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Critical Success Factors for Accounting Information Systems Data Quality

A dissertation submitted by

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ABSTRACT

Quality information is critical to organisations' success in today's highly competitive environment. Accounting information systems (AIS) as a discipline within information systems require high quality data. However, empirical evidence suggests that data quality is problematic in AIS. Therefore, knowledge of critical factors that are important in ensuring data quality in accounting information systems is desirable.

A literature review evaluates previous research work in quality management, data quality, and accounting information systems. It was found that there was a gap in the literature about critical success factors for data quality in accounting information systems. Based on this gap in the literature and the findings of the exploratory stage of the research, a preliminary research model for factors influence data quality in AIS was developed. A framework for understanding relationships between stakeholder groups and data quality in accounting information systems was also developed. The major stakeholders are information producers, information custodians, information managers, information users, and internal auditors.

Case study and survey methodology were adopted for this research. Case studies in seven Australian organisations were carried out, where four of them were large organisations and the other three are small to medium organisations (SMEs). Each case was examined as a whole to obtain an understanding of the opinions and perspectives of the respondents from each individual organisation as to what are considered to be the important factors in the case. Then, cross-case analysis was used to analyze the similarities and differences of the seven cases, which also include the variations between large organisations and small to medium organisations (SMEs). Furthermore, the variations between five different stakeholder groups were also examined. The results of the seven main case studies suggested 26 factors that may have impact on data quality in AIS.

Survey instrument was developed based on the findings from case studies. Two large-scale surveys were sent to selected members of Australian CPA, and Australian Computer Society to further develop and test the research framework. The major findings from the survey are: 1. respondents rated the importance of the factors

consistent higher than the actual performance of those factors. 2. There was only one factor, *'audit and reviews'*, that was found to be different between different sized organisations. 3. Four factors were found to be significantly different between different stakeholder groups: *user focus*, *measurement and reporting*, *data supplier quality management* and *audit and reviews*. 4. The top three critical factors for ensuring data quality in AIS were: top management commitment, education and training, and the nature of the accounting information systems.

The key contribution of this thesis is the theoretical framework developed from the analysis of the findings of this research, which is the first such framework built upon empirical study that explored factors influencing data quality in AIS and their interrelationships with stakeholder groups and data quality outcomes. That is, it is now clear which factors impact on data quality in AIS, and which of those factors are critical success factors for ensuring high quality information outcomes. In addition, the performance level of factors was also incorporated into the research framework. Since the actual performance of factors has not been highlighted in other studies, this research adds new theoretical insights to the extant literature. In turn, this research confirms some of the factors mentioned in the literature and adds a few new factors. Moreover, stakeholder groups of data quality in AIS are important considerations and need more attention. The research framework of this research shows the relationship between stakeholder groups, important factors and data quality outcomes by highlighting stakeholder groups' influence on identifying the important factors, as well as the evaluation of the importance and performance of the factors.

CERTIFICATION OF DISSERTATION

I certify that the ideas, results, analyses and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

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Signature of Candidate Date

ENDORSEMENT

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Signature of Supervisor Date

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Publication list

The following is a list of publications of the candidate, which are direct products from this PhD research.

Book chapter

- Xu, H., Koronios, A., & Brown, N., 2002, "Managing Data Quality in Accounting Information Systems," *IT-Based Management: Challenges and Solutions*, Joia, L. A. (Ed.) Idea Group Publishing: Hershey PA, ISBN 1-59140-033-3 (h/c), eISBN 1-59140-075-9

International refereed Journal article

- Xu, H., Nord, J, Brown, N. & Nord, D, 2002, "Data quality issues in implementing an ERP," *Industrial Management & Data Systems*, volume 102, number 1, pp47 –58.

- Xu, H., Nord, J & Nord, D, forthcoming, "Key Issues of Accounting Information Quality Management: Australian Case Studies," *Industrial Management & Data Systems*, accepted and scheduled for publication.

International refereed conference proceeding papers

- Xu, H. & Al-Hakim, L. 2003, "Do IT Professionals Think Differently?" Information Resources Management Association International Conference (IRMA'2003), Philadelphia PA, USA

- Xu, H. & Al-Hakim, L. 2002, "Accounting Information Systems Data Quality: A Critical Success Factors Approach," Information Resources Management Association International Conference (IRMA'2002), Seattle WA, USA

- Xu, H., Koronios, A. & Al-Hakim, L. 2002, "Critical success factors for financial information systems," Pacific Conference on Manufacturing (PCM'2002), Bangkok, Thailand

- Xu, H., 2002, "The Survey of Factors Impacting Upon Accounting Information Quality", ACME International Conference on Pacific Rim Management, Los Angles, USA

- Xu, H., Koronios, A., & Brown, N., 2001, " A model for data quality in accounting information systems," the invited session Data and Information

Quality (DIQ), the 5th World Multiconference on Systemics, Cybernetics and informatics (SCI'2001), Orlando, USA

- Xu, H., 2001, " Key Issues of Accounting Information Quality Management-An Australian Case Study," International Conferences on Info-tech & Info-net (ICII'2001), Beijing, China

- Xu, H. & Koronios, A., 2000, " Critical success factors for accounting information systems data quality," the invited session Data and Information Quality (DIQ), the 4th World Multiconference on Systemics, Cybernetics and informatics (SCI'2000), Orlando, USA

- Xu, H., 2000, "Managing accounting information quality- an Australian study," the 21st International Conference on Information Systems (**ICIS'2000**), Brisbane, Australia.

National refereed conference proceeding papers

- Xu, H., 2001, "A Case Study on Factors Influencing Accounting Information Quality," Systems in Management 7th Annual ANZSYS Conference, Perth, Australia

- Xu, H., 2001, " Stakeholder Perspectives of Accounting Information Quality," The Annual Conference of CHISIG, the Computer-Human Interaction Special Interest Group of the Ergonmics Society of Australia (OZCHI'2001), Perth, Australia

International conference proceeding papers

- Xu, H. & Koronios, A., 2000, "Knowledge quality management in e-Business, " European Conference on Knowledge Management (ECKM'2000), Bled, Slovenia

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1 Introduction

1.1 Background

Today's organisations are operating and competing in an information age. Information has become a key resource of most organisations, economies, and societies. Indeed, an organisation's basis for competition has changed from tangible products to intangible information. More and more organisations believe that quality information is critical to their success (Wang et al., 1998). However, not many of them have turned this belief into effective action. Poor quality information can have significant social and business impacts (Strong, Lee & Wang, 1997). There is strong evidence that data quality problems are becoming increasingly prevalent in practice (Redman 1998, Wand & Wang, 1996). Most organisations have experienced the adverse effects of decisions based on information of inferior quality (Huang, Lee & Wang, 1999). It is likely that some data stakeholders are not satisfied with the quality of the information delivered in their organisations. In brief, information quality issues have become important for organisations that want to perform well, obtain competitive advantage, or even just survive in the 21st century.

In particular, Accounting Information Systems (AIS) maintain and produce the data used by organisations to plan, evaluate, and diagnose the dynamics of operations and financial circumstances (Anthony, Reese & Herrenstein, 1994). Providing and assuring quality data is an objective of accounting. With the advent of AIS, the traditional focus on the input and recording of data needs to be offset with recognition that the systems themselves may affect the quality of data (Fedorowicz & Lee, 1998). Indeed, empirical evidence suggests that data quality is problematic in AIS (Johnson, Leith, & Neter, 1981). AIS data quality is concerned with detecting the presence or absence of target error classes in accounts (Kaplan, Krishnan, Padman & Peters, 1998).

Thus, knowledge of the critical factors that influence data quality in AIS will assist organisations to improve their accounting information systems' data quality. While many AIS studies have looked at internal control and audit, Data Quality (DQ)

studies have focussed on the measurement of DQ outcomes. It appears that there have been very few attempts to identify the Critical Success Factors (CSFs) for data quality in AIS. Thus, there is a need for research to identify the critical success factors that affect organisations' AIS DQ.

Information technology has changed the way in which traditional accounting systems work. There is more and more electronically captured information that needs to be processed, stored, and distributed through IT-based accounting systems. Advanced IT has dramatically increased the ability and capability of processing accounting information. At the same time, however, it has also introduced some issues that traditional accounting systems have not experienced. One critical issue is the data quality in AIS. IT advantages can sometimes create problems rather than benefiting an organisation, if data quality issues have not been properly addressed. Information overload is a good example. Do we really need the quantity of information generated by the systems to make the right decision? Another example is e-commerce. Should the quality of data captured online always be trusted?

Data quality has become crucial for the success of AIS in today's IT age. The need arises for quality management of data, as data processing has shifted from the role of operations support to a major operation in itself (Wang, Kon & Madnick, 1993b). Therefore, knowledge of those factors impact on data quality in accounting information systems is desirable, because those factors can increase the operating efficiency of AIS and contribute to the effectiveness of management decision-making.

1.2 Research problem and research questions

In brief, it appears that little literature has discussed the CSF impact on the data quality of AIS. Preliminary research of the area done by the researcher showed real-world practitioners addressed it as an important issue in AIS, yet there are no guidelines on what are the CSFs for data quality in AIS at the moment. Therefore, the thesis seeks to address this problem.

Research Problem: There is a lack of knowledge of critical success factors for ensuring data quality in accounting information systems.

In order to explore the research problem, the focus of the thesis is on four research questions:

RQ 1. What factors affect the variation of data quality in accounting information systems, and why?

RQ 2. Are there any variations with regard to the perceptions of importance of those factors that affect data quality in accounting information systems between:

- *RQ 2.1. different major AIS stakeholder groups*
- *RQ 2.2. different sized organisations*

RQ 3. What is the actual performance level of real-world organisations in terms of the factors that affect data quality in accounting information systems?

*RQ 4. Which of these factors are **critical success factors** to ensure a high quality of data in accounting information systems?*

General plan and specific objectives for this research:

Stage one: Exploratory

- Propose a list of possible factors influencing the data quality of AIS from the literature;
- Conduct pilot case studies to identify further factors;
- Identify possible factors that impact on DQ in AIS using the findings from the pilot case studies together with the literature;

Stage two: Confirmatory / disconfirmatory

- Examine those factors identified by the first stage in real practice use multiple case studies, including the similarities and differences between:
    - different major AIS stakeholders,

- different sized organisations;
- Identify a set of general important factors for data quality in AIS from the analysis of multiple case studies findings;

Stage three: Theory testing

- Use a large scale survey to investigate those factors identified in the second stage, with respect to:
  - The extent of the actual performance of CSFs,
  - The perceptions of importance of CSFs between:
    - Different stakeholder groups,
    - Different sized organisations; and
- Identify critical success factors in ensuring data quality in accounting information systems.

1.3 Justification for this research

The proposed research can be justified in terms of:

1. Gaps in the literature;
2. The importance of data quality issues;
3. Benefits to research and practice.

1.3.1 Gaps in the literature

Most of the information system research into data quality focuses on the theoretical modelling of controls and measurement. For example, there is research on the impact and propagation of error throughout information systems (Brodie 1980; Menkus 1983; Wand & Weber 1989; Redman 1998). Other studies focus on editing data and input controls (Fellegi and Holt 1976; Liepens, Garfinkel & Kunnathur 1982; McKeown 1984; Garfinkel, Kunnathur & Liepens 1986; Little & Smith 1987; Bowen 1993). Many studies in AIS have focused on internal controls and audit, (Yu 1973; Cushing 1974; Nicholes 1987; Jonson 1981). However, few studies have attempted to understand what causes the difference in AIS data quality outcomes,

and what should be done to ensure high quality accounting information. Therefore, there is lack of knowledge of the CSF for data quality in AIS that can assist organisations to ensure and improve accounting information quality.

1.3.2 The importance of data quality issues

Computerised databases continue to proliferate, and organisations continue to become increasingly dependent upon their databases to support business process and decision making. The number of errors in stored data and the organisational impact of these errors is likely to increase (Klein 1998). Inaccurate and incomplete data may adversely affect the competitive success of an organisation (Redman 1992). Indeed, poor quality information can have significant social and business impacts. For example, *NBC News* reported that "dead people still eat!" Because of outdated information in US government databases, food stamps continued to be sent to recipients long after they died. Fraud from food stamps costs US taxpayers billions of dollars. (Huang et al 1999). Another example, from a business perspective, a financial company absorbed a net loss totalling more than $250 million when interest rates changed dramatically, and the company was caught unawares (Huang et al 1999).

In particular, there are consequences of poor data quality in AIS. For example, errors in an inventory database may cause managers to make decisions that generate over-stock or under-stock conditions (Bowen 1993). One minor data entry error, such as the unit of product / service price, could go through an organisation's AIS without appropriate data quality checks, and cause losses to an organisation and / or harm its reputation.

1.3.3 Possible benefits of outcomes for research and practice

Identifying the critical success factors for AIS could enhance the ability of AISs to gather data, process information and prepare reports. Outcomes of this research will contribute to the body of knowledge both in AIS and data quality field, and it may benefit other research into these areas. For example, it can help arouse the awareness

of data quality issues in AIS field, and to make it possible to establish the linkage of the identified CSFs with the existing data quality dimensions for outcomes assessment.

Thus, understanding how these factors affect organisations' AIS performance may be useful to practitioners. Focusing on those factors that are more critical than others will lead to efficiency and effectiveness AIS's procedures. In brief, the results from this research are likely to help organisations' top management, accountants, and IT managers obtain better understanding of AIS DQ issues.

1.4 Research approach and methodology

In order to achieve the research objectives, the research was structured in terms of the following four phases:

1. Development of the research model;
2. Testing of the research model through multiple case studies;
3. Modification of the research model in response to identification of critical success factors for data quality in AIS;
4. Further developing and testing of the research model through a large scale survey.

The first phase involved the development of the research model representing possible factors impacting upon data quality in AIS. The prior theories from the relevant literature were used together with the pilot case study, in order to build the research model.

A list of factors that influence data quality in AIS was proposed by synthesising critical success factors for quality management, data quality, and accounting information systems concepts. An initial model of factors that could possibly influence DQ in AIS was drawn from the literature review. This prior model was used to help develop the preliminary research model, and focus the data-collection phase.

Two pilot case studies were conducted in two Brisbane organisations because of their geographical convenience. The pilot studies tested the pilot case study protocol, before the case study data collection. They assisted in refining data collection plans with respect to both the contexts of the data and the procedures to be followed (Yin 1994). The pilot interviews provided guidelines for the development of the interview protocol to be used in the second phase of the study. They provided a broad picture of data quality issues in AIS, and the evidence of accepting or rejecting initial proposed factors from the literature. The pilot study uncovered some additional factors that influence accounting information quality beyond those gleaned from the literature. Therefore, this added to the factors in the developing research model, which is discussed next.

Data from the pilot study and the literature was used to build the preliminary research model of possible critical success factors for DQ in AIS. The detailed literature review is provided in Chapter 2.

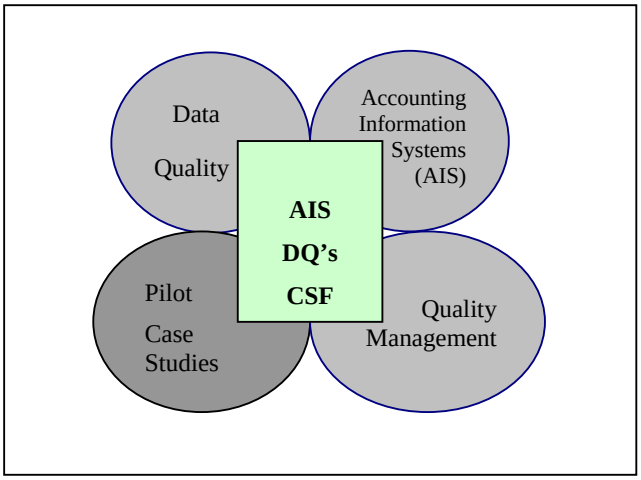


Figure 1.1 Areas that contributed to the model building of this research

Figure 1.1 shows how different areas of literature and the pilot study contributed to the model building of this study. The initial exploratory research was used to design the interview protocol and data collection procedures, for the second phase.

In the second phase of this research, the applicability of the proposed critical success factors for DQ in AIS was examined in practice. The case study research method was used in this phase. It has been recommended that case study research be used to study contemporary phenomena in real-life contexts (Yin 1994) and where research and theory are at their early, formative stages (Benbasat, Goldstein & Mead 1987). Given that little research has been conducted on critical success factors for data quality in AIS, there was a need to examine the real world AIS DQ critical success factors, and modify the initial proposed critical success factors based on real-life practice. Therefore, the case study method seemed appropriate for this phase.

Seven case studies were conducted as the methodology to investigate the critical success factors for accounting information quality. Within those seven cases, four were chosen from large organisations, and the other three from small to medium organisations (SMEs). This design allowed for investigating whether organisational size influences critical success factors. Due to funding constraints, the selected organisations are from cities on the eastern seaboard of Australia.

