between Groups	Deviation from Linearity	.351	.266	.900
	Within Groups		1.318		

(Appendix E-3)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ISO-Y1 * ISO–X2	Between Groups	Deviation from Linearity	1.754	1.898	.110
	Within Groups		.924		
ISO-Y2 * ISO-X2	Between Groups	Deviation from Linearity	1.050	1.065	.373
	Within Groups		.985		
ISO-Y3 * ISO-X2	Between Groups	Deviation from Linearity	1.060	.742	.563
	Within Groups		1.428		
ISO-Y4 * ISO-X2	Between Groups	Deviation from Linearity	1.770	1.146	.335
	Within Groups		1.545		
ISO-Y5 * ISO-X2	Between Groups	Deviation from Linearity	1.310	.887	.472
	Within Groups		1.478		
ISO-Y6 * ISO-X2	Between Groups	Deviation from Linearity	1.541	.877	.477
	Within Groups		1.757		
ISO-Y7 * ISO-X2	Between Groups	Deviation from Linearity	.432	.331	.857
	Within Groups		1.306		

(Appendix E-3)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X3	Between Groups	Deviation from Linearity	.194	.210	.933
	Within Groups		.924		
ISO-Y2 * ISO-X3	Between Groups	Deviation from Linearity	1.250	1.275	.279
	Within Groups		.980		
ISO-Y3 * ISO-X3	Between Groups	Deviation from Linearity	1.922	1.351	.250
	Within Groups		1.423		
ISO-Y4 * ISO-X3	Between Groups	Deviation from Linearity	2.202	1.412	.229
	Within Groups		1.559		
ISO-Y5 * ISO-X3	Between Groups	Deviation from Linearity	.513	.344	.848
	Within Groups		1.492		
ISO-Y6 * ISO-X3	Between Groups	Deviation from Linearity	1.869	1.084	.364
	Within Groups		1.724		
ISO-Y7 * ISO-X3	Between Groups	Deviation from Linearity	2.624	2.028	.090
	Within Groups		1.294		

(Appendix E-3)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ISO-Y1 * ISO–X4	Between Groups	Deviation from Linearity	.797	.851	.494
	Within Groups		.937		
ISO-Y2 * ISO-X4	Between Groups	Deviation from Linearity	1.167	1.186	.316
	Within Groups		.984		
ISO-Y3 * ISO-X4	Between Groups	Deviation from Linearity	2.178	1.558	.185
	Within Groups		1.398		
ISO-Y4 * ISO-X4	Between Groups	Deviation from Linearity	.480	.307	.873
	Within Groups		1.563		
ISO-Y5 * ISO-X4	Between Groups	Deviation from Linearity	2.123	1.441	.220
	Within Groups		1.473		
ISO-Y6 * ISO-X4	Between Groups	Deviation from Linearity	.896	.510	.728
	Within Groups		1.757		
ISO-Y7 * ISO-X4	Between Groups	Deviation from Linearity	.401	.306	.874
	Within Groups		1.311		

(Appendix E-3)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ISO-Y1 * ISO–X5	Between Groups	Deviation from Linearity	.248	.264	.901
	Within Groups		.941		
ISO-Y2 * ISO-X5	Between Groups	Deviation from Linearity	.587	.589	.671
	Within Groups		.997		
ISO-Y3 * ISO-X5	Between Groups	Deviation from Linearity	1.276	.878	.477
	Within Groups		1.453		
ISO-Y4 * ISO-X5	Between Groups	Deviation from Linearity	2.552	1.651	.161
	Within Groups		1.546		
ISO-Y5 * ISO-X5	Between Groups	Deviation from Linearity	2.094	1.380	.240
	Within Groups		1.517		
ISO-Y6 * ISO-X5	Between Groups	Deviation from Linearity	1.685	.963	.427
	Within Groups		1.749		
ISO-Y7 * ISO-X5	Between Groups	Deviation from Linearity	1.589	1.214	.304
	Within Groups		1.308		

(Appendix E-3)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X6	Between Groups	Deviation from Linearity	1.233	1.340	.254
	Within Groups		.920		
ISO-Y2 * ISO-X6	Between Groups	Deviation from Linearity	.007	.007	1.000
	Within Groups		.994		
ISO-Y3 * ISO-X6	Between Groups	Deviation from Linearity	1.602	1.122	.346
	Within Groups		1.428		
ISO-Y4 * ISO-X6	Between Groups	Deviation from Linearity	.782	.499	.736
	Within Groups		1.566		
ISO-Y5 * ISO-X6	Between Groups	Deviation from Linearity	1.844	1.231	.297
	Within Groups		1.497		
ISO-Y6 * ISO-X6	Between Groups	Deviation from Linearity	3.938	2.287	.059
	Within Groups		1.722		
ISO-Y7 * ISO-X6	Between Groups	Deviation from Linearity	1.725	1.326	.260
	Within Groups		1.301		

(Appendix E-3)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ISO-Y1 * ISO–X7	Between Groups	Deviation from Linearity	.177	.188	.944
	Within Groups		.940		
ISO-Y2 * ISO-X7	Between Groups	Deviation from Linearity	.795	.807	.521
	Within Groups		.985		
ISO-Y3 * ISO-X7	Between Groups	Deviation from Linearity	.470	.331	.857
	Within Groups		1.417		
ISO-Y4 * ISO-X7	Between Groups	Deviation from Linearity	.440	.281	.890
	Within Groups		1.567		
ISO-Y5 * ISO-X7	Between Groups	Deviation from Linearity	1.309	.866	.484
	Within Groups		1.511		
ISO-Y6 * ISO-X7	Between Groups	Deviation from Linearity	2.428	1.390	.237
	Within Groups		1.747		
ISO-Y7 * ISO-X7	Between Groups	Deviation from Linearity	.675	.512	.727
	Within Groups		1.317		