Semi-structured interviews were conducted with key stakeholders of AIS. In data quality studies, four types of stakeholders have been identified; they are data producers, data custodians, data consumers, and data managers (Strong et al 1997, Wang 1998). For the purpose of this research, AIS DQ's stakeholder groups were identified as follows:

- Information producers - those who create or collect data for AIS;
- Information custodians - those who design, develop and operate AIS;
- Information consumers - those who use the accounting information in their work activities;
- Data managers - those with overall responsibility for managing data quality in AIS.

From previous AIS literature (Hall, 1998) it was discovered that auditors play an important role in monitoring data quality. Consequently, organisations' internal auditors were also included as one of the major stakeholder groups.

In case studies of this research, key stakeholders in large organisations have been identified as accounting managers, accountants as information producers, IT managers as information custodians, senior managers as information consumers, DAs or DBAs as data managers, and internal auditors. It is likely that SMEs have fewer personnel involved in their AIS. Therefore, there are fewer stakeholders in SMEs than in larger organisations. Thus, key people that were interviewed in SMEs included accountants, IS personnel, and senior managers. Data collection sources also includes relevant documents, such as position descriptions, policy manuals, organisational structure charts and training documents; as well as some published information about organisations, such as financial statements and annual reports.

There are two different units of analysis in case studies. The individual organisation is the unit of analysis when comparing different organisations. The individual stakeholder is the unit of analysis when comparing the views of different stakeholders.

The purpose of the thesis case studies was to investigate key stakeholders' perceptions of critical success factors of AIS DQ and to determine the empirical validity of the conceptual basis of the proposed critical success factors.

This led to the identification of CSF for data quality in AIS. The case study data was used to modify or affirm the proposed critical success factors and making the decision for accepting and rejecting factors based on the case study data analysis. A particular set of critical success factors for AIS DQ can focus the attention of accounting and IS professionals as well as top management on the factors that need to be addressed for producing high quality accounting information.

The fourth phase involved a large scale cross-sectional survey, in order to further develop and test the research model. An attempt was made to rank the critical success factors identified by the case studies, and also investigate what level of performance had been achieved by real-world organisations in practice regarding those factors.

The survey instrument was used to capture information about:

1) The ranking order of the critical success factors that identified from case studies. That is, how organisations considered the importance of each of the critical success factors;
2) Variation in the level of CSFs that has been achieved in organisations. That is, what level of those factors organisations actually achieved in practice;
3) Whether there were any variations in stakeholders' perceptions regarding the importance of CSFs; and
4) Whether there were any variations for different sized organisations in their perceptions regarding the importance of CSFs.

1.5 Outline of the thesis

There are six chapters in the thesis. *Chapter 1* provides the background to the research and introduces the research problem and four research questions for investigation. It also includes justifications of the research and a brief overview of the research approach and methodology. Finally, the layout and content of the chapters is described.

Chapter 2 reviews the literature about the three parent disciplines of this research, which are quality management, data quality, and accounting information systems. This then leads to the immediate discipline of critical success factors for data quality in accounting information systems. From this review of the literature, a preliminary theoretical framework was developed and then refined after the pilot case study interviews. In addition, four research questions for investigation derived from the framework.

Chapter 3 describes and justifies case study and survey methodology within the scientific realism and positivism paradigms adopted for this research. The Chapter discusses the selection of cases together with the data collection procedures and unit of analysis. The pilot studies are also described. For the survey methodology, development of the survey instrument and data collection procedure is discussed,

along with the sampling strategy. The Chapter concludes with a discussion of the ethical considerations adopted in this research.

Chapter 4 presents the analysis of the case study data. The analysis is facilitated through the use of NUDIST software with the utilisation of selected qualitative analysis techniques, including within-case and cross-case analysis. Quotations of the interviewees from case studies are included to reinforce the research findings.

Chapter 5 presents the survey results, and the demographic profile of the survey respondents. It analyses the data collected from survey questionnaires using the techniques of comparing means, the paired comparison *t*-test, and analysis of variance (ANOVA) together with Tukey's post hoc comparison tests to evaluate research hypotheses.

Chapter 6 presents the major conclusions of this research. Each research question is answered, and then the research question is solved accordingly. The contributions to the body of knowledge made by this research are outlined as well as the implications for theory and practice. Finally, the limitations of this research are discussed, along with future research directions.

1.6 Conclusion

The purpose of this chapter is to lay the foundation for the research by providing background information and introducing the research problem and research questions. Justifications for this research are provided together with the contributions of the research. Then, the research approach and methodology are presented. Thus, this research is designed to contribute to the theory and practice of data quality management in accounting information systems. Finally, an outline of the thesis is given at the end of the chapter.

2 Literature review and development of preliminary research models

2.1 Introduction

The previous chapter introduced the research problem about the critical success factors for data quality in accounting information systems. In turn, the aim of this chapter is to review the literature concerning data quality, accounting information systems, and quality management that are relevant to the research problem. The background theories / parent disciplines used to develop the theoretical framework are discussed first broadly and then in a more focused way on the research problem.

This chapter has eight sections as depicted in Figure 2.1. After this introduction, Section 2.2 identifies the core terms to set the scene for the research. The three *parent disciplines,* quality management, data quality, and accounting information systems, are reviewed in Sections 2.3 to 2.5. These bodies of literature provide a basis for investigating data quality in accounting information systems as shown in the model of the chapter in Figure 2.2. These parent disciplines are the background for the *immediate discipline* that is discussed in turn to identify gaps in the literature, which lead to the four research questions for investigation (Section 2.6). Section 2.7 presents the pilot case study and the analysis of the findings from pilot study. As well as the development of preliminary research models for this study.

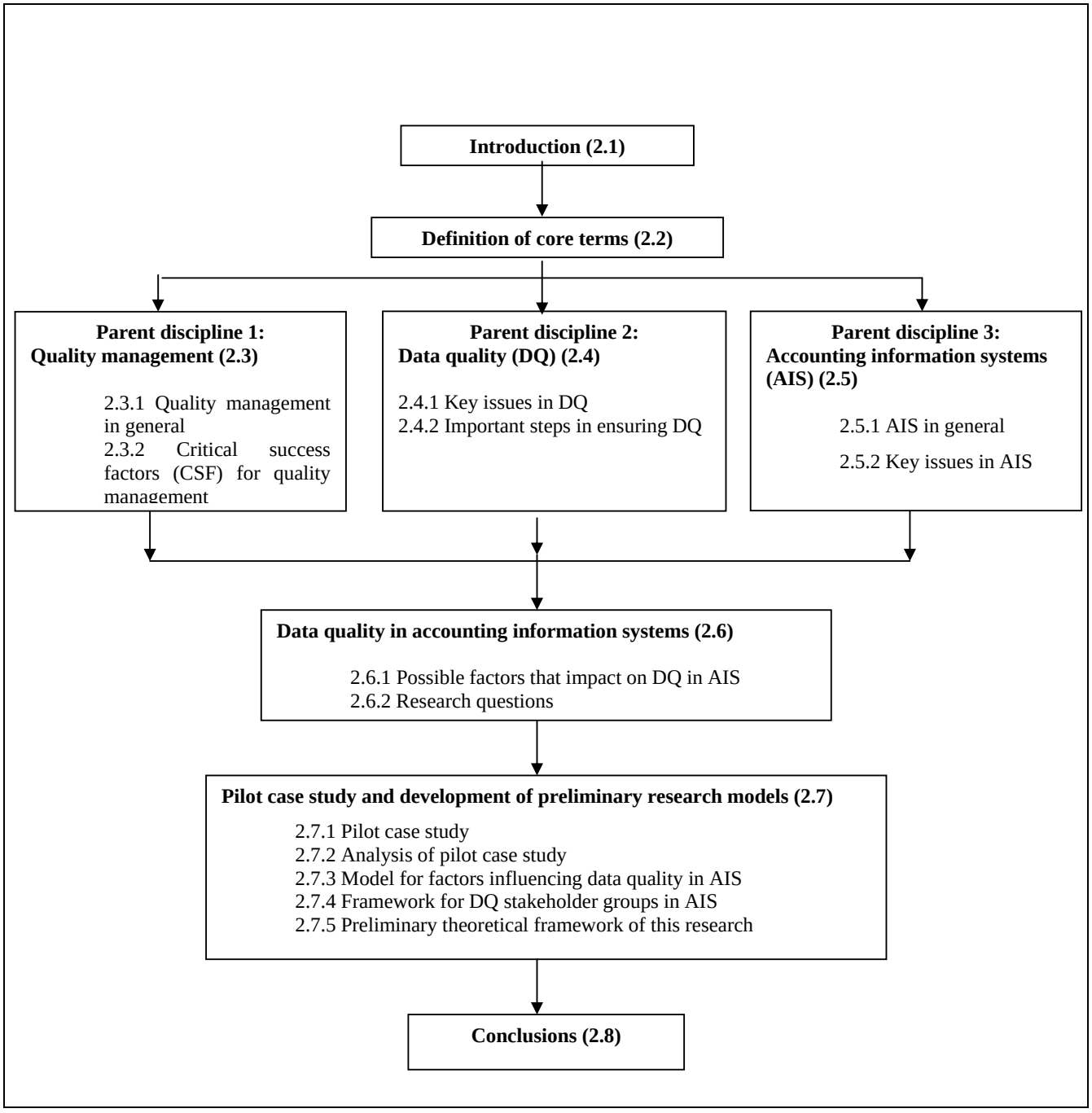


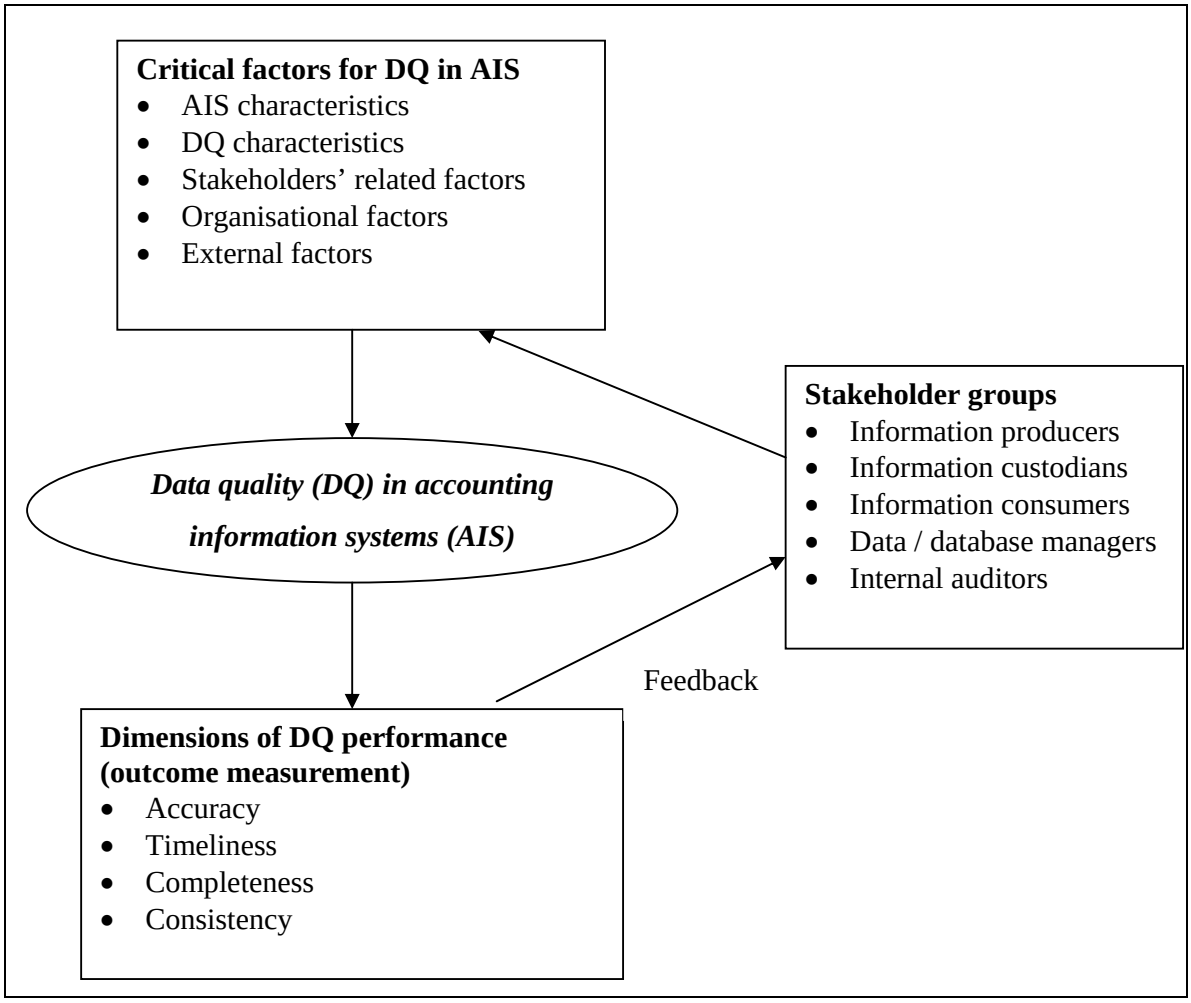
Figure 2.1 Outline of Chapter 2 with section numbers

Source: developed for this research

Theoretical framework

The key elements of data quality in accounting information systems are identified in the immediate discipline (Section 2.6), which was based on three parent disciplines (Sections 2.3 – 2.5). These elements of data quality are important to researchers and

practitioners and are developed in the theoretical framework of this research which is shown in figure 2.4 in Section 2.7 of this chapter. This framework is reproduced here as Figure 2.2 to provide readers with a theoretical overview of this research before the start of the detailed literature review. The major themes of the framework are the critical factors for data quality in AIS, the stakeholder groups in AIS and the dimensions of data quality measurement. Briefly, the framework posits that there are five major categories of critical factors for data quality in AIS that influence the data quality in AIS, the performance/ outcomes of which can then be measured by different dimensions. Within AIS, there are five stakeholder groups, who are also part of and have impact on the critical factors, and have different perspectives of DQ measurements. Four research questions are developed from this framework that will be the focus of data collection of this research. The framework is developed based upon the extant literature review and the two pilot case studies, which is discussed next.



Legend: Rectangles: main components of the framework
Oval: accounting information systems
Arrows: relationships between components and systems

Figure 2.2 Preliminary theoretical framework of this research

Source: developed for this research, copied from figure 2.6 in section 2.7.5

2.2 Definition of core terms

This section develops the definition of core terms for this research because precise definitions of core terms are the foundation of any research project (Perry 1998b). In particular, it is important to first define data quality to fully understand the research problems.

2.2.1 What is data quality?

Traditionally, data quality has often been described from the perspective of accuracy. Nowadays, research and practice indicates that data quality should be defined beyond accuracy and is identified as encompassing multiple dimensions (Huang et al 1999). However, there is no single standard data quality definition that has been accepted in the field (Klein 1998).

Before reviewing the literature, the core term of data quality needs to be clarified. By themselves, information and data are often different, for example, data is a collection of symbols which signify real world system states and are brought together because they are considered relevant to some purposeful activity. Information is an objective commodity carried by symbols and relates to who produced it, why and how it was produced and its relationship to the real world state it signifies (Shanks & Darke 1999). Although data and information are different concepts, data quality is often treated as the same as information quality in some literature and real-world practice. Therefore, in this research, data quality and information quality are synonymous.

The general definition of data quality is 'data that is fit for use by data consumers' (Huang et al 1999). Many data quality dimensions have been identified. Commonly identified data quality dimensions are:

- *accuracy*, which occurs when the recorded value is in conformity with the actual value;
- *timeliness*, which occurs when the recorded value is not out of date;
- *completeness*, which occurs when all values for a certain variable are recorded, and
- *consistency*, which occurs when the representation of the data values, is the same in all cases. (Ballou et al. 1982, 1985,1987,1993)

Four other data quality dimensions have been identified (Wang & Strong 1996) that are also widely accepted:

- *intrinsic dimensions* define the quality of data in its own right;

- *contextual dimensions* define data quality within the context of the task at hand;
- *accessibility dimensions* emphasise the role of information systems in providing data, and
- *representational* dimensions define data quality in terms of the presentation and delivery of data.

A set of comprehensive essential dimensions of data quality for delivering high quality data has been determined as follows:

Table 2.1 Data quality dimensions (source: Wang & Strong 1996)

Dimensions	Definitions
Accessibility	The extent to which data is available, or easily and quickly retrievable
Appropriate Amount of Data	The extent to which the volume of data is appropriate for the task at hand
Believability	The extent to which data is regarded as true and credible
Completeness	The extent to which data is not missing and is of sufficient breadth and depth for the task at hand
Concise Representation	The extent to which data is compactly represented
Consistent Representation	The extent to which data is presented in the same format
Ease of Manipulation	The extent to which data is easy to manipulate and apply to different tasks
Free-of-Error	The extent to which data is correct and reliable
Interpretability	The extent to which data is correct and reliable
Objectivity	The extent to which data is unbiased, unprejudiced, and impartial
Relevancy	The extent to which data is applicable and helpful for the task at hand
Reputation	The extent to which data is highly regarded in terms of its source or content
Security	The extent to which access to data is restricted appropriately to maintain its security
Timeliness	The extent to which the data is sufficiently up-to-date for the task at hand
Understandability	The extent to which data is easily comprehended
Value-Added	The extent to which data is beneficial and provides advantages from its use

2.2.2 What is AIS?

In order to understand data quality issues in AIS in particular, it is important that the term *AIS* is clearly defined. There are various definitions of AIS. AIS is seen as a subsystem of a management information systems, and its major function is to process financial transaction, as well as non-financial transactions that directly affect the processing of financial transactions (Siegel & Shim; Hall 1998). An AIS comprises four major sub-systems that are relevant to this research:

- The *transaction processing system*, which supports daily business operations with numerous documents and messages for users throughout the organisation;
- The *general ledger/financial reporting system*, which produces the traditional financial statements, such as income statements, balance sheets, statements of cash flows, tax returns, and other reports required by law;
- The *fixed asset system*, which processes transactions pertaining to the acquisition, maintenance, and disposal of fixed assets, and
- The *management reporting system*, which provides internal management with special purpose financial reports and information needed for decision making, such as budgets, variance reports, and responsibility reports. (Hall 1998)

2.2.3 What is data quality within AIS?

In accounting and auditing, where internal control systems require maximum reliability with minimum cost, the key data quality dimension used is *accuracy* – defined in terms of the frequency, size, and distribution of errors in data (Wang, Storey & Firth 1995). In assessing the value of accounting information, researchers have also identified *relevance* and *timeliness* as desirable attributes (Feltham 1968).

2.2.4 What is data quality in AIS for this research?

The dimensions that have been identified by Ballou et al (1982,1985,1987,1993) will be adopted in this research because they cover the most important dimensions that have been addressed in the AIS literature and have been reasonably widely accepted in the data quality field. Therefore, quality data in AIS in this research means accurate, timely, complete, and consistent data.

2.3 Parent discipline one: quality management

With the definitions of the core terms for this research established, this section discusses the theoretical background to quality management and its implication for data quality management. Then the critical success factors of quality management are included. There are some similarities between quality data manufacturing and quality product manufacturing. For instance, both quality data and quality product need to conform to specification, lower defect rates and improved customer satisfaction (Wang, Kon & Madnick, 1993b). Therefore, quality management concepts in general and CSFs developed for quality management could aid the development of the theoretical framework of this research. The discussion in this section is about quality management that is the first parent discipline, while data quality management in particular as the second parent discipline will be covered in the next section.

2.3.1 Quality management in general

Quality management in general has been a major concern of businesses and research for many years (Deming, 1982; Shewhart, 1925), and is managed by using quality measurements, reliability engineering, and statistical quality control (Crosby, 1979; Garvin, 1988). Many attempts have been made to define quality. One of the fundamental definitions for quality is ‘fitness for use’ that includes quality of design, quality of conformance, abilities, and field service (Juran, 1979). Some focus on the cultural and behavioral aspects of quality, such as, Crosby (Crosby, 1979) identified major steps to achieve quality improvement, which consist of management

commitment, quality measurement, cost of quality evaluation, quality awareness, and commitment to the 'zero defects' performance standard. Deming states that 'A product or a service possesses quality if it helps somebody and enjoys a good and sustainable market' (Deming, 1993). His philosophy focuses on bringing about improvements in product and service quality by reducing uncertainty and variability in the design and manufacturing process (Evans & Lindsay, 1996). These quality management experts identify sets of key variables that are critical to achieve high quality outcomes. For example, Deming has summarised his philosophy in 'a system of profound knowledge (SPK)', which consists of: appreciation of a system, some knowledge of the theory of variation, theory of knowledge, and psychology. He identifies 14 principles of quality management, each of which can be derived from one or more of his SPK parts. According to Deming, all those points cannot be implemented selectively; they are an all-or-nothing commitment. Table 2.2 lists those 14 principles.

Table 2.2 Deming's *14 principles* of quality management (Deming, 1982)

Point 1	Create a vision and demonstrate commitment
Point 2	Learn the new philosophy
Point 3	Understand inspection
Point 4	Stop making decisions purely on the basis of cost
Point 5	Improve constantly and forever
Point 6	Institute training
Point 7	Institute leadership
Point 8	Drive out fear
Point 9	Optimize the efforts of teams
Point 10	Eliminate exhortations
Point 11	Eliminate numerical quotas and management by objective
Point 12	Remove barriers to pride in workmanship
Point 13	Encourage education and self-improvement
Point 14	Take action

In comparing quality philosophies (i.e. Deming, Juran, and Crosby), it is clear that quality is viewed as crucial for organisations to obtain competitive advantages, and it requires a total commitment from everyone in the organisation.

The philosophies of Deming, Juran, and Crosby provide fundamental principles on which quality management, and total quality is based. However, those principles are only proposed by the experts without rigorous supporting evidence. Therefore, sometimes, they might not be able to provide sufficient specificity for real-world organisations' initiation of quality improvements and quality performance evaluation (Motwani, 2001). There are also practical frameworks of quality awards, such as the Malcolm Baldrige National Quality Award, the Deming Prize and the European Quality Award. Together with experts' philosophies they comprise the principal theories, concepts and frameworks that direct real-world quality management practice.

Research in quality management has evolved from the analysis of specific success cases to scientific theory building. For example, in the early seventies, a scientific theory building model was formulated by Wallace (1971), which involves observation, empirical generalisation, turning empirical generalisations into theories, hypothesis generation and testing and logical deduction. More recent quality management empirical studies focus on hypothesis generation and testing (Flynn, Schoeder & Sakakibara, 1994; Black & Porter, 1996; Ahire, Golhar & Waller, 1996) and logical deduction (Anderson et al., 1995; Rungtusanatham et al., 1998). The next section details the major studies into the development of constructs of critical success factors for quality management.

2.3.2 Critical success factors for quality management

Critical factors for quality management and TQM.

Research into quality management and TQM has identified many critical success factors that affect an organisation's position. Many of those studies were based on the principles of quality experts including Deming, Juran, Feigenbaum (Feigenbaum,

1991), and Crosby, as well as the practical frameworks like the Baldrige Award criteria. In addition, the Ernst & Young and American Quality Foundation (1992) study reviewed the quality management practices in the USA and the other major economies of the world. The study found that not all methods are equally beneficial to all organisations. Instead, it found that the level of quality performance should be used to define practices.

Some of the critical factors identified in quality management studies focused on performance measurement (Oakland, 1993; Mann & Kehoe, 1994), quality training (Snell & Dean, 1992; Blackburn & Rosen, 1993), employee involvement and participation in quality improvement efforts (Oliver, 1988; Bowen & Lawler, 1992b; Flynn, Schroeder & Sakakibara, 1995), compensation and assessment in quality management (Lawler, Mohrman & Ledford, 1992; Lawler, 1994; Waldman, 1994; Flynn, Schroeder & Sakakibara, 1995), employee empowerment and employees' interaction with customers (Conger & Kanungo, 1988; Bowen & Lawler, 1992a), significance of teams (Scholtes, 1988; Kumar & Gupta, 1991), process improvement methods (Modarress & Ansari, 1989; Anderson et al., 1995; Anderson, Rungtusanatham & Schroeder, 1994), the role of technology (Davenport, 1993), and benchmarks (Camp, 1989)

In order to evaluate quality management implementation status, valid instruments for measurement are important. A questionnaire to measure management policies related to total quality management has been developed by Saraph, Benson, and Schroeder (1989). Their research identifies eight critical factors of quality management in business enterprises, which include:

- Role of divisional top management and quality policy;
- Role of the quality management;
- Training;
- Product/ service design;
- Supplier quality management;
- Process management / operating;
- Quality data and reporting and

- Employee relations.

CSFs for quality management identified by Saraph et al (1989) have been tested by other researchers, and the results have confirmed the reliability and construct validity of the instrument (Badri, Davis & Davis1995). Those eight factors have been widely accepted in the TQM field. Other researchers of TQM study critical success factors have used different methodologies (Porter & Parker 1993; Tamimi & Gershon 1995; Ahire, Golhar & Waller 1996). Different sets of factors have been found by other researchers (Black & Porter 1996; Ramirez & Loney 1993). Furthermore, there is also research concerning the critical success factors for implementation of TQM in small and medium enterprises (Yusof & Aspinwall 1999).

For example, there is a 10-dimensional 32-item instrument of critical factors of quality management developed by Black and Porter (1996) based on the Malcolm Baldrige National

Quality Award (MBNQA) of the USA. The 10 dimensions included:

- People and customer management;
- Supplier partnerships;
- Communication of improvement information;
- Customer satisfaction orientation;
- External interface management;
- Strategic quality management;
- Teamwork structures for improvement;
- Operational quality planning;
- Quality improvement measurement systems; and
- Corporate quality culture.

This instrument was further tested by a recent cross-sectional study of quality–oriented companies in Hong Kong (Lai, Weerakoon & Cheng, 2002). The study surveyed companies of four types of industries: manufacturing, service, construction and public utility. The results showed that although the companies in all the industry

types view quality management as an integrated approach, giving generally equal importance to all aspects of quality management implementation, those companies in the public utility and service industries appear to have a higher level of quality management. Furthermore, among the quality management implementation factors, the companies in service and construction industries were perceived to be relatively weak in the factors of teamwork structures for improvement, and those in the manufacturing industry put less effort into the communication of improvement information.

A recent study by Motwani (2001) provided a comparative analysis of the empirical studies of critical factors of TQM (Table 2.3), which found that validated scales for integrated TQM developed by the empirical studies complement one another. Furthermore, those empirical studies had higher validity and were more comprehensive than the non-empirical TQM studies; and also 'incorporated most of the TQM implementation constructs' as proposed by quality management experts (Motwani, 2001). By grouping the similar constructs from those studies, seven factors could be identified, which contributed to an integrated TQM:

- Top management commitments;
- Quality measurement and benchmarking;
- Process management;
- Employee training and empowerment;
- Suppler quality management; and
- Customer involvement and satisfaction. (Motwani, 2001)

Table 2.3 Comparative list of critical factors of TQM identified in the empirical studies

Saraph et al. (1989)	Flynn et al. (1994)	Ahire et al. (1996)	Zeitz et al. (1997)	Black and Porter (1996)	Powell (1995)
Top management leadership	Top management support	Top management commitment	Management support	Strategic quality management and corporate quality culture	Executive commitment and adopting the philosophy
Quality data and reporting	Quality information	Internal quality information usage	Use of data	Quality improvement measurement system and communication of improvement information	Measurement and zero defect mentality
Process management	Process management			Operational quality planning	Process improvement and flexible manufacturing
Product/service design	Product design	Design quality management			
Training	Workforce management	Employee training			Training
Supplier quality management	Supplier involvement	Supplier quality management and supplier performance	Supplier relationships	Supplier partnerships	Closer to suppliers
Role of the quality department			Supervision		
Employee relations		Employee involvement Employee empowerment	Employee suggestions Employee improvements		Employee empowerment
	Customer involvement	Customer focus	Customers	People and customer management Customer satisfaction orientation	Closer to customer
		SPC usage			
		Benchmarking			Benchmarking
				External interface management	

Source: developed from Motwani (2001)

The constructs developed in quality management empirical studies represented the various approaches taken in quality management theory development. Quality management theory was derived from the common focus of quality management and management theory on organisational effectiveness (Dean & Bowen, 1994). The relationship between quality management and organisational models was examined to link quality management practice and management theory (Spencer, 1994). Many empirical studies were examined to evaluate the quality management prescriptive models. The constructs developed in some of those studies are compared in Table 2.4. The model, like the Deming Management Method, was used to develop constructs (Anderson et al., 1995), as well as the Baldrige Award criteria (Black & Porter, 1996), and the combination of both (Forza & Filippini, 1998). In addition, some studies were examined which developed constructs based on the broad review of quality management literature (Saraph, Benson & Schroeder, 1989; Flynn, Schoeder & Sakakibara, 1994; Ahire, Golhar & Waller, 1996). Research also takes quality management into some specific fields like health care (Li, 1997).

Most of the quality management studies have included analysis of the quality information as a construct, while some studies have also defined a separate construct of how to communicate quality information (Flynn, Schoeder & Sakakibara, 1994; Ahire, Golhar & Waller, 1996; Black & Porter, 1996). In addition, benchmarking has been identified as a construct for gathering and analysing information with the external focus (Ahire, Golhar & Waller, 1996; Behara & Gundersen, 2001).

Human related factors are important aspects in quality management and have been mentioned in many studies that are discussed next. There are many constructs that can be categorised into human related factors, for example, employee training (Saraph, Benson & Schroeder, 1989; Anderson et al., 1995; Ahire, Golhar & Waller, 1996; Black & Porter, 1996), which includes training management (Behara & Gundersen, 2001). Employee empowerment is also identified as an important human resource management issue that refers to authorising and encouraging employees to participate and become empowered in quality management (Ahire, Golhar & Waller, 1996; Behara & Gundersen, 2001). Studies also address other constructs, such as, employee relations (Saraph, Benson & Schroeder, 1989), employee recognition (Black & Porter, 1996), assessment and compensation for quality performance

(Behara & Gundersen, 2001), as well as quality improvement rewards (Flynn, Schoeder & Sakakibara, 1994).

In analysing various quality management and TQM studies into critical factors / constructs, the Saraph et al (1989) study is an early piece of ground-breaking empirical research, designed on the basis of wide review of the literature with comprehensive validation tests. However, one of the limitations of this study is that it has not included customer focus and satisfaction as a construct, because it is such an early study. Research between manufacturing and service industries has similar basic constructs, but there are also some variations. For instance, some factors are particularly related to manufacturing industry, such as product design and process controls. Many studies in service industries incorporate constructs that are equivalent to those in manufacturing industry, but with different names.

Table 2.4 Comparison of quality management constructs

Baldrige Award (7 criteria)	Anderson et al. (1995) (7 constructs)	Forza and Filippini (1998) (6 constructs)	Li (1997) (6 constructs)	Behara and Gundersen (2001) (11 constructs)
Leadership	Visionary leadership	Orientation towards quality	Top management leadership	
Information and analysis			Information analysis	Benchmarking
Strategic planning				
HR development and management	Learning, employee fulfilment		Workforce development	Compensation, training management, empowerment, participation, training, assessment, teamwork
Process management	Process management, continuous improvement, internal and external cooperation	Link with suppliers, Link with customers, Process control	Organisational cooperation, technology leadership	Technology management, process measurement
Customer focus and satisfaction	Customer satisfaction	Customer satisfaction	Service quality performance	
Business results		Conformance		Outcome measurement

Source: developed from Behara and Gundersen (2001)

Quality management: just-in-time

In comparison to TQM, in the field of Just-in-Time (JIT), a survey was carried out (Zhu & Meredith 1995) of published articles on JIT inventory control strategies to study the critical factors affecting JIT applications. They provided a list of JIT implementation elements. Among those elements those that were related to quality were: quality circle, cross-training, JIT education, relationship with suppliers, communication, JIT team, quality certificate of suppliers, top management commitment and co-worker relations.

Procedures / processes improvement and training

In order to stay competitive in their respective industries, many organisations are pursuing quality improvement operational strategies. However, they often only focus on improving products and services for their customers, not the improvement of the procedures for the production and distribution of their products and services (McCahon, Rys & Ward, 1996). The International Quality Study showed that approximately 80 per cent of US businesses did not focus on process improvement compared to 50 per cent of Japanese firms (1991). The study further defined process improvement as the practice of continuously reviewing, analysing, incorporating changing consumer expectations and refining the process so that products and services continuously improve. In addition, the study suggested that organisations should invest more in process improvement, and therefore, needed to realign employee training to meet this need.

Training is critical for organisations' quality improvement efforts to achieve their goals. The challenge for organisations that are already aware of quality improvement lies in their unfamiliarity with the amount of training and education required to support the implementation of effective quality improvement strategies (Johnson, 1993). Because lack of appropriate training has led to negative outcomes or not being able to achieve the proposed objectives, some organisations have failed their quality initiatives (Revelle, 1993). Therefore, proper investment in the workforce – education and training - is crucial in ensuring the success of the implementation of

quality strategies (Aguayo, 1990). However, many quality initiatives have failed, in spite of the large amount of resources spent on training (Chang, 1993), because many obstacles impeded the effectiveness of training: improper needs assessment, unskilled trainers and poor training techniques (McCahon, Rys & Ward, 1996). Organisations have often rushed into training programs without thoughtful needs assessments (Johnson, 1993). Overly ambitious quality directors sometimes implemented unnecessary training programs that were exercises in information overload, dooming them to failure (Chang, 1993).