(Appendix E-3)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ISO-Y1 * ISO–X8	Between Groups	Deviation from Linearity	2.637	2.960	***.020***
	Within Groups		.891		
ISO-Y2 * ISO-X8	Between Groups	Deviation from Linearity	.650	.658	.622
	Within Groups		.989		
ISO-Y3 * ISO-X8	Between Groups	Deviation from Linearity	1.729	1.199	.311
	Within Groups		1.441		
ISO-Y4 * ISO-X8	Between Groups	Deviation from Linearity	4.328	2.819	***.025***
	Within Groups		1.535		
ISO-Y5 * ISO-X8	Between Groups	Deviation from Linearity	.757	.509	.729
	Within Groups		1.488		
ISO-Y6 * ISO-X8	Between Groups	Deviation from Linearity	3.529	2.078	.083
	Within Groups		1.698		
ISO-Y7 * ISO-X8	Between Groups	Deviation from Linearity	2.155	1.663	.158
	Within Groups		1.296		

Appendix E-4: Linearity checked by statistic (Model 4)

ANOVA Table					
			Mean Square	**F**	**Sig.**
ISO-Y1 * ISO–X1	Between Groups	Deviation from Linearity	1.498	1.632	.165
	Within Groups		.918		
ISO-Y2 * ISO-X1	Between Groups	Deviation from Linearity	1.325	1.423	.225
	Within Groups		.931		
ISO-Y3 * ISO-X1	Between Groups	Deviation from Linearity	3.846	3.115	***.015***
	Within Groups		1.235		
ISO-Y4 * ISO-X1	Between Groups	Deviation from Linearity	4.051	2.915	***.021***
	Within Groups		1.389		
ISO-Y5 * ISO-X1	Between Groups	Deviation from Linearity	3.395	2.647	***.033***
	Within Groups		1.283		
ISO-Y6 * ISO-X1	Between Groups	Deviation from Linearity	.753	.499	.737
	Within Groups		1.509		
ISO-Y7 * ISO-X1	Between Groups	Deviation from Linearity	.620	.509	.729
	Within Groups		1.219		

(Appendix E-4)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X2	Between Groups	Deviation from Linearity	.870	.938	.441
	Within Groups		.927		
ISO-Y2 * ISO-X2	Between Groups	Deviation from Linearity	1.592	1.716	.145
	Within Groups		.928		
ISO-Y3 * ISO-X2	Between Groups	Deviation from Linearity	1.386	1.132	.341
	Within Groups		1.225		
ISO-Y4 * ISO-X2	Between Groups	Deviation from Linearity	2.260	1.623	.167
	Within Groups		1.393		
ISO-Y5 * ISO-X2	Between Groups	Deviation from Linearity	1.450	1.126	.343
	Within Groups		1.287		
ISO-Y6 * ISO-X2	Between Groups	Deviation from Linearity	1.822	1.181	.318
	Within Groups		1.542		
ISO-Y7 * ISO-X2	Between Groups	Deviation from Linearity	.796	.663	.618
	Within Groups		1.200		

(Appendix E-4)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X3	Between Groups	Deviation from Linearity	.422	.460	.765
	Within Groups		.918		
ISO-Y2 * ISO-X3	Between Groups	Deviation from Linearity	.210	.224	.925
	Within Groups		.934		
ISO-Y3 * ISO-X3	Between Groups	Deviation from Linearity	1.139	.918	.453
	Within Groups		1.241		
ISO-Y4 * ISO-X3	Between Groups	Deviation from Linearity	1.986	1.402	.232
	Within Groups		1.417		
ISO-Y5 * ISO-X3	Between Groups	Deviation from Linearity	.524	.400	.809
	Within Groups		1.310		
ISO-Y6 * ISO-X3	Between Groups	Deviation from Linearity	2.464	1.632	.165
	Within Groups		1.510		
ISO-Y7 * ISO-X3	Between Groups	Deviation from Linearity	1.590	1.308	.266
	Within Groups		1.216		

(Appendix E-4)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X4	Between Groups	Deviation from Linearity	.539	.581	.677
	Within Groups		.929		
ISO-Y2 * ISO-X4	Between Groups	Deviation from Linearity	.919	.994	.410
	Within Groups		.925		
ISO-Y3 * ISO-X4	Between Groups	Deviation from Linearity	2.147	1.755	.136
	Within Groups		1.223		
ISO-Y4 * ISO-X4	Between Groups	Deviation from Linearity	1.200	.860	.488
	Within Groups		1.395		
ISO-Y5 * ISO-X4	Between Groups	Deviation from Linearity	2.801	2.206	.067
	Within Groups		1.270		
ISO-Y6 * ISO-X4	Between Groups	Deviation from Linearity	1.287	.854	.492
	Within Groups		1.508		
ISO-Y7 * ISO-X4	Between Groups	Deviation from Linearity	.257	.212	.932
	Within Groups		1.215		

(Appendix E-4)