Therefore, in order to ensure positive training results, organisations need to complete necessary phases for training: first, needs assessment; second, development; and third evaluation (Goldstein, 1993). There has been research into the evaluation of the effectiveness of different training techniques in meeting different training objectives (Carroll, Paine & Ivancevich, 1972; Newstrom, 1980; Neider, 1981; Swigart, 1986). Although results from these studies were slightly different, they all highlight the important role that training performs in the quality management process.

2.4 Parent discipline two: Data Quality

This research concerns data quality in accounting information systems and so the second parent discipline of data quality is considered in turn. As mentioned before, the emphasis of data quality research is the measurement dimensions and its related issues. Thus, the literature about key issues in data quality is reviewed first (Section 2.4.1) with a discussion of different research on measurements of data quality outputs. Then, the literature specific to critical steps and success factors for ensuring data quality is reviewed (Section 2.4.2).

2.4.1 Key issues in DQ

A product perspective on data quality management

There exist some similarities between quality issues in product manufacturing and information manufacturing. Information manufacturing can be viewed as a system

that produces information products from the raw data, similar to product manufacturing, which produces physical products from raw materials, as shown in Table 2.5 (Wang, 1998).

Table 2.5 Products vs. information manufacturing (Wang, 1998)

	Product manufacturing	Information Manufacturing
Input	Raw materials	Raw data
Process	Assembly line	Information system
Output	Physical products	Information products

To treat information as a product is done because the information output from an information manufacturing system has value that can be transferred to the information consumer. Therefore, like a physical product, an information product has quality dimensions, and the information quality can be viewed as fitness for use by the information consumer. Clearly, there are also some differences between product manufacturing and information manufacturing. For instance, the raw materials used in information manufacturing are data, which can be consumed by more than one consumer without depletion, not like raw materials in product manufacturing that can only be used for single physical products. (Wang, 1998)

In the semantic data modeling area, research suggests capturing more meaning about application data (Codd, 1979; Hull & King, 1987; Kim & Lochovsky, 1989). Semantics in data models have various dimensions and categories, such as the quality and context of data that have significant implications for users in the business community (Madnick, 1992). Data of poor quality and mismatched context may lead to erroneous decisions. Therefore, capturing data quality and context semantics at an early stage of database design is a critical issue for both database researchers and practitioners (Tu & Wang, 1993).

Several research efforts have addressed the issue of explicitly representing quality information, such as attribute-based research to facilitate cell-level tagging of data to enable consumers to retrieve data that conforms to their quality requirements (Wang & Madnick, 1990; Wang, Kon & Madnick, 1993a; Wang, Reddy & Kon, 1993)

Product quality and service quality

Information should be treated as both a product and a service. The literature draws distinctions between product quality and service quality of information (Zeithaml, Berry & Parasuraman, 1990). Product quality includes product features that involve the tangible measures of information quality, such as accuracy, completeness, and freedom from errors. Service quality includes dimensions related to the service delivery process, and intangible measures such as ease of manipulation, security, and added value of the information to consumers (Kahn, Strong & Wang, 2002).

Data quality in database systems

In a conventional database management system (DBMS), the quality of data has been treated implicitly through functions such as recovery, concurrency, integrity, and security control (Chen, 1976; Codd, 1979; Bernstein & Goodman, 1981; Fernandez, Summers & Wood, 1981; Ullman, 1982). However, from the data consumer's perspective, those functions are not sufficient to ensure the quality of data in the database (Laudon, 1986; Liepins & Uppuluri, 1990; Redman, 1992; Wang, Kon & Madnick, 1993b). For example, although there are some essential built-in functions for ensuring data quality in a database like integrity constraints and validity checks, they are often not sufficient to win consumers' confidence on data (Maxwell, 1989). In fact, data is used by a range of different organisational functions with different perceptions of what constitutes quality data, and therefore it is difficult to meet all data consumers' quality requirements. Thus, data quality needs to be calibrated in a manner that enables consumers to use their own yardsticks to measure the quality (Wang, Reddy & Gupta, 1993).

In database design, although the primary focus is not on data quality itself, there are many tools that have been developed for the purpose of data quality management. For example, it is recommended to build integrity constraints and use normalisation theory to prevent data incompleteness and inconsistencies, as well as through transaction management to prevent data corruption (Codd, 1970; Codd, 1986; Elmasri, 1989; Stonebraker & Kemnitz, 1991). However, those tools are only related

to system design and control. Although they can help for making sure of the quality of data in the system, by themselves they are not sufficient to solve the issue of imperfect data in the real world.

Data quality is affected by other factors rather than only by the system, such as whether it reflects real world conditions, and can be easily used and understood by the data user. If the data is not interpretable and accessible by the user, even accurate data is of little value (Wang, Kon & Madnick, 1993b). Therefore, a methodology for designing and representing corporate data models is needed. The use of scenarios, subject areas and design rationale was found to be effective in enhancing understanding of corporate data models (Shanks & Darke, 1999).

Total data quality management (TDQM)

To achieve a state of high data quality, an organisation needs to implement Total Data Quality Management (TDQM). Different industries with different goals and environments can develop more specific and customised programs for data quality management to suit their own needs. However, some researchers argue that regardless of differences organisations must follow certain steps in order to enable the successful implementation of a viable TDQM:

1) Clearly define what the organisation means by quality in general and data quality in particular;
2) Develop a set of measures for the important dimensions of data quality for the organisation that can be linked to the organisation's general goals and objectives. (Kovac, Lee & Pipino, 1997)

Data quality in e-Business

Data quality in the context of eBusiness has some different features from the issues in the traditional environment, because of the increasing utilisation of Internet and online transactions in the eBusiness environment. The eBusiness organisation has more interactions with the environment, which adds complexities to data quality. Therefore, it is imperative for eBusiness organisations to establish data quality

strategies and implementation methodologies that suit their eBusiness transformation approaches (Segev & Wang, 2001). While basic principles of traditional information systems methodologies still apply, the scope and context have changed significantly in the eBusiness environment.

A framework for data quality research

To aid the understanding of data quality in theory and practice, a framework for data quality analysis was developed by Wang, Storey and Firth (1995),.This framework Comprises seven elements: management responsibilities, operation and assurance costs, research and development, production, distribution, personnel management, and legal function (see Table 2.6). The framework was further employed to analyse articles relevant to data quality research in the same study. It covered articles from a wide range of different disciplines and across the period from 1970 up to 1994, which provided a comprehensive review of studies in data quality and related areas.

Table 2.6 A framework for data quality research (Wang, Storey & Firth, 1995)

Element	Description
Management responsibilities	Development of a corporate data quality policy; Establishment of a data quality system
Operation and assurance costs	Operating costs include prevention, appraisal, and failure costs; Assurance costs relate to the demonstration and proof of quality as required by customers and management
Research and development	Definition of the dimensions of data quality and measurement of their values; Analysis and design of the quality aspects of data products; Design of data manufacturing systems that incorporate data quality aspects
Production	Quality requirements in the procurement of raw data components and assemblies needed for the production of data products; Quality verification of raw data, work-in-progress and final data products; Identification of non-conforming data items
Distribution	Storage, identification, packaging, installation, delivery, and after-sales servicing of data products; Quality documentation and records for data products
Personnel management	Employee awareness of issues related to data quality; Motivation of employees for produce high quality data products; Measurement of employee's data quality achievement
Legal function	Data product safety and liability

Due to the significance of Wang et al's (1995) study, this section discusses some relevant components of the framework of the study. The citations of this section are mainly from Wang et al's (1995) article. The first important component that needs to be addressed is management responsibilities. The importance of top management's commitment and involvement has been recognised by many quality management studies as described in Section 2.3 of this chapter when discussing the parent discipline one of this research. Similarly, the importance of top management commitment has also been addressed by data quality studies (Halloran et al., 1978; Bailey, 1983). However, despite the increasing awareness of the need for corporate

policy for data quality management (Bulkeley, 1992; Cronin, 1993; Liepins, 1989; Liepins & Uppuluri, 1990; Sparhawk, 1993), there is a lack of research into what constitutes the success of data quality policies and systems. In particular, in order to convince top management of the importance of data quality to the survival of the organisation in the dynamic global environment, research that assists management in identifying data quality factors that affect a company's position is needed (Wang, Storey & Firth, 1995).

The cost of data quality effort is another important area in data quality research. There are two different types of costs for a data quality system. They are operating costs (prevention, appraisal and failure), and assurance costs (Wang, Storey & Firth, 1995). In particular, information systems research has looked into cost/quality tradeoffs of internal control for ensuring the quality output from an information system that covers processing activities, corrective procedures, and penalties for failing to detect errors (Ballou & Pazer, 1987). Furthermore, researchers have also found that there is a need to obtain better estimates of the penalty costs of poor data quality (Ballou & Tayi, 1989). However, it is very hard to quantify the cost of data errors, though it is very costly (Liepins, 1989).

One of the critical aspects for data quality research is to identify the appropriate dimensions and measurement methods for the quality of information. Wang et al's (1995) study indicates that researchers in data quality, information systems success and user satisfaction, and accounting and auditing areas have attempted to identify data quality dimensions. In the previous discussion, some commonly accepted definitions of data quality have been included. Dimensions identified by other studies are discussed in this section.

In the information systems field, information quality has been assessed from the users' viewpoint, such as Halloran et al (1978), which identifies usability, reliability, independence as major information quality dimensions. Studies in evaluating the quality and value of information systems have identified information quality attributes like accuracy, timeliness, precision, reliability, relevancy, completeness (Zmud, 1978; Kriebel, 1979; Ahituv, 1980). In addition, research into user satisfaction and user involvement has also identified similar attributes (Bailey &

Pearson, 1983; Ives & Olson, 1984). Furthermore, researchers have also looked into the measurement of data quality attributes. For example, the reliability attribute is divided and measured by internal reliability, relative reliability that related to fulfilling the information user's requirements, and absolute reliability as to how well the data represents reality (Agmon & Ahituv, 1987). Other relevant aspects have also been addressed, such as, the measurement of usefulness of information, the effectiveness of the system, the quality of information systems and the evaluation of the structure of executive information systems (McCall, Richards & Walters, 1977; Larcher & Lessig, 1980; Blaylock & Rees, 1984; Jones & McLeod, 1986).

One important contribution of Wang et al's framework is to include personnel management as part of the data quality management, which is the area that has been overlooked by data quality research. Not too many studies have looked into human related factors that impact on data quality. Among those few attempts into personnel issues, a framework for understanding data production that incorporates the person-environment fit and the effect of employees' ability and motivation has been developed (Te'eni, 1993). This study discovered that when data production is separated from data use, such as one worker creates data and another uses it, data quality problems are more likely to occur. Another study, showed how a company's employees identified the importance of data quality improvement and aroused top management's awareness, which then led to further action in dealing with the issues. The attention to data quality issues by the company's management and employees helped the improvement of data quality in the company's large MIS database (Oman & Ayers, 1988).

2.4.2 Important steps in ensuring DQ

In the data quality field, not much research has been conducted directly into the investigation of critical success factors for ensuring high quality data. Only a few researchers have attempted to identify critical success factors of data quality, for example Table 2.7 shows the seven factors suggested by English (1999).

Table 2.7 Critical success factors in data quality (Source: English 1999)

Understand fully what information quality improvement is and why you are doing it.
Implement information quality improvement effectively.
Implementing information quality improvement on the right problem.
Training and communication.
Incentives for information quality.
Management commitment to information quality improvement as a management tool.
Managing change.

Although other researchers in DQ area have not proposed critical success factors, they have suggested some important areas and steps that may be taken to ensure DQ. For example, four steps for the initiation and implementation of successful systems' data quality were recommended by Firth (1996):

(1) Establish a data quality position;
(2) Formulate a data quality policy;
(3) Determine objectives and
(4) Obtain management and employee commitment.

Furthermore, six important points in managing data quality were proposed by Segev (1996):

(1) Establish organisational awareness of the importance of data quality, and parties responsible for it;
(2) Define what organisations mean by data quality;
(3) Establish an information flow and processes map;
(4) Identify data quality problems and their location on that map;
(5) Identify technologies and practices that can be used to solve such DQ problems and
(6) Evaluate the cost/benefit tradeoffs associated with improving the quality of particular data or processes.

In order to maintain reasonable level of data quality, organisations need to treat information as a product, not as a by-product, and they should follow four principles:

(1) Understand consumers' information needs;
(2) Manage information as the product of a well-defined production process;
(3) Manage information as a product with a life cycle. (Information product life cycle was defined as the stages through which information passes from introduction to obsolescence. The life cycle can be divided into four stages: introduction (creation), growth, maturity, and decline.)
(4) Appoint an information product manager (IPM) to manage the information processed and the resulting product (Wang, Lee & Strong 1998).

In addition, most researchers also recommend organisations establish information quality programs. According to Huang et al (1999), in order to do this, organisations should:

- Articulate an information quality vision in business terms:
  - Set standards;
  - Information quality vision must be clearly identified with top-level management;
  - Chief information officer must make it clear to the entire organisation that information quality has become a top priority;
- Establish central responsibility for information quality within through the organisation;
- Educate information product suppliers, manufacturers and consumers;
- Educate key people in the organisation who will take charge of continuous improvements of information quality;
- Teach new information quality skills; and
- Institutionalise continuous information quality improvement

2.5 Parent discipline three: accounting information systems

We now move from general quality management literature and data quality to the more specific AIS literature. The emphasis of accounting information systems literature on data quality is on internal control systems and audits. Accounting professionals have been concerned with data quality measurement for some time (Wang et al. 1995).

The global business environment is changing and creating new strategic management challenges, as well as accounting information management challenges. The United States Government Accounting Office (GAO) defines information management as:

> Strategic information is one critical, integrated part of any general management framework. Similar to the way modern organisations have gradually become dependent on information technologies, it has become an indispensable lens through which to view most vital general management decisions. Strategic information management typically involves defining a mission based on customer segments and needs, establishing core processes that accomplish the mission; understanding the key decisions that guide mission delivery processes; supporting those decisions with the right information available to the right people at the right time; and using technology to collect, process, and disseminate information in ways that improve the delivery of products, goods, and services to customers (The United States Government Accounting office).

A very early attempt at AIS data quality measurement was a statistical approach to measure errors in outputs of internal control systems (Yu & Neter 1973). Another mathematical model of the accounting internal control system and measures of reliability and cost was developed by Cushing (1974). Later researchers moved on to address data quality as it relates to audit populations (Johnson, Leitch & Neter 1981; Groomer & Murthy 1989). Others presented models of the internal control process that responded to guidelines and regulations calling for auditors to evaluate management's effort to assure that accounting data was correct (Hamlen 1980; Stratton1981; Fields, Sami & Sumners 1986). Some AIS research extended the

models developed in the accounting literature, and analysed cost/quality control trade-offs for information systems, and furthermore extended to spreadsheet models (Ballou & Pazer 1985, Ballou, Belardo & Klein 1987). A model of internal control from a survey of audit data was developed by Nichols (1987). Some researchers have presented a review of information systems research as it applied to accounting and auditing (Amer, Golhar & Waller 1987). Others have developed a methodology which provides management with a quantitative measure for determining the quality of data in information systems (Paradice & Fuerst 1991). Researchers have also used a decision support systems approach-combining human judgement and model-based procedures. This allows auditor-determined variability in establishing quality thresholds to assessing data quality in AIS (Kaplan et al 1998).

The management accountants within AIS were viewed as involving the design and operation of financial advisory and information systems in organisational settings (Birkett 1986). Three factors influence quality of management accounting:

- *compliance*, which focuses on the design and operation of systems concerned with technical compliance with external regulations and reporting requirement;
- *control*, which is the systems to support resource management and control including standard costing and variance analysis, flexible budgeting, responsibility accounting and accounting performance measures; and
- *competitive support*, which is the provision of financial services to the management team in order to enhance the firm's competitiveness. The accounting function is seen as one of producing financial services, which add value, and the management team is seen as a consumer of those services (Birkett 1986).

2.6 Data quality in accounting information systems

In order to ensure data quality in AIS, it is important to understand the underlying factors that influence the AIS's data quality. Knowledge of the critical factors that constitute an AIS having high data quality is desirable but is still unclear at this time.

This section first proposes the possible factors that might impact on data quality in accounting information systems from a summary of the thoroughly review of the relevant literature. It then describes two pilot case studies conducted to examine the proposed possible factors, followed by an analysis of the case studies.

2.6.1 Possible factors that impact on data quality in accounting information systems

Although the critical success factors for high data quality in AIS have not been addressed, there have been many studies of critical success factors in quality management such as Total Quality Management (TQM) and Just-In-Time (JIT) (Saraph et al 1989; Porter & Parker 1993; Black & Porter 1996; Badri, Davis & Davis 1995; Yusof & Aspinwall 1999). Some of the data quality literature has addressed the critical points and steps for DQ (Firth 1996; Segev 1996; Huang et al 1999; English 1999). Table 2.8 indicates the related research efforts and reflects whether these research efforts addressed certain issues or elements of critical factors of quality or data quality management.

Table 2.8 Summary of literature review identifying factors influencing data quality

Factor	Saraph (1989)	English (1999)	Firth (1996)	Wang (1998, 1999)	Segev (1996)	Zhu (1995)	Birkett (1986)	Yu (1973) Cushing (1974) Fields (1986) Nichols (1987)	Johnson (1981) Groomer (1989)	Bowen (1993)
Role of top management	✔	✔	✔	✔	✔	✔				
(Data) quality polices & standards			✔	✔	✔					
Role of (data) quality & (data) quality manager	✔	✔	✔	✔	✔	✔				
Training	✔	✔		✔		✔				
Organisational structure		✔				✔				
Nature of the system Product/service design	✔				✔					
Approaches (control & improvement) Process management	✔	✔		✔	✔					
Employee/ personnel relations	✔		✔			✔				
Supplier quality management	✔			✔		✔				
Performance evaluation and rewards (responsibility for DQ)		✔		✔			✔			
Manage change		✔								
External factors							✔			
Evaluate cost/benefit tradeoffs					✔	✔				
Audits									✔	
Internal control (systems, process)								✔		
Input control										✔
Customer focus				✔						
Continuous improvement		✔								

Source: Developed by the author (Xu 2000, Xu et al. 2001)

2.6.2 Research questions

The focus and contribution of this research is to identify the critical success factors for data quality in accounting information systems, and investigate whether there is any variation between different stakeholder groups regarding those factors. Thus four research questions are developed and each of these research questions is described in turn.

Table 2.8 contains factors impacting upon data quality from general quality and data quality management literature. However, those factors have not been previously studied in the context of accounting information systems. Thus the first research question is:

Research Question 1: What factors affect the variation of data quality in accounting information systems, and why?

There is a literature link to stakeholder groups with data quality. However, precise perceptions of the importance of critical factors from different stakeholder groups are not explicit in the extant literature. In addition, the literature merely considers the sizes of the organisations' impact on the perceptions of the critical factors for data quality in AIS. This leads to the second research question:

Research Question 2: Are there any variations with regard to the perceptions of importance of those factors that affect data quality in accounting information systems between:

- *2.1. different major AIS stakeholder group*
- *2.2. different sized organsations*

After investigating the perceptions of the importance of critical factors for data quality in AIS, it is important to find out what organisations have done with regard to those factors, that is what the actual performance of critical factors in practice is. Thus the third research question is:

Research Question 3: What is the actual performance level by real-world organisations in practice about those factors that affect data quality in accounting information systems?

Finally, is to identify which of those important factors are critical success factors. This is the fourth research question:

*Research questions 4: Which of these factors are **critical success factors** to ensure high quality of data in accounting information systems?*

In addition, three research hypotheses were formed to help answer the research questions. Those hypotheses are listed below and tested in Chapter 5.

H_1: There is a significant difference between the perceptions of importance of critical factors for accounting information systems' data quality, and actual performance of those factors

H_2: There is a significant difference between different stakeholder groups in their perceptions of importance of critical factors for accounting information systems' data quality

H_3: There is a significant difference between different sized organisations in their perceptions of importance of critical factors for accounting information systems' data quality

2.7 Pilot case study and development of preliminary research models

2.7.1 Pilot case study

Two pilot case studies were conducted prior to the start of the major case studies. Those two pilot case studies were used to identify the main issues and also examine the applicability of the proposed critical factors from the literature in practice. In addition, the pilot study tested the case study protocol, prior to the collection of the

case study data. It also assisted in refining data collection plans with respect to both the contexts of the data and the procedures to be followed (Codd, 1970). It was considered that the pilot interviews could provide guidelines for the development of the interview protocol to be used in the second phase of the study. The pilot study uncovered some additional factors that influence accounting information quality beyond those gleaned from the literature and, therefore had the potential to add to the factors in developing the research model, which will be discussed next.

Semi-structured and unstructured interviews with major AIS stakeholders were conducted, which included accounting and finance managers, finance systems managers, and human resource managers. Data collection sources also included relevant documents, such as, position descriptions, policy manuals, organisational structure charts, and training documents; as well as some published information about organisations, such as financial statements and annual reports. Qualitative data analysis methods were used to classify and analyse case data. The unit of analysis in the case study was responses from case studies' major stakeholders, which includes their interaction with AIS.

The *first* organisation was a large Public Service organisation and involved a large accounting information system across the organisation. There was more than 4000 staff within the organisation. In its financial branch, it had 25 employees, and it also had many geographical divisions. Within each of these divisions there were permanent staffs involved in accounting tasks. It had an internal audit unit, which was separate from finance. Internal auditors audit independently on the operational audit and the finance audit. Its role was to maintain and improve financial management practices within the organisation.

The *second* organisation was a large private manufacturing company. Its IS department was divided into core systems and support systems, in which support systems were defined as supporting financial payroll, general ledger, and supply purchasing. The company had totally different systems in different branches at the time of the study. It was difficult to obtain consolidated reports, and it was hard to communicate between separate systems with different interfaces. The organisation managers wished to move to SAP in order to have a fully integrated system.

2.7.2 Analysis of Pilot case study findings

The findings from the pilot case study indicated that critical success factors varied in relative importance for AIS's data quality between different stakeholders and different organisations. Nevertheless, some factors were consistently more important than others. *The role of top management*, *nature of the system*, *employee/ personnel relations*, and *training* were addressed by all organisations and stakeholders.

It was proposed that *data quality policies and standards* were critical. However, the case study indicated that policies and standards themselves were not as important as the implementation of those policies. An organisation might have good data quality policies, but if they were not adhered to, it was a problem. It was also found that simple, appropriate and easy to follow policies are better than complex and more detailed policies. Policies containing too much detail have less chance of being followed. Complex policies and standards are always hard to implement. Therefore, the proposed factor, '(data) quality policies and standards', should change to '*appropriate data quality policies, standards and their implementation'*, where appropriate means simple, adequate and easy to follow.

Although almost all the literature in quality management and data quality emphasises the importance of the *role of (data) quality and the (data) quality manager*, real-world organisations seldom have data quality manager positions and do not really emphasise the importance of data quality issues. Although there were no data quality manager positions that existed in the organisations examined, the role of data quality and the data quality manager were found to be critical to AIS. While conducting the case study many interviewees voiced disagreement with the suggestion that one individual be required to be responsible for the whole system. Consequently, it was then suggested that for the large organisations, data quality management could involve a group of people rather than just one person. The factor of the *role of (data) quality and the (data) quality manager* was therefore divided into two factors: *Role of DQ* and *Role of DQ manager/ manager group*.

The case study evidence confirmed that *organisational structure* within the organisation is critical and suggested that the *culture of an organisation* would also have an impact upon data quality in AIS. Good organisational structures, such as segregation between relevant functional departments could provide efficient controls to ensure data quality in AIS. As further suggested by the case study, an additional factor was added, namely, *organisational culture*, which means the organisation has a positive culture on effective data quality management.

Based upon the pilot case study, it seemed that professionals from other disciplines did not really understand the process of AIS, and therefore, knew little about the data quality control approaches that should be used in AIS. *Data quality control approaches and AIS process management* were only understood by accounting professionals. Despite the lack of wide understanding of the *data quality control approaches in AIS*, it is essential to have appropriate activities and controls to ensure the quality of accounting information. This factor is heavily linked to other factors. For example, in order to have successful and efficient DQ controls and AIS process management, organisations should have adequate training, sufficient communication and good employee relations.

While *supplier quality management* is critical to product quality management, it was surprising to find that none of the stakeholders in AIS in the case study stated that information supplier quality management was critical to data quality in AIS. This might have been because AIS always has strict controls on the data entry point to ensure its correctness. It may also be due to the high accuracy requirement of accounting information, where the raw data is always checked very carefully before it is entered into the system. This might explain the reduced dependence upon the information supplier's data quality.

It was proposed that *customer focus* would have an impact upon data quality in AIS. However, the findings from the case study did not support this proposed factor. Financial information was found to be always required and needed to be accurate and timely regardless of different customers. Although there may be internal and external financial information customers and they may need different levels of finance

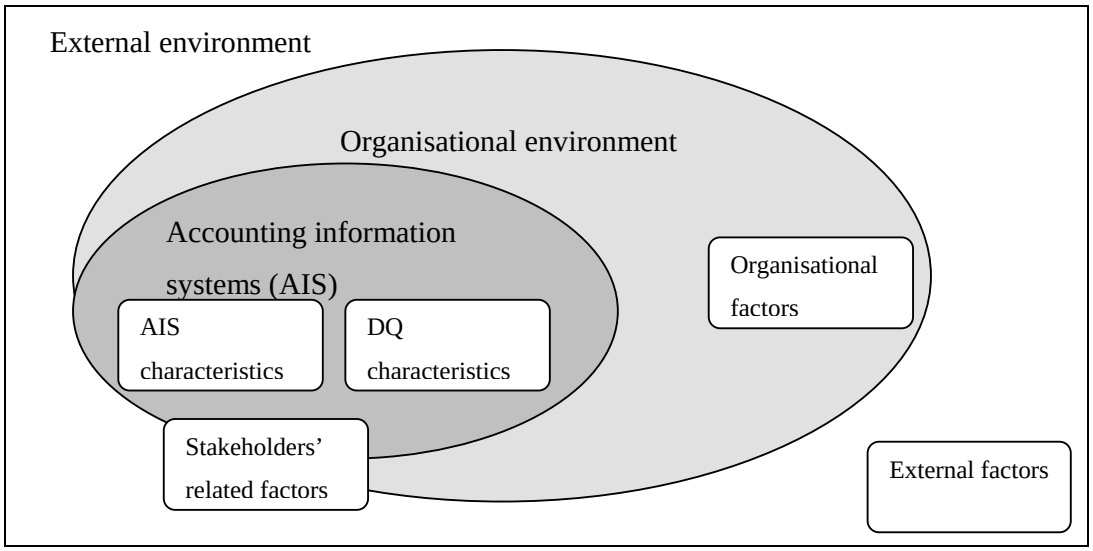
information or reports, their different requirements for accounting information did not seem to have much influence on data quality of AIS.

It was concluded that the *supplier quality management* and *customer focus* could not be eliminated from the list, even though they were not supported by the pilot cases, because two pilot case organisations may not represent the general real situation. Those two factors were kept in the research model for further testing during the next phase of the study.

Two other new factors were suggested from pilot cases, namely, *understanding of the systems and DQ*, and *teamwork*, which will be discussed in details in Chapter 4. They are to be included into the preliminary research model and examined by the two other stages of this research – multiple case studies and large-scaled surveys.

2.7.3 The model for factors influencing data quality in accounting information systems

Data from the pilot study and the literature were used to build the preliminary research models of possible critical success factors for DQ in AIS. In a review of prior research, a commonly accepted model to investigate the critical success factors for data quality in AIS was not found. Consequently, a model for critical success factors of accounting information systems' data quality was developed based upon the AIS, DQ, quality management literature and the pilot case studies. Several categories of factors were identified that according to the theoretical and empirical literature have the potential to influence data quality in AIS. These categories were: *AIS characteristics, DQ characteristics, stakeholders' related factors, organisational factors,* and *external factors*.



Legend: Rectangles: categories of factors
Small oval: accounting information systems
Large oval: organisational environment

Figure 2.3 Categories of factors impacting upon data quality in AIS

According to the relationships of those factors, they were organised into the research model shown in Figure 2.3, which contains five constructs at three levels. The first level is the external environment that consists of external factors, the second level is the organisational environment that consists of organisational factors, and the third level is the accounting information systems, which has AIS characteristics and DQ characteristics. Stakeholders of AIS could come from within the AIS, outside the AIS but within the organisation, and outside the organisation. For example, AIS could have both internal and external information suppliers and customers. Within each of those identified categories, a list of factors was grouped. Factors were identified by the comprehensive literature review and the empirical pilot case studies. The relationship between factors and categories is shown in Figure 2.4, and forms the model for factors influencing data quality in accounting information systems.

Although there is only one factor, *nature of the AIS*, under the category of AIS characteristics, this factor has many attributes, such as the number of the systems / packages, the number of staff, what kind of the system it is, the age and maturity of the system, and the organisational structure of the system. There are seven factors listed under the category of DQ characteristics, those factors are all related directly to the data quality itself. They are: *appropriate DQ policies and standard and its*

implementation, DQ approaches (control & improvement), Role of DQ, Internal control, Input control, Understanding of the systems and DQ, and *Continuous improvement of DQ.*

As previously mentioned the stakeholders of AIS could come from both inside and outside the AIS and the organisation. Human related factors have always been the focus within social science and IT research. The category of stakeholders' related factors in this research deals with the human/people related factors' influence on DQ in AIS. They include, *top management's commitment to DQ, role of DQ manager/manager group, customer focus, employee/personnel relations, information supplier quality management*, and *audits and reviews*. In the organisational level, there are seven factors, *training, organisational structure, organisational culture, performance evaluation & rewards, management of change, evaluation of cost/benefit tradeoffs*, and *teamwork (communication)*. External factors have been identified as factors outside the organisation from the external environment, and the organisation has little or no control over them.

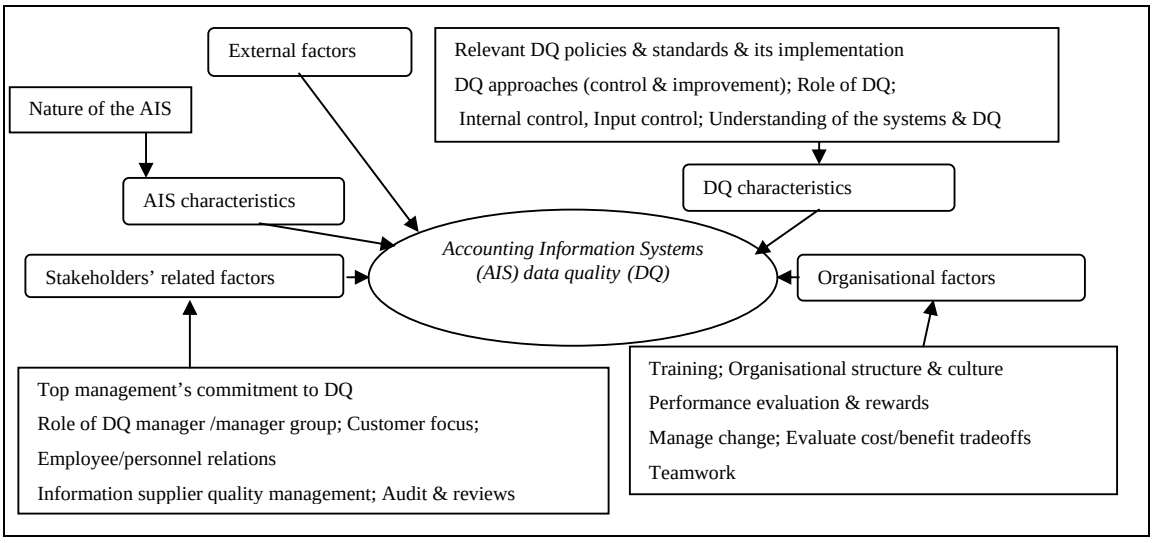


Figure 2.4 The model for factors influencing data quality in accounting information systems

2.7.4 Stakeholder groups for DQ in AIS

In order to understand the stakeholders groups' impact on accounting information quality, it is essential to identify their relationships with accounting information systems. The framework for understanding stakeholders in accounting information systems proposed in this chapter combines the stakeholder concepts from data quality, data warehouse, accounting information systems and quality management areas.

In data quality and data warehouse fields, there are four stakeholder groups that have been identified who are responsible for creating, maintaining, using, and managing data. They are data producers, data custodians, data consumers, and data managers (Strong et al, 1997; Wang, 1998; Sharks and Darke 1998). In the accounting information systems area, auditors were recognised as fulfilling the role of monitoring how the accounting information systems work and the quality of the information which has been generated by the systems. Internal auditors especially perform the internal policing and quality adviser role within the organisation.

Data quality research focuses on processing. Accounting management research focuses on results checking and monitoring. In the quality management area the source where raw data comes from is also addressed. In the quality management literature, suppliers' quality management has been highlighted as the important aspect of the total quality management (Saraph et al., 1989; Badri, Davis & Davis, 1995). In accounting information systems, data suppliers also play a role in data quality management. Therefore, they are also included in the framework.

Thus, in summary and combination of the above mentioned areas, for the purpose of this research, the stakeholders in accounting information systems have been identified as follows:

- Information producers: create or collect information for the AIS;
- Information custodians: design, develop and operate the AIS;
- Information users: use the accounting information in their works;

- Information managers: are responsible for managing the information quality in the AIS;
- Internal auditors: monitor the AIS and its data quality, check internal controls in the AIS; and
- Data suppliers: provide the unorganised raw data to the AIS

The framework components and their interrelationships are shown in Figure 2.5.