ANOVA Table

			Mean Square	**F**	**Sig.**
ISO-Y1 * ISO–X5	Between Groups	Deviation from Linearity	.620	.667	.615
	Within Groups		.930		
ISO-Y2 * ISO-X5	Between Groups	Deviation from Linearity	.164	.174	.952
	Within Groups		.942		
ISO-Y3 * ISO-X5	Between Groups	Deviation from Linearity	.783	.624	.646
	Within Groups		1.255		
ISO-Y4 * ISO-X5	Between Groups	Deviation from Linearity	2.964	2.140	.074
	Within Groups		1.385		
ISO-Y5 * ISO-X5	Between Groups	Deviation from Linearity	2.069	1.580	.178
	Within Groups		1.309		
ISO-Y6 * ISO-X5	Between Groups	Deviation from Linearity	.980	.641	.633
	Within Groups		1.528		
ISO-Y7 * ISO-X5	Between Groups	Deviation from Linearity	1.174	.966	.426
	Within Groups		1.216		

(Appendix E-4)

ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X6	Between Groups	Deviation from Linearity	.449	.485	.747
	Within Groups		.926		
ISO-Y2 * ISO-X6	Between Groups	Deviation from Linearity	.217	.235	.918
	Within Groups		.922		
ISO-Y3 * ISO-X6	Between Groups	Deviation from Linearity	1.953	1.604	.172
	Within Groups		1.217		
ISO-Y4 * ISO-X6	Between Groups	Deviation from Linearity	.309	.220	.927
	Within Groups		1.407		
ISO-Y5 * ISO-X6	Between Groups	Deviation from Linearity	1.922	1.480	.207
	Within Groups		1.298		
ISO-Y6 * ISO-X6	Between Groups	Deviation from Linearity	3.788	2.517	***.040***
	Within Groups		1.505		
ISO-Y7 * ISO-X6	Between Groups	Deviation from Linearity	.568	.469	.759
	Within Groups		1.212		

(Appendix E-4)

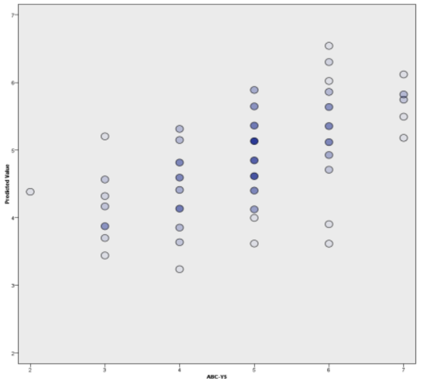
ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X7	Between Groups	Deviation from Linearity	.306	.330	.858
	Within Groups		.929		
ISO-Y2 * ISO-X7	Between Groups	Deviation from Linearity	.902	.981	.417
	Within Groups		.919		
ISO-Y3 * ISO-X7	Between Groups	Deviation from Linearity	.085	.069	.991
	Within Groups		1.241		
ISO-Y4 * ISO-X7	Between Groups	Deviation from Linearity	.607	.429	.788
	Within Groups		1.415		
ISO-Y5 * ISO-X7	Between Groups	Deviation from Linearity	1.338	1.011	.401
	Within Groups		1.323		
ISO-Y6 * ISO-X7	Between Groups	Deviation from Linearity	1.286	.832	.505
	Within Groups		1.546		
ISO-Y7 * ISO-X7	Between Groups	Deviation from Linearity	.089	.073	.990
	Within Groups		1.225		

(Appendix E-4)

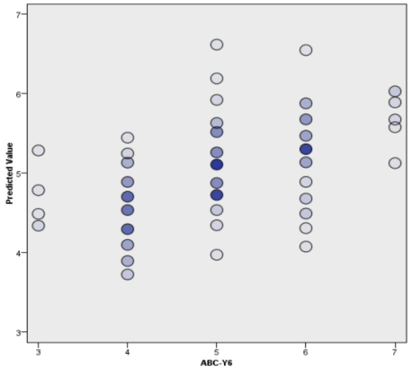
ANOVA Table					
			Mean Square	F	Sig.
ISO-Y1 * ISO–X8	Between Groups	Deviation from Linearity	.857	.956	.431
	Within Groups		.897		
ISO-Y2 * ISO-X8	Between Groups	Deviation from Linearity	.339	.362	.836
	Within Groups		.935		
ISO-Y3 * ISO-X8	Between Groups	Deviation from Linearity	2.101	1.690	.151
	Within Groups		1.243		
ISO-Y4 * ISO-X8	Between Groups	Deviation from Linearity	1.212	.854	.492
	Within Groups		1.420		
ISO-Y5 * ISO-X8	Between Groups	Deviation from Linearity	.568	.432	.785
	Within Groups		1.313		
ISO-Y6 * ISO-X8	Between Groups	Deviation from Linearity	2.799	1.866	.115
	Within Groups		1.500		
ISO-Y7 * ISO-X8	Between Groups	Deviation from Linearity	2.004	1.658	.158
	Within Groups		1.209		

Appendix F: Scatter plots of testing linearity

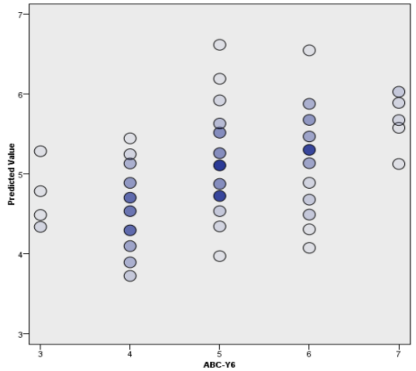
Appendix F-1: Scatter plots of testing linearity (Model 1)