In accounting information systems, different stakeholders have different functional roles in relation to the quality of the information. The framework relates all stakeholders to accounting information systems on three different levels. The lower level has only one stakeholder group - the data suppliers who provide unorganised raw data to the AIS. It represents the input stage, which is getting raw data into the AIS. In the middle level, there are four stakeholder groups, namely, information producers, information custodians, information managers, and internal auditors, who are responsible for creating and collecting the information, designing, developing and operating the AIS, managing information, and monitoring AIS and information respectively. This important level contains the processing, storing, maintaining, and monitoring stages. The final and highest level distributes the organised, useful information to the information users, and it is the output stage.

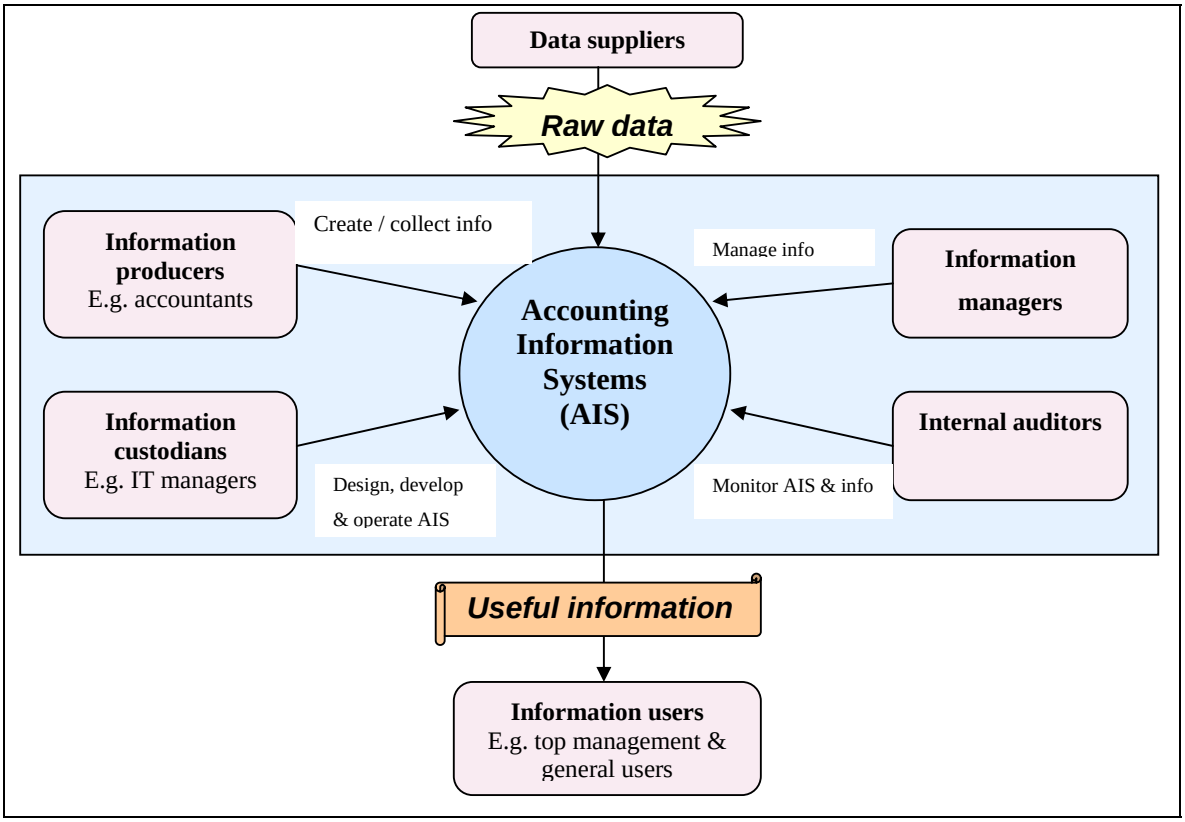
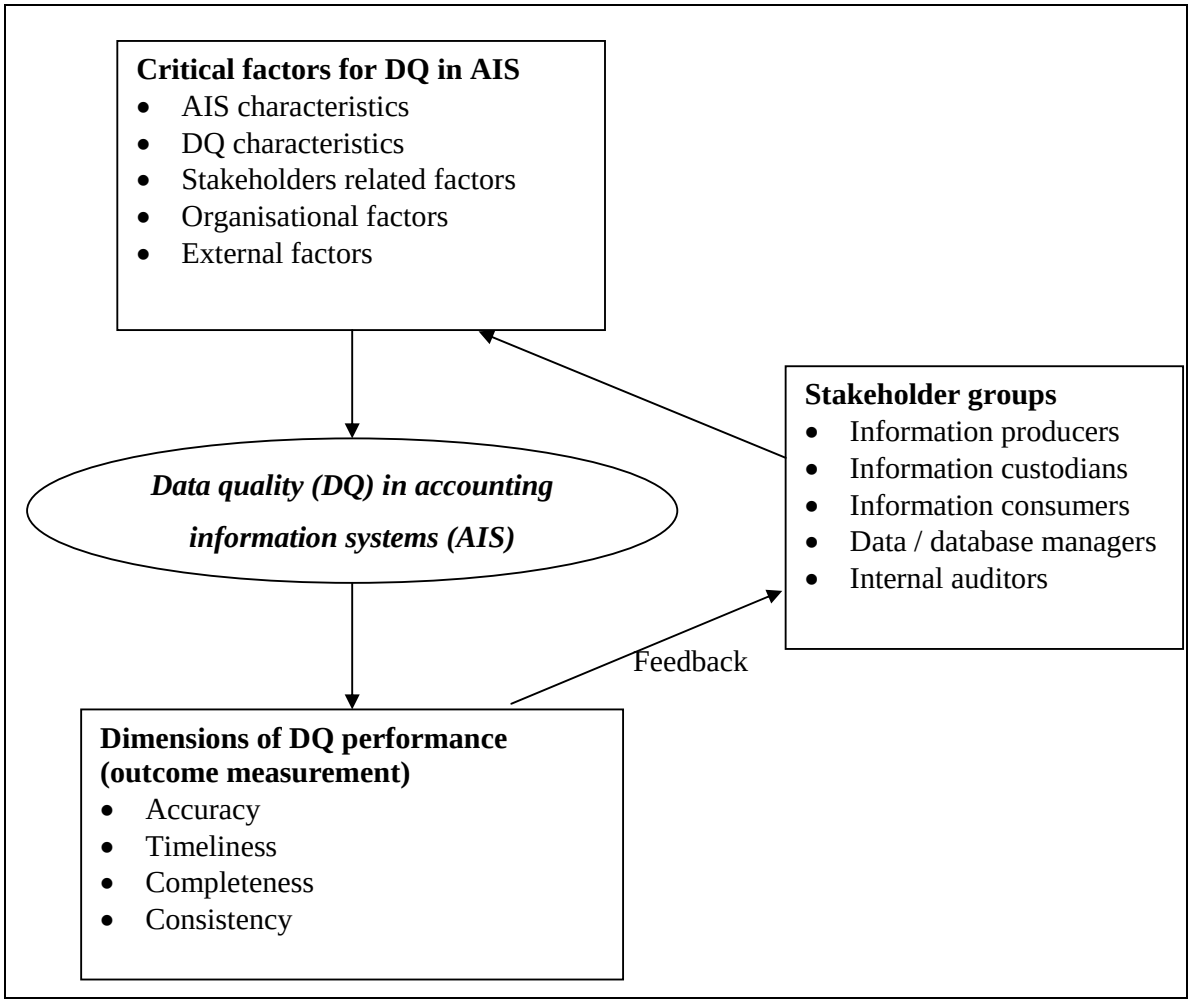


Figure 2.5 The framework for understanding relationships between stakeholder groups and data quality in accounting information systems

2.7.5 Preliminary theoretical framework of this research

The review of the literature and the exploratory pilot case study research on factors impacting upon data quality in accounting information systems, the theoretical framework developed for this research to address the research problem is reviewed in Figure 2.6. This framework was also given at the start of the chapter in Figure 2.2 and was introduced in Section 2.1 for the reader's convenience.



Legend: Rectangles: main components of the framework
Oval: accounting information systems
Arrows: relationships between components and systems

Figure 2.6 Preliminary theoretical framework of this research

Source: developed for this research, copied from figure 2.2 in section 2.1

This framework integrates several key themes concerning data quality management in accounting information systems. More specifically, this framework identifies five

key categories for factors that impact upon data quality in AIS. Those categories are: AIS characteristics, DQ characteristics, stakeholders' related factors, organisational factors and external factors. In addition, five stakeholder groups for data quality in AIS have also been identified. The research framework ties them to data quality management in AIS. The part of the framework relates to data quality outcome measurement. Ballou et al's (1987, 1993) data quality dimensions were adopted. Since there is an extensive literature that exists in this area as discussed in the previous sections of this chapter, it is not the focus of this research. The focus and contribution of this research is to identify the critical success factors for data quality in accounting information systems, and investigate whether there is any variation between different stakeholder groups regarding those factors.

2.8 Conclusion

A preliminary theoretical framework for data quality in accounting information systems was developed in this chapter after a detailed literature review and two pilot case studies. Based on this framework four research questions have also been developed. These research questions will be investigated by using theory building and testing research methodologies described in the next chapter.

3 Research methodology

3.1 Introduction

Chapter 2 reviewed the literature and proposed and discussed a model for critical success factors for data quality in accounting information quality. Chapter 3 explains and justifies the research methodology used to test the research model and collect the data.

In order to achieve the research objectives this research comprised four phases:

Phase 1: Detailed and focused literature review;
Phase 2: Two pilot case studies – exploratory stage;
Phase 3: Data collection through multiple case studies – confirmatory stage;
Phase 4: Two large-scale surveys to further develop and test the research model.

Chapter 3 has fourteen sections as shown in figure 3.1 to describe the four phases. The chapter starts with a discussion about the scientific paradigms on which the research is based. Then the chapter discusses the research methodology of the case studies and survey, and justifies the selection of the chosen methodology. For the case study methodology, the selection of cases is discussed together with the data collection and units of analysis. The pilot studies are then described. For the survey methodology, development of the survey instrument and the data collection procedure is discussed, along with the sampling strategy. The limitations of the research methods are addressed, followed by the ethical considerations adopted in the research.

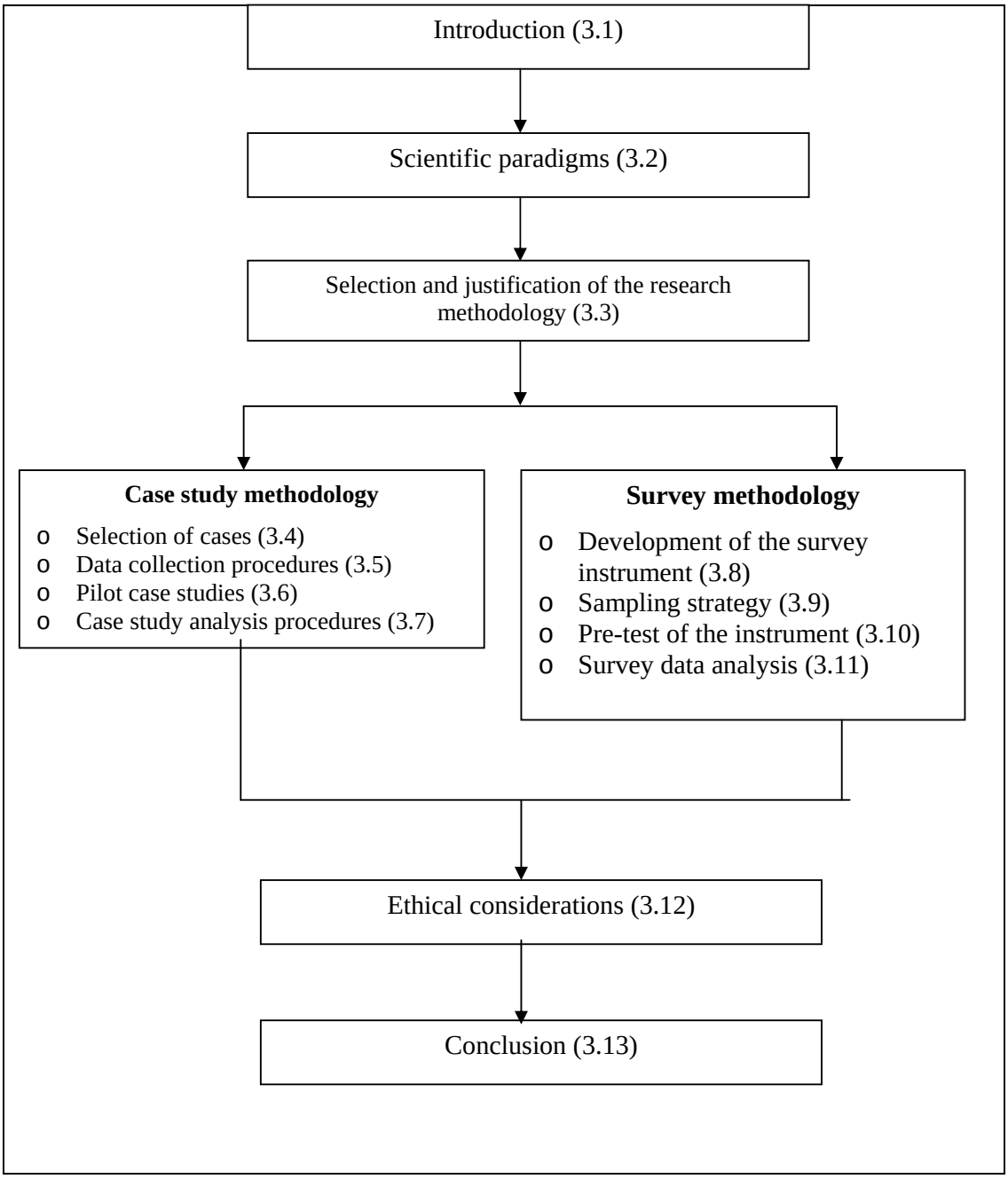


Figure 3.1 Outline of Chapter 3 with section numbers in brackets

Source: developed for this research

3.2 Scientific paradigms

This section addresses the issues of the selection and justification of the scientific paradigms for the research. For any research work, it is important to determine the appropriate scientific paradigm, that is the overall conceptual framework within

which a group of researchers work (Johnson & Scholes 1999), and a set of theories and methods that exhibit the same patterns or elements in common (Creswell 1994). A paradigm is a set of beliefs and feelings about the world and how it should be understood and studied, not only in choices of methods but ontologically and epistemologically (Denzin 1978; Denzin & Lincoln 1994). The *scientific realism* paradigm (Bhaskar 1978) was the preferred paradigmatic basis of the theory building stage of this research because the aim of this stage was to build the research model. The *positivist* paradigm was employed in the theory testing stage. A detailed justification of the scientific paradigm selection is discussed next.

In order to determine the appropriate scientific paradigm, it is essential to examine the ontological and epistemological characteristics of the research context. O*ntology* is a branch of metaphysics that deals with the nature of being or existence, and *epistemology* is the nature of the relationship between the knower and the known or knowable. They lead to *methodology*, which is the technique of how knowledge is gained. Furthermore, for research purposes, ontology means *what* can be discovered about the nature of reality or phenomenon of the study (Guba & Lincoln 1994). Epistemology means *how* knowledge of reality or phenomenon becomes known to researchers (Parkhe 1993).

There are many different classifications of the research paradigms from the traditional postitivist-phenomenologist paradigm (Morgan & Smircich 1980) developed from scientific research to more business related paradigms. For example, in management science research, paradigms have been classified in terms of formalism or empiricism (Beged-dov & Klein 1970), positivistism and hermeneutics (Gummesson 2000), induction and deduction (Parkhe 1993), qualitative and quantitative aspects of research (Van Maanen 1979), nomothetics and idiographics (Luthans & Davis 1982). For information system research, Orlikowski and Baroudi (1991) suggest three underlying paradigms: positivist, interpretive and critical.

Based on a synthesis of different classifications of paradigms, Guba and Lincoln (1994) suggest four underlying paradigms: positivism, critical theory, post-positivism/scientific realism, and constructivism. However, those research epistmologies are philosophically distinct. In real social science research there are no

clear distinctions. Furthermore, there is no agreement as to whether those research paradigms can be combined within one study.

The research for the thesis accommodated the scientific realism and positivism paradigms. Table 3.1 overleaf provides the justification of the paradigm selection by listing the dimensions of the three interrelated elements of ontology, epistemology and methodology. Details of the paradigms are then discussed.