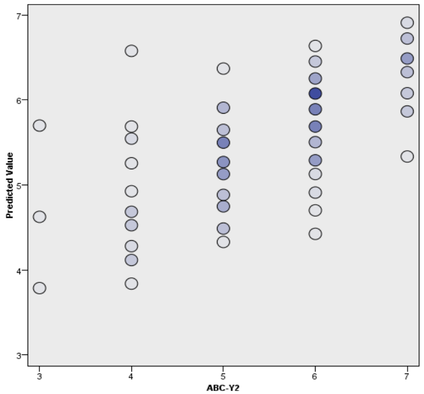
Y5, X4



Y6, X4

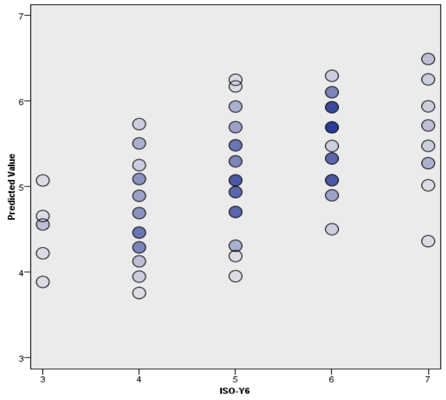


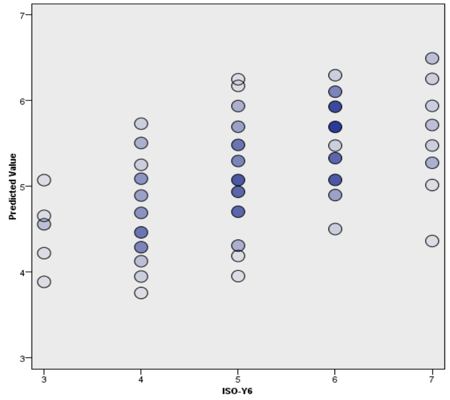
Y6, X5



Y2, X6

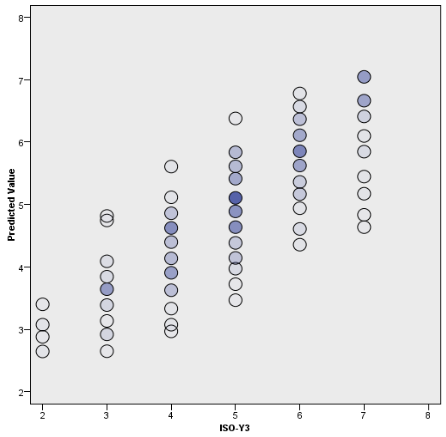
Appendix F-2: Scatter plots of testing linearity (Model 2)



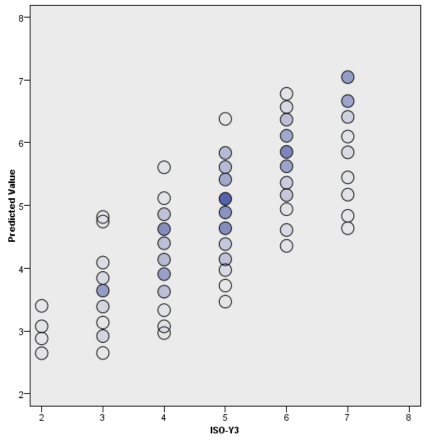


Y6, X6 **Y7, X6**

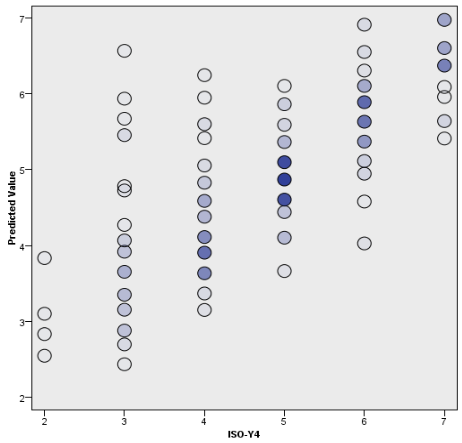
Appendix F-3: Scatter plots of testing linearity (Model 3)



Y3, X1

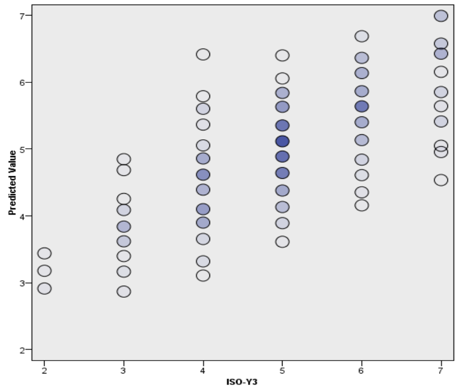


Y1, X8

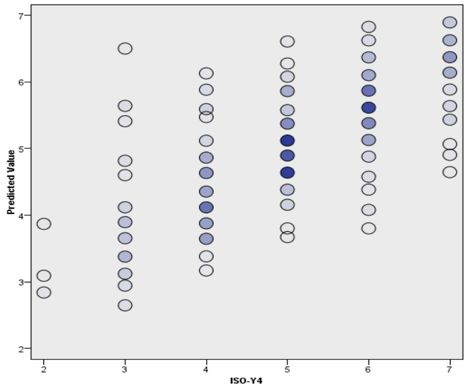


Y4, X8

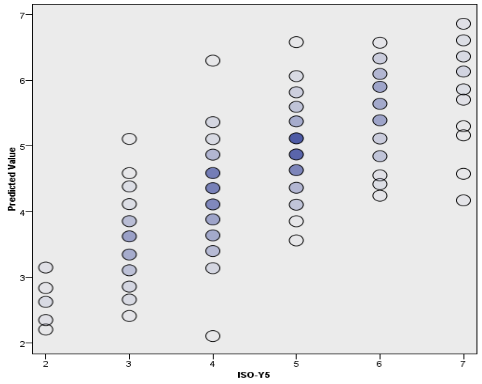
Appendix F-4: Scatter plots of testing linearity (Model 4)



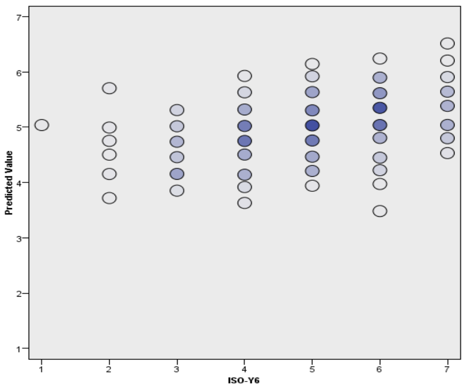
Y3, X1



Y4, X1



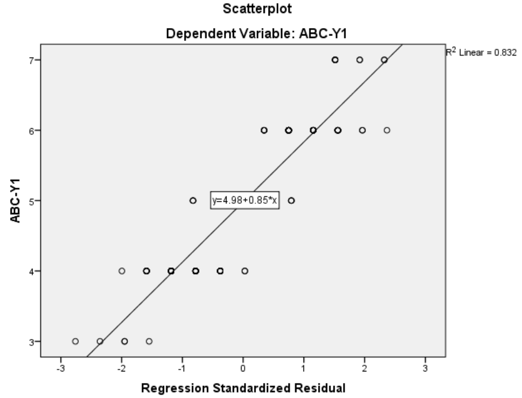
Y5, X1



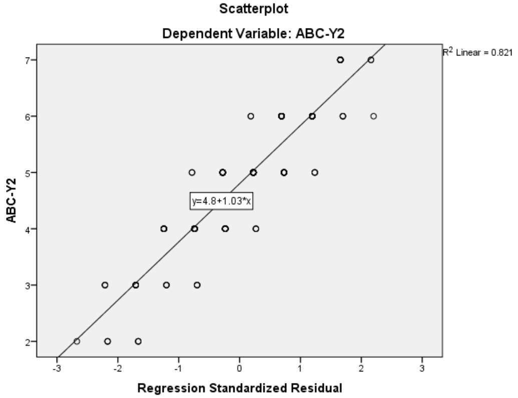
Y6, X6

Appendix G: Scatter plots of testing homoscedasticity

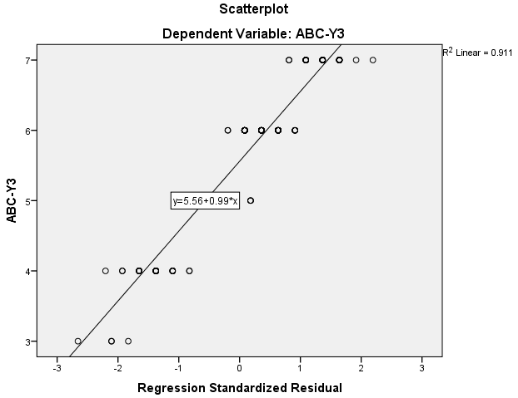
Appendix G-1: Scatter plots of testing homoscedasticity (Model 1)