Table 3.1 Justification of the paradigm selection

	Positivism		**Scientific realism**	
Elements	**Theory**	**This research (Phase 4)**	**Theory**	**This research (Phases 2, 3)**
Ontology	Naive realism: o Reality is real and apprehensible o Scientific knowledge is absolute and cumulative o Focus is on determining cause and effect relationships	o Reality is real and apprehensible o Knowledge is gained through literature review and empirical case studies o Focus is on determining cause and effect relationships between dependent variables and critical factors for data quality in AIS	o Reality is real but only imperfectly and probabilistically apprehensible o The world exists independently of its being perceived o Focus is on studying causal tendencies or generative mechanisms	o Discovery of unobservable realities o Little previous knowledge o Focus on studying causal tendencies: possible important factors impact on data quality in AIS
Epistemology	Objectivist: o 'One way mirror' observer o Findings are true o Investigation goals could be causal, deductive, theory testing, ungrounded and prescriptive	Objectivist: o Findings reflect the real-world practice o Investigation goals are to further develop and test the theory	Modified objectivist: o Findings probably true with awareness of values between them o Focus on exploration, theory building, inductive research	o Capture the nature of the research problem and associated issues in their natural settings o Exploration o Theory building –build the research model
Methodology	Mostly quantitative: o Surveys, experiments, hypothesis testing o Statistical generalisation o Large sample size o Distance from data	Quantitative: o Two large scale surveys o Original mail-out sample size: 2000 with a 19% response rate o Testing of hypotheses o Generalise the CSFs for AIS DQ from statistic analysis o Distance from data	Mostly qualitative and some quantitative: o Case study o Convergent interviews o Structural equation modelling o Triangulation of evidence o Multiple measures o Analytical generalisation	Mostly qualitative and some quantitative: o Seven Case studies o Pilot study interviews o Triangulation of evidence o Include both qualitative and quantitative measures o Develop the model based on case study analysis

Source: developed for this research from Guba & Lincoln (1994); Marsden & Littler (1996); Perry, Riege & Brown (1999).

Scientific realism.

Scientific realism is based upon the ontology that there is a real external world that consists of structures and mechanisms, though they may be only imperfectly and probabilistically apprehensible (Godfrey & Hill 1995; Guba & Lincoln 1994; Hunt 1990; Merriam 1988). Since the first two research questions involve the discovery of unobservable realities, scientific realism is more suited to answer those two questions.

Phases 2 and 3 of the thesis research aim to identify the generative mechanisms that lead to high quality information in accounting information systems as observed in various Australian organisations. It is intended that the results from those phases be used to develop the theory – research model that might provide important insights into the CSFs for data quality in accounting information systems. There is little prior theory and previous research about CSFs for data quality in AIS. Therefore, based on the nature and background of the research problem and the aims of the first two research questions of this research, the scientific realism paradigm seems to be a sound methodological base for the theory building stages of this study.

Positivism.

Positivism is one of the dominant paradigms in science research, and many social science researchers also prefer this approach. Positivists generally assume that reality can be objectively described and used for theory testing. According to the positivists, the purpose of science is simply to accept only those facts that we can observe and measure, and knowledge of anything beyond those is impossible (Tsoukas 1989). In the information systems area, research is classified as positivist if there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from the sample to a stated population (Orlikowski and Baroudi 1991). This approach is suitable for phase 4 of this research as it is for the further development and testing of the research model.

An objective of the positivist paradigm is to measure the relationships among variables that are nomothetic across time and context (Wicks & Freeman 1998). It suggests the collection of data based on controlled experiments and surveys (Hunt 1990). For the theory testing stage of this study, the *positivist* paradigm has been

employed to enable wide coverage of the industries studied, the size of the organisations studied, and the stakeholder groups of AIS.

3.3 Selection and justification of the research methodology

As listed in section 3.1, this research has four phases. This section explains the details of those stages. The research was completed in three stages, as illustrated in Figure 3.2. The Y-axis represents the phases of this research, while the X-axis refers to the stages. The first stage was inductive and exploratory, while the second stage involved confirmatory case studies. The third stage included two large-scale surveys for the purpose of further theory developing and testing. The inductive stage began with a focused and detailed literature review followed by two pilot studies. The objective of this stage was to obtain some prior theory. The pilot studies were to help to refine the data collection instruments and the development of the interview protocol for uses in the later multiple case studies. The exploratory stage contained two phases, while the confirmatory and theory testing stages had one phase each. A detailed explanation and description of those phases follows.

Phase 1: Detailed and focused literature review

The first phase involved a detailed and focused literature review, which led to the development of the preliminary research model representing possible critical success factors for data quality in AIS. (The prior model from the literature was used together with the pilot case study, in building the research model.) A broad reading of the literature was followed by consultation with professionals in the related areas. This helped to identify and narrow the research. After the identification of the precise research problem, a more focused literature review was conducted to aid the development of the preliminary theoretical framework. Several information systems, business and management databases were included, such as *Infotrac* and *Business ASAP*, as a part of literature review. The research questions were identified and defined in Chapter 2 from a review of the literature in relation to the theoretical framework.

3.3.1 Identification of factors from the literature

A list of factors that influence data quality in AIS was proposed by synthesising critical success factors, data quality, and accounting information systems concepts from the quality management, DQ and AIS literature. An initial model of factors that could possibly influence DQ in AIS was drawn from the literature review. This prior model was then used to help develop the preliminary research model, and also focus the data-collection phase.

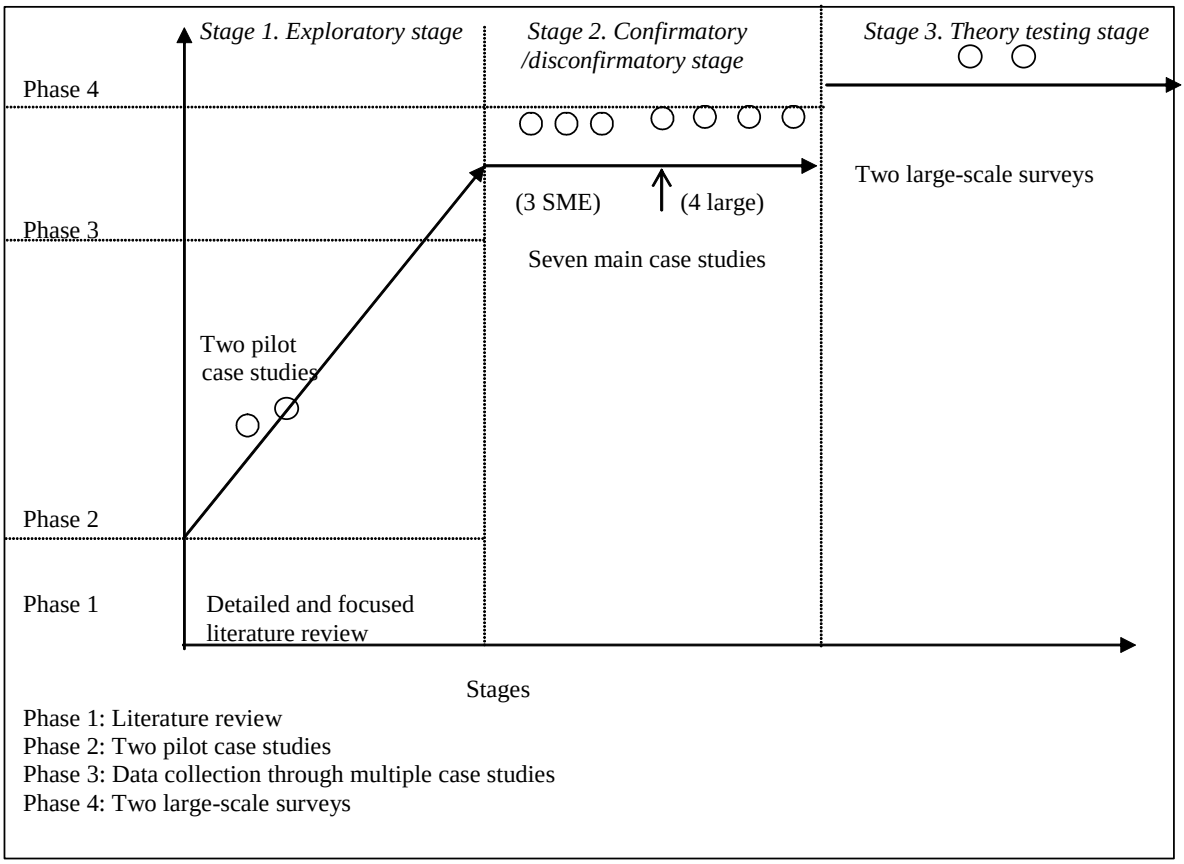


Figure 3.2 Research design for this research

Source: developed for this research from Carson et al. (2001), Perry (1998b), Perry & Coote (1994)

Phase 2: Pilot case study

Two pilot case studies were conducted in two large organisations based in Brisbane. The organisations were chosen because of their geographical convenience. The pilot studies tested the pilot case study protocol, before the case study data collection.

They assisted in the accepted procedure of refining the data collection plans with respect to both the contexts of the data and the procedures to be followed (Yin 1994). The pilot studies provided the recommended prior theory and general directions for the data collection process (Perry 1998b) A pilot case study protocol was used, because it is considered to be of assistance in increasing the reliability of case study research and in guiding the investigator in carrying out the case study (Yin 1994). Pilot case studies are considered to help the determination and assessment of the reliability and validity of interview questions (Eisenhardt 1989; Parkhe 1993; Yin 1994). The pilot interviews provided guidelines for the development of the interview protocol used in the third phase of the study. The study covered both substantive and methodological issues. It provided a broad picture of data quality issues in AIS, and the evidence of accepting or rejecting initial proposed factors from the literature. The pilot studies uncovered some additional factors that influence accounting information quality beyond those gleaned from the literature. Therefore, they were of possible value in adding to the identification of factors in the developing research model, which will be discussed next.

3.3.2 Development of the preliminary research model

Data from the pilot study and the literature was used to build the preliminary research model of possible critical success factors for DQ in AIS.

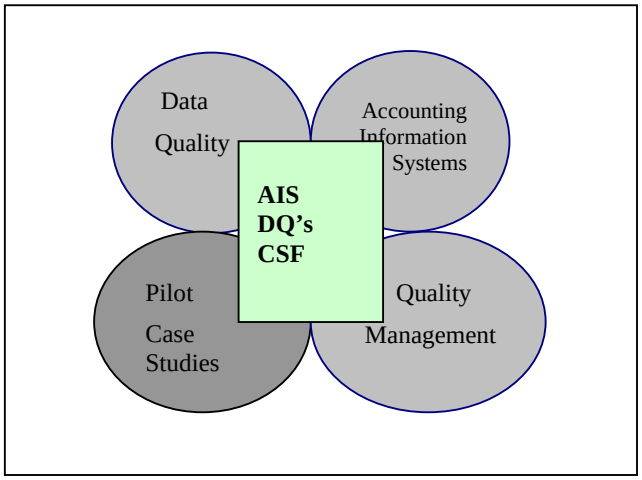


Figure 3.3 Areas that contributed to the model building of this research

Figure 3.3 shows how different areas of literature and the pilot studies contributed to the model building of this study. The initial exploratory research was used to design the interview protocol and data collection procedures for the third phase, and it also added to the preliminary framework.

Phase 3: Multiple case studies - confirmatory stage

In the third phase of the research the applicability of the proposed critical success factors for DQ in AIS in practice was examined. The case study research method was used in this phase. Case study research is used to study the contemporary phenomenon in its real-life context (Yin 1994) and it can be used where the research and theory are at their early, formative stages (Benbasat, Goldstein & Mead 1987). Given that little research has been conducted on DQ critical success factors in AIS, there is a need to examine the real world AIS DQ critical success factors, and modify the initial proposed critical success factors based on real-life practice. Therefore, the case study method seemed appropriate for this phase.

Multiple case studies were conducted as the methodology in Phase 3 to investigate the critical success factors for accounting information quality. Evidence from multiple cases is often considered more compelling, and an overall study with

multiple cases is therefore regarded as being more robust (Herriott & Firestone 1983).

Modification of the research model - Identification of critical success factors for data quality in AIS

At the end of the third phase case study data was used to modify or affirm the proposed critical success factors. Therefore, a set of critical success factors for AIS DQ was able to be identified. This was a key result of data analysis of the case study data.

Although there are many differences between organisations in relation to size and type, the degree to which these affect the CSFs is generally considered to vary between organisations and at different periods of time. However, there are also many similarities among organisations. Therefore, it was decided to research whether it is possible to identify a general set of CSF that influence the data quality of AIS.

The purpose of this phase was to justify and adjust the hypothesised critical success factors, and make the decision to accept or reject factors based on the case study. A set of critical factors derived from literature and modified by the case study was considered likely to provide integrative, logically consistent important factors, which would likely cover the most important aspects for ensuring the DQ of AIS. It was considered that a particular set of critical success factors for AIS DQ could focus the attention of accounting and IS professionals as well as senior managers on the factors that need to be addressed for producing high quality accounting information.

From the previous two phases, the literature review and the pilot case studies, the preliminary research framework and protocol were proposed and used to aid the detailed planning and preparations for the third phase – the multiple case studies. The interview protocol developed in Phase Two above was used for the confirmatory stage's seven cases. The collected data from the third phase was then analysed in Chapter 4 with the refined research framework developed at the end of the chapter. The research framework was then further developed and tested using the two large-scale surveys –the fourth phase of the research. The analysis of the case studies was

focused on the concept of analytical generalisation within the scientific realism paradigm.

Phase 4: Large-scale surveys - theory testing stage

The fourth phase involved two large scale cross-sectional surveys, in order to further develop and test the research model. An attempt was made to rank the critical success factors identified by the case studies, and also investigate what levels had been achieved by real-world organisations in practice with those factors. The purpose of the analysis of this phase was to test research hypotheses.

Phase 3 of the case study was the exploratory stage of the study. The primary goal of this phase was descriptive. The objectives of phase 4 were to:

- Determine the ranking order of the CSFs for data quality in AIS;
- Evaluate the performance of those factors in real world practice;
- Examine the similarities and differences between the importance and performance of the factors;
- Examine the relationships, if any, between the CSFs, the stakeholder groups and organisation size.

In summary, the first phase reviewed the existing literature, and prior theory in the research area, which assisted in formulating the research questions, while the two pilot case studies in the second phase helped the refinement of the interview protocol. Furthermore, the first two phases together enabled the development of the appropriate preliminary theoretical framework for this research. They helped control the contextual environment of the study, and improve its reliability. The knowledge gained was then used to identify more appropriate types of cases and organisations for the third phase, and therefore aided the conceptual clarification of the research design. The case selections of the third phase were based on literal and theoretical replication. They were based on the requirement to answer the research questions. Therefore, random selection was not used, and instead a purposeful selection procedure was conducted. The data collected from the cases was analysed to shape

the emerging theories. Finally, survey methodology was used in the fourth phase to further develop and test the research model.

The following is a detailed discussion of the case study and survey methodology. For the case study methodology, the selection of cases (3.4), the case study data collection procedures (3.5), the pilot case studies (3.6), and the case study analysis procedures (3.7) are included. There is then an outline of the development of the survey instrument (3.8), the data collection procedures (3.9), and the sampling strategy (3.10) for the survey methodology.

The case study methodology

3.4 The selection of cases

The first question to answer for the case study strategy was whether to include single or multiple cases. For this research, the multiple case study approach was chosen. The reasons for choosing the multiple case study approach over the single case approach were its capacity to handle the complexity of the phenomena under study (Donnellan 1995; Eisenhardt 1989; Merriem 1988; Yin 1994), and the fact that it augmented external validity and helped guard against observer bias (Leonard-Barton 1990). It was recommended to be of assistance in capturing the complexity of the social settings and facilitating the comparison of activities across a variety of settings and situations (Adams, Day & Dougherty 1998). The multiple case study approach uses replication logic to achieve methodological rigour (Donnellan 1995; Yin 1994) and triangulate evidence, data sources and research methods (Eisenhardt 1989).

In order to limit variations and enhance external validity, a particular population for selection of cases needed to be specified (Wilson & Vlosky 1997). For the case study phase of this research, organisations belonging to Australian services industries were considered. The services industry was selected as a specified industry because it might help cross-case analysis and ease the comparison of data from the different case organisations. Within this industry, two types of organisations, public and private, were included.

3.4.1 Theoretical and literal replication

It is generally recommended that both literal and theoretical replication should be considered when selecting cases for the multiple case study approach. This process contrasts with sampling logic based on a random sample of a number of respondents representing a large population (Yin 1994). For this type of research, it is recommended that random selection of cases is not undertaken. Instead, maximum variation sampling is considered to be more appropriate for multiple case studies because cases can be selected based on replication logic that may assist in theory building (Perry 1998b).

Multiple cases should be regarded as multiple experiments rather than multiple respondents and hence it is recommended that replication logic rather than sampling logic should be used (Yin 1994). Hence, it is recommended that each case should be chosen in such a way that it either predicts similar results for predictable reasons that is literal replication, or produces contrary results for predictable reasons, that is, theoretical replication (Perry 1998b). Thus, literal replication is similar to multiple experiments where the same results are predicted from different experiments if the conditions are the same, while theoretical replication arises if multiple case studies produce contrary results for predictable reasons.