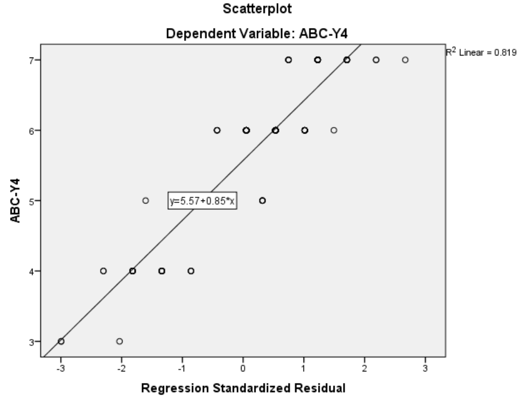
X1, Y1



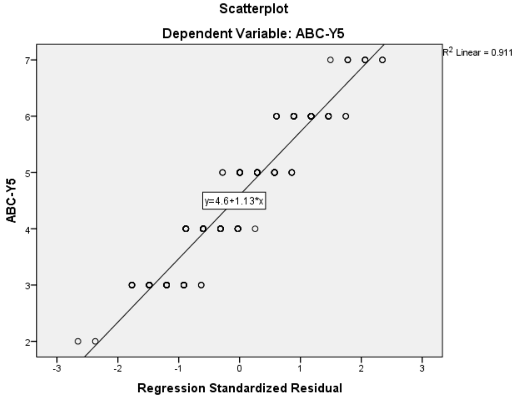
X2, Y2



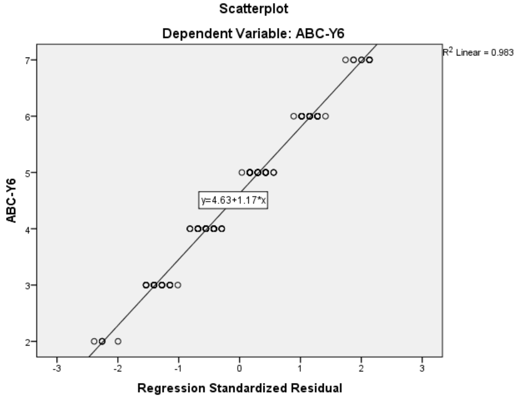
X3, Y3



X4, Y4

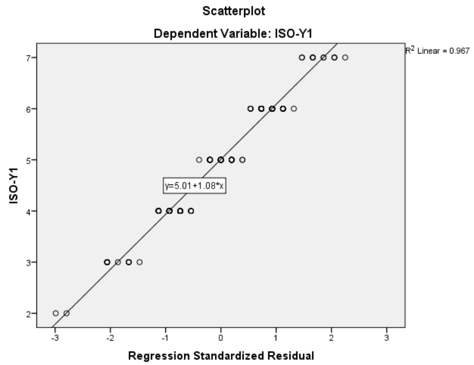


X5, Y5

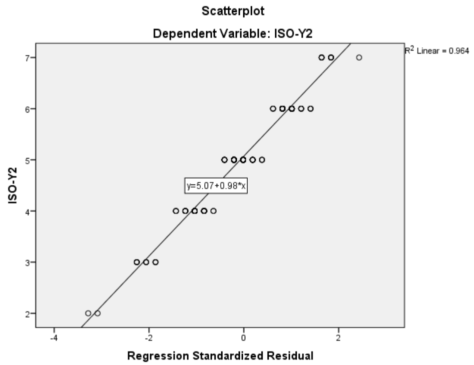


X6, Y6

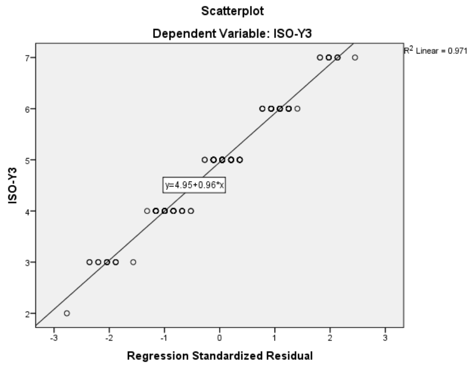
Appendix G-2: Scatter plots of testing homoscedasticity (Model 2)



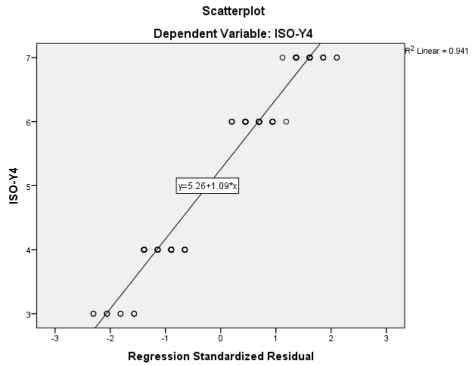
X1, Y1



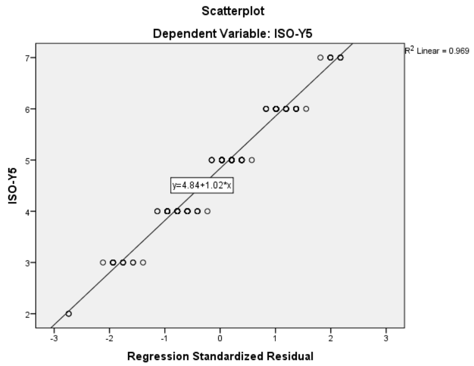
X2, Y2



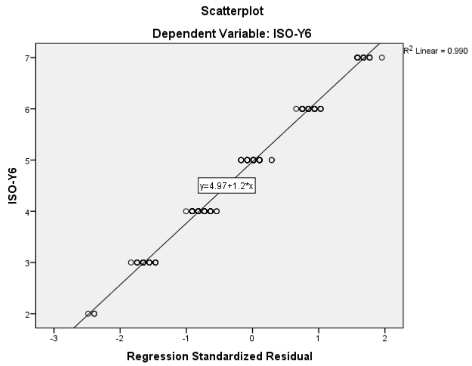
X3, Y3



X4, Y4

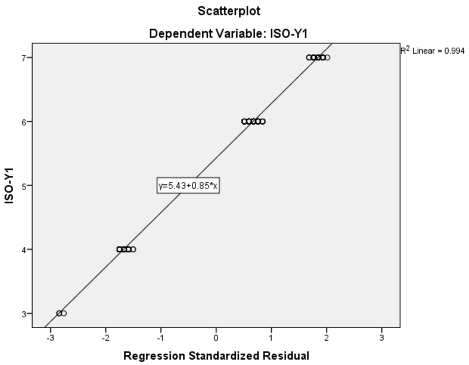


X5, Y5

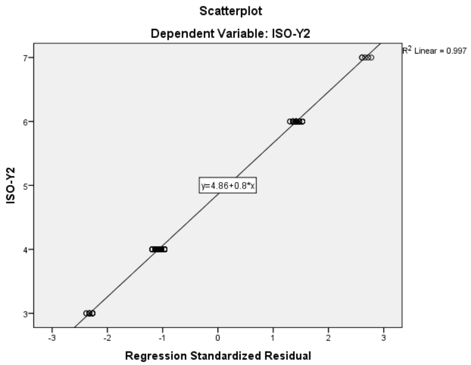


X6, Y6

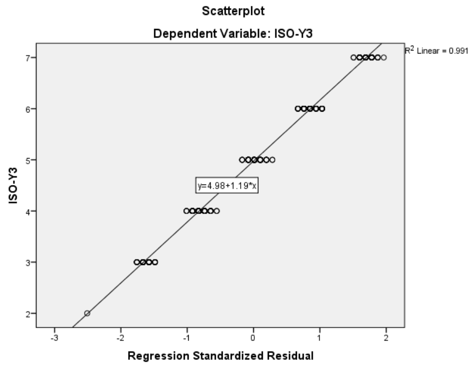
Appendix G-3: Scatter plots of testing homoscedasticity (Model 3)



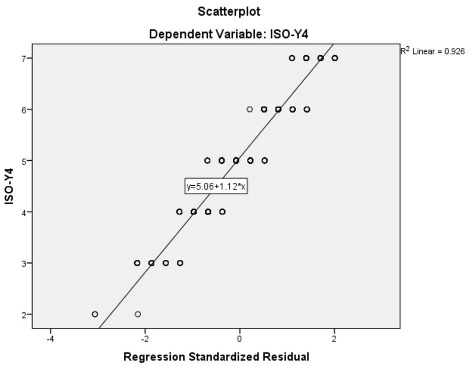
X1, Y1



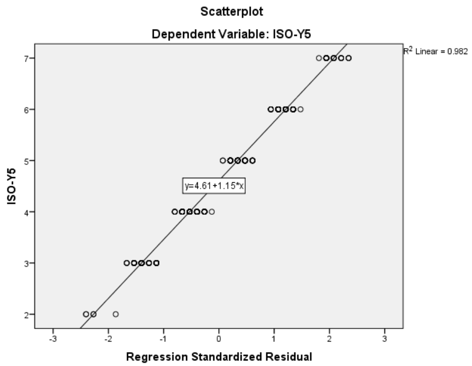
X2, Y2



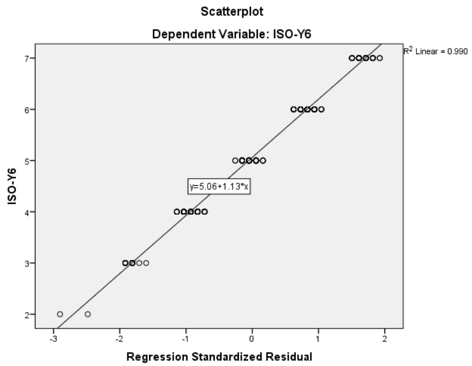
X3, Y3



X4, Y4

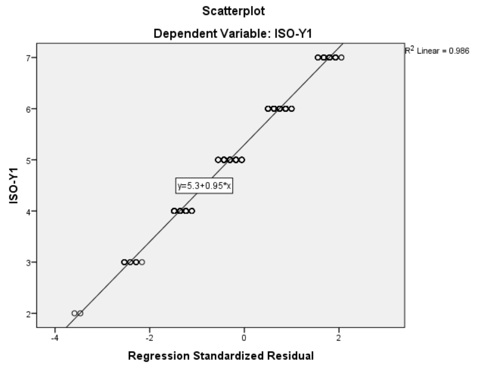


X5, Y5

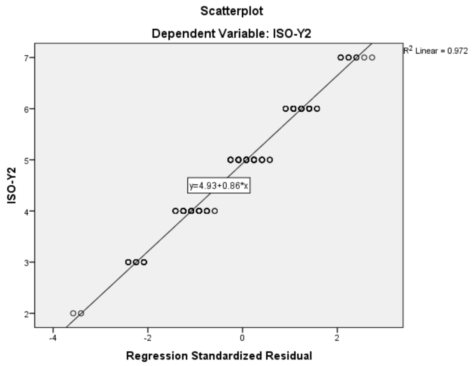


X6, Y6

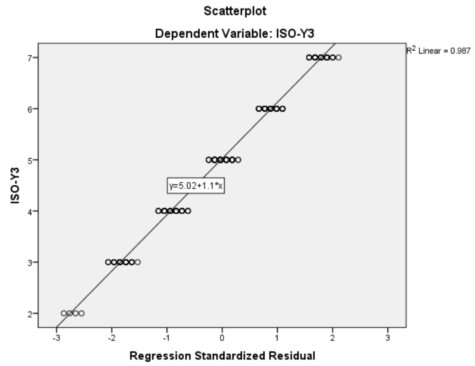
Appendix G-4: Scatter plots of testing homoscedasticity (Model 4)



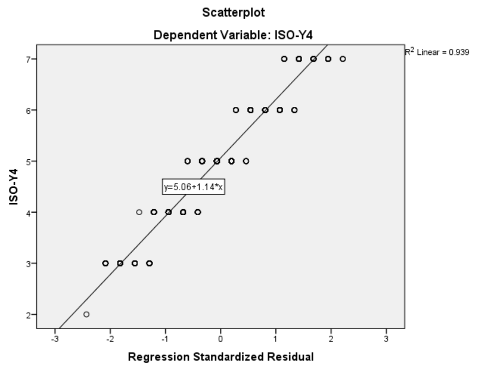
Y1, X1



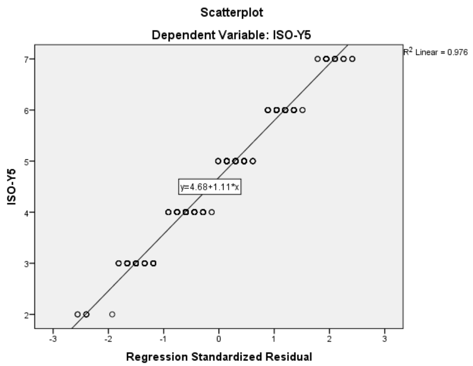
Y2,X2



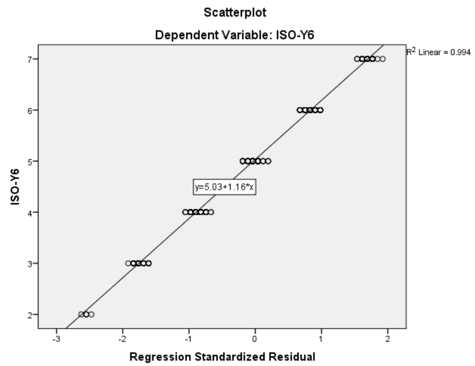
Y3,X3



Y4,X4



Y5,X5



Y6,X6

Appendix H: Respondents' profile

ISIC	Industrial Classification	Total	Coding		R	N	U	%
			Begins	Ends				
1	Agriculture, Hunting and Forestry	61	0001	0061	2	0	2	0.33
14	Other mining and quarrying	7			-	-	-	
151	Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats	50	0069	0118	8	2	6	1.00
152	Dairy products	11	0119	0129	-	-	-	
153	Grain mill products, starches and prepared animal feeds	67	0130	0196	13	1	12	2.00
154	Other food products	56	0197	0252	11	0	11	1.83
155	Beverages	17	0253	0269	4	0	4	0.67
16	Tobacco products	3	0270	0272	-	-	-	
17	Textiles	29	0273	0301	5	0	5	0.83
19	Leather/footwear	2	0302	0303	-	-	-	
20	Wood products	11	0304	0314	-	-	-	
21	Paper & paper products	43	0315	0357	25	1	24	3.99
22	Publishing/printing	16	0358	0373	2	0	2	0.33
232	Petroleum products	45	0374	0418	4	0	4	0.67
241	Basic chemicals	132	0419	0550	13	0	13	2.16
242	Other chemical products	157	0551	0707	27	1	26	4.33
243	Man-made fibres	2	0708	0709	-	-	-	
251	Rubber products	60	0710	0769	11	0	11	1.83
252	Plastic products	143	0770	0912	29	1	28	4.66
261	Glass & glass products	24	0913	0936	4	0	4	0.67
2691-3	Ceramic/clay products	19	0937	0955	2	0	2	0.33
2694-5	Cement/concrete	111	0956	1066	13	0	13	2.16
2696-9	Cutting, shaping and finishing of stone	4	1067	1070	0	0	0	0.00
271	Basic iron/steel	53	1071	1123	10	0	10	1.66
272	Precious/non-ferrous metals	15	1124	1138	-	-	-	
73	Casting of metals	15	1139	1153	-	-	-	
28	Metal products	305	1154	1458	88	3	85	14.14
29	Machinery and equipment	117	1459	1575	22	0	22	3.66
30	Office/accounting/computing machinery	43	1576	1618	8	0	8	1.33
31	Electrical machinery	197	1619	1815	72	1	71	11.81
32	Radio, TV, communication equipment	31	1816	1846	11	0	11	1.83
3311	Medical appliances	7	1847	1853	1	0	1	0.17
3312	Instruments and appliance for measuring	23	1854	1876	6	0	6	1.00
34/35	Motor vehicles/transport equipment	67	1877	1943	18	1	17	2.83
3610	Furniture	10	1944	1953	1	0	1	0.17
3691	Jewellery	5	1954	1958	-	-	-	
3693	Sports goods	1	1959	1959	-	-	-	
3694	Games/toys	6	1960	1965	1	0	1	0.17

(Appendix H)

ISIC	Industrial Classification	Total	Coding		R	N	U	%
			Begins	Ends				
3699	Other manufacturing	6	1966	1971	2	0	2	0.33
37	Recycling	14	1972	1985	-	-	-	
401	Production of electricity	19	1986	2004	-	-	-	
402	Manufacture of gas	25	2005	2029	3	0	3	0.50
41	Collection, purification and distribution of Water	37	2030	2066	6	0	6	1.00
45	Construction	105	2067	2171	34	1	33	5.49
502	Maintenance and repair of motor vehicles	69	2172	2240	11	0	11	1.83
505	Retail sale of automotive fuel	1	2241	2241	-	-	-	
51/52	Wholesale/retail trade	351	2242	2592	78	2	76	12.65
551	Hotels & accommodation	1	2593	2593	-	-	-	
60-63	Transport & supporting activities	148	2594	2741	19	2	17	2.83
642	Telecommunications	10	2742	2751	2	0	2	0.33
66	Insurance	32	2752	2783	2	0	2	0.33
70	Real estate activities	15	2784	2798	3	0	3	0.50
71	Renting of Machinery and equipment	5	2799	2803	-	-	-	
72	Computer & related activities	121	2804	2924	31	2	29	4.83
7412	Accounting, book-keeping and audited activities, tax consultancy	1	2925	2925	-	-	-	
7414	Business &management consultancy	8	2926	2933	2	0	2	0.33
7421	Architectural/engineering/technical consultancy	59	2934	2992	4	0	4	0.67
7422	Technical testing & analysis	5	2993	2997	-	-	-	
7491	Labour recruitment	3	2998	3000	-	-	-	
7492/ 7499	Investigation/security and other services	10	3001	3010	1	0	1	0.17
7493	Cleaning	3	3011	3013	1	0	1	0.17
7495	Packaging	1	3014	3014	-	-	-	
75	Public administration	22	3015	3036	-	-	-	
80	Education	16	3037	3052	4	0	4	0.67
8511	Hospital	13	3053	3065	-	-	-	
8519	Other human health activities	15	3066	3080	-	-	-	
90	Sanitation and similar activities	23	3081	3103	5	0	5	0.83
91	Activities of membership Organisation N.E.C	2	3104	3105	-	-	-	
	Total	3,105			619	18	601	100

Note: R indicates the total number of returned questionnaires

N indicates the number of non-usable or uncompleted questionnaires

U indicates the number of usable questionnaires