The selection of cases in this study was purposefully carried out in order to achieve *theoretical* and *literal* replication. Cases were selected containing the three dimensions of service industry type, the types of organisations, and the size of organisations. The first dimension was the different type of service industries, which consists of agricultural services, education, online infrastructure, transportation, and government sectors. The second dimension was the type of organisation, public or private. The third dimension was the size of the organisation. This included large organisations and SMEs. For each theoretical category, some cases were expected to achieve literal replication while others were expected to achieve theoretical replication.

The organisation size was chosen for theoretical replication purposes because the pattern of case study data might differ across different sized organisations, and small and large organisations are not likely to possess the same organisational structures and cultures that might impact on data quality in AIS. Furthermore, the pattern of data may vary across different types of service industries because differences in service types impact on the degree of focus on data quality issues. Finally, there are differences between public and private organisations. Because public and private organisations have different aims and purposes, their accountabilities to the public and shareholders are different. These are examples of theoretical replication. Similarly, the data pattern may be somewhat similar for the cases from organisations with similar characteristics, which is literal replication. With this process, external validity in the research was achieved.

After consideration of both theoretical and literal replication, the number of cases was decided and justified. Following is a discussion regarding the selection of the number of cases to be included in the research, followed by the determination of the appropriate number of interviews. The units of analysis for the multiple case studies are also discussed.

3.4.2 The number of cases

Seven cases were chosen for this research. Of these cases, four were chosen from large organisations, and the other three were small to medium organisations (SME). There is no agreement on how many cases should be included in a study, and particularly for PhD research. In fact, there are two different opinions on this issue. Some researchers argue that there is no certain number of cases in a case study research, while others suggest the number of cases that might be included.

There is no ideal number of cases that should be chosen for research. The number of cases depends more on the purpose of the research, the questions asked, the resources available and the constraints being faced, and therefore the decision regarding the number of cases should be left to the individual researcher (Romano 1989; Patton 1990). Gummesson (2000) suggests that the researcher should stop adding cases

when theoretical saturation is reached, at which point incremental learning is minimal.

In contrast, some researchers give the specific number of cases suitable for case study research. There have been considerations of the upper and lower limits of cases. Researchers suggest that the maximum number of case should not be over 12 to 15 cases (Hedges 1985; Miles and Huberman 1994; Ellram 1996), because any number greater than 15 could generate too much information, therefore, out of the researcher's ability to follow the possible local dynamics. For the lower limit, two to four cases is seen as the minimum acceptable requirement, given that when the number of cases is less than four, it is difficult to generate theory and empirical findings are likely to be unconvincing (Eisenhardt 1989).

Because the first two phases – detailed literature reviews and two pilot case studies – of this study helped build the preliminary research model, which made the case study stage build on replication logic and prior theory, it was possible to determine the seven cases to be studied in this research in advance. The selection of seven cases is within the recommended range given above and appears appropriate for this research. Within those seven cases, four are large organisations, while three are SMEs (Table 3.2). This design allows for the investigation as to whether the organisational size influences the critical success factors, and whether it is possible to generate some common critical success factors for different sized organisations. Due to funding constraints, the selected organisations are from cities on the eastern board of Australia.

Table 3.2 number of case studies in different size of organisation

Organisational size	**Number of case studies**
Large organisations	4
SMEs	3

3.4.3 Number of interviews

It is recommended that semi-structured interviews be conducted with key stakeholders of AIS. In information quality studies, four types of stakeholders have been identified. They are: information producers, information custodians, information consumers, and information managers (Strong et al 1997, Wang 1998). In AIS, these stakeholders are identified as follows:

(1) Information producers are those who create or collect information for the AIS;
(2) Information custodians are those who design, develop and operate the AIS;
(3) Information consumers are those who use the accounting information in their work activities;
(4) Information managers are those who are responsible for managing the information and information quality in AIS.

From previous AIS literature, auditors play an important role in monitoring data quality. Consequently, the internal auditors of the case study organisations are also included in the research. Table 3.3 shows the details of the interview plans for this study.

Table 3.3 Planned case study interviews

Stakeholder category	**Position within the organisation**	
	Large organisations	**Small organisations**
Information producers	Accounting managers	Accountants
Information custodians	IS managers	IS personnel
Information consumers	Senior managers	Senior managers
Information managers	Data managers (DA /DBA)	N/A
Internal auditors	Internal auditors	N/A

The key stakeholders to be interviewed in large organisations were accounting managers as information producers; IS/IT managers as information custodians; senior managers as information consumers and DA/DBAs as the information

managers, and internal auditors. Those internal auditors could have been IT or financial internal auditors, as they both had valuable experiences with AIS. It was likely that SMEs had fewer personnel involved in their AIS; therefore, it seemed probable that fewer stakeholders were involved in SMEs than in larger organisations. Therefore, key people planned to be interviewed in SMEs were accountants, IS personnel, and senior managers.

3.4.4 Units of analysis

There were two different units of analysis for this study. The individual organisation was the unit of analysis when comparing differences between case organisations. The individual stakeholder was the unit of analysis when comparing the views of different stakeholders.

The purpose of the case study was to investigate key stakeholders' perceptions of critical success factors of AIS DQ in different case study organisations, and to determine the empirical validity of the proposed critical success factors concepts, in order to lead to the identification of CSFs for data quality in AIS. Therefore, choosing the individual organisation and stakeholder groups as the units of analysis seemed appropriate.

In summary, a multiple case study approach was adopted in this research and seven cases were selected based on theoretical and literal replication logic. Within these seven cases there were a total of 35 interviews with different AIS stakeholders that is, information producers, custodians, consumers, managers, and internal auditors. Since the research plan has been described, the fieldwork and data collection process can be discussed next.

3.5 Data collection procedures

3.5.1 Sources of data

Data for the case studies in this research was collected from multiple sources. It is generally accepted that multiple data sources allow an investigator to address a broader range of historical, attitudinal, and behavioural issues (Eisenhardt 1989). Furthermore, the use of multiple sources of evidence is considered to facilitate the development of a 'converging line of inquiry', by which the process of *triangulation* is ensured (Yin 1994). With this triangulation it is considered that *construct validity* can be achieved because the multiple sources of evidence essentially provide multiple measures of the same phenomena (Yin 1994).

In-depth interviews with the major AIS stakeholders were selected as the main source of the data collection because it is suggested that most case studies are about human affairs and well-informed respondents can provide important insights into the situation (Yin 1994). Furthermore, it is recommended that an interview is a better method of obtaining quality data efficiently (Marshall & Rossman 1995).

Data collection sources also include relevant documents, such as position descriptions, policy manuals, organisational structure charts and training documents as well as some published information about organisations, such as financial statements and annual reports. It is considered that documents can be used to corroborate and augment evidence from other sources, and they play an explicit role in the data collection process in doing case studies (Yin 1994). Position descriptions can provide the researcher explicit responsibilities of certain positions in AIS. Furthermore, organisational structure charts can be used to understand the interrelationship among different divisions, such as IT and Finance, within an organisation. Training documents provide evidence of training that has been undertaken by an organisation. Annual reports and financial statements provide the general background information about an organisation and its financial position.

3.5.2 The case study protocol

Case study protocols contain the instruments and the procedures and general rules that should be followed in using the instruments, and can be used to control the *contextual environment* of studies (Yin 1994). Controlling the contextual environment is an important consideration in the design and application of qualitative research approaches (Emory & Cooper 1991; McDaniel & Gates 1991) and in case study research designs in particular (Yin 1994).

For this research, a case study protocol was developed to help increase the reliability of the study. It also became the guide for carrying out the investigation more efficiently (Yin 1994). It is considered that the essential components of a protocol are: an overview of the case study project, field procedures, case study questions and a guide for case study reports (Yin 1994). How each of these components of the case study protocol was present in the thesis research is discussed next.

An overview of the case study project

The objectives of the study have been addressed in Chapter 1, which provides the overview of the study. The relevant literature about the topic has been reviewed in Chapter 2. That consideration led to the development of the research questions.

Field procedures

The second component was the development of field procedures. Because in case studies data are collected from existing organisations and stakeholder groups of AIS, there was a need in the data collection plan to integrate real-world events. As most of the interviewees were middle and top management, the schedule of the interviews had to fit the interviewees' time and availability. Thus, it was necessary to make well-planned field procedures such as adequate plans for access and communication with each respondent, access to the required resources for each interview beforehand, proper preparation of a time schedule and development of a contingency plan in the event of interview cancellation. These procedures were devised for this research well in advance as a part of fieldwork discussed in detail in the next section (section

3.5.3). Names of organisations and respondents were disguised to maintain confidentiality. This confidentiality was important because they did not want their names to be revealed in any manner. Therefore, organisations were identified as Case A to Case G, and respondents were identified by their position titles.

Case study questions

The case study questions followed the recommendation that the heart of the protocol be a set of substantive questions reflecting the actual inquiry (Yin 1994). Several interview questions were developed based upon the concepts in the theoretical framework and the research questions. These interview questions, given in Appendix I of this thesis, were used in all the cases for data collection purposes. The interview protocol was divided into five sections. Section 1 contains the questions about the demographic details of the organisation and the respondent. Section 2 describes the nature of the organisation's accounting information systems. Section 3 contains some specific questions about data quality issues in accounting information systems. Section 4 focuses on the factors that may influence the data quality in accounting information systems. In Section 5, a list of the factors identified by the researcher is given, the interviewees asked to rate factors according to their perceptions of the importance of those factors. This is the small quantitative part of the case study. The protocol then concludes by asking whether there were any additional comments on the issues and the study. This interview protocol was reviewed by the researcher's colleagues, tested in the two pilot case studies, and refined with the feedback received. Some changes made to the interview protocol as a result of feedback from colleagues were: refining unclear questions, modifying the structure of sections, and changing the format of the protocol.

The guide for the case study report

The next issues that needed to be considered were the outline, format, and potential readers for the case study report. The guide for the case study report followed the convention that it should be thought through before the data collection, not after. Furthermore, a guide was created to facilitate the collection of relevant data in an appropriate format, and reduce the possibility of requiring a return visit to the case

study site if something was missing. The principle was followed that a case study database was considered suitable for recording all relevant documents, interview transcripts and recordings. Furthermore, it was decided to present the information and analysis in a written format suitable for the potential audience, which was identified as being likely to include academics, researchers, and professionals in the area of accounting information systems, and data quality management.

3.5.3 Fieldwork for the data collection

Subsequent to the development of the case study protocol, the process of data collection was then planned. Although the case study approach has been criticised for being less codified than theory testing approaches, case study research can be carried out systematically and its data collection process can be structured (Adams, Day & Dougherty 1998). The research for this thesis adopts the systematic process of conducting fieldwork to collect data shown in Figure 3.4 overleaf.

Selection of the case organisation

The fieldwork began with the selection of the case organisation. The type of the target case organisations, as discussed in section 3.4.1, contained three dimensions. The first dimension was the type of service industries, such as agricultural or educational services. The second dimension was the type of organisation, public or private. The third dimension was the size of the organisation, large organisation or SME.

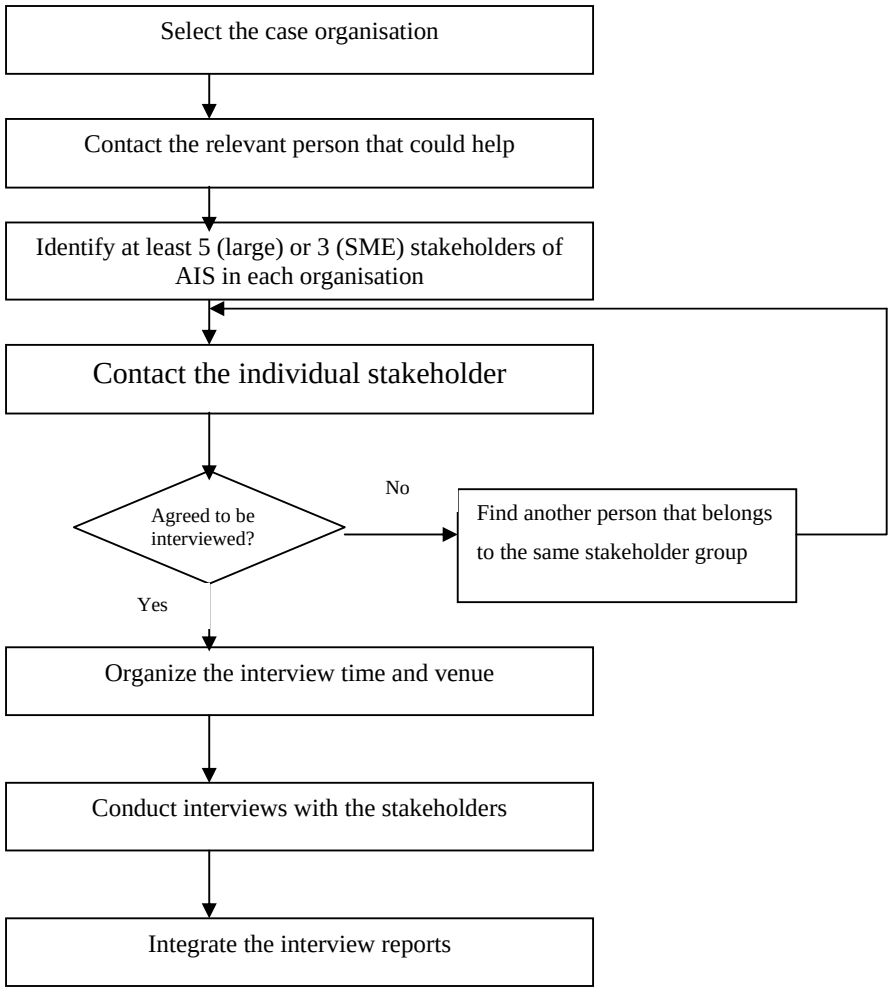


Figure 3.4 The systematic process of fieldwork for the case studies of this research
Source: developed for this research

The search for suitable cases started with organisations that the researcher had contact with, because it is usually considered that familiar organisations usually possess a greater willingness to cooperate with the researcher. The online organisation directory and yellow pages were used for searching possible case sites. The targeted companies were contacted by phone, email and letters and were requested to participate in the research. Short document summaries of the research purpose and design, together with supporting letters from the supervisors were included in the initial contact. Different types of services organisation were included, as well as different sized organisations. Both private and public organisations were targeted. However, although all the necessary effort was applied, there were no

suitable private large organisations willing to participate in the case study. This limitation of the case organisation selection was recognised, and an attempt was made to overcome this by the inclusion of large private organisations in other stages of the research, which were the pilot case study, and the survey. Table 3.4 describes the case selection of the case studies.

Table 3.4 The case selection of the case studies

Size / Type / Case			Description
Large	**Public**	**A**	Federal government department
		B	Government funded research institution
		C	Public utility
		D	Higher educational institution
SMEs	**Private**	**E**	Private educational enterprise
	Public	**F**	Federal agency
	Private	**G**	Private national agricultural enterprise

Contacting case participants

First contact was made with potential participants through the connections of colleagues from the candidate's university. In cases where personal connection did not exist, the Human Resources or Marketing Manager of the potential case organisation were the first contact. A more formal invitation and outline of the research was subsequently sent to those who had expressed an interest in participating. Supporting letters from the candidate's supervisors were also included to enhance the credibility of the research.

Identification of the stakeholders

After obtaining the agreement or approval to participate in the case study, the next task was to identify the AIS stakeholders that needed to be interviewed, five for large organisations and three for SMEs. The people contacted in the previous stage were asked to help in identifying the appropriate person in the organisation that would best

match the defined stakeholder groups. From each of the participating organisations, at least five AIS stakeholders were identified in the large organisations, and three for the SMEs. They were selected according to the research design of the stakeholders as listed in Table 3.3. The interviewees who worked in the accounting or finance areas were identified as AIS information producers. The IT professionals looking after the AIS were selected as the information custodians. Senior managers and general users of the AIS were included as information consumers. Those three types of stakeholders were identified for all the organisations, while for large organisations, there were two additional stakeholder groups: data/data quality managers and internal auditors. Since in all the case organisations, there was no such position as 'data quality manager' as stated in the original design, the compromise was made to include data or database administrators (DA or DBA) to represent the stakeholder of data manager.

Contact with the individual stakeholders

After having identified stakeholders, contact was made with them by e-mail and phone to introduce the researcher, to explain the research and assure them of confidentiality. However, not all of the first identified stakeholders were willing to participate in the research. Therefore, other people that belonged to the same stakeholder groups in the organisation were identified. After receiving the agreement of all the participants in the case study, interview times and venues were organised.

The conduct of the interviews with the stakeholders

Face to face interviews with the stakeholders were conducted at the scheduled times and mostly at case organisations' premises, with a few conducted via telephone due to some constraints. The interviews were tape-recorded and each lasted about one to two hours. A semi-structured in-depth interview method was used, which gave the interviewees the opportunity to express their opinions more freely, while maintaining the same structure of the interviews with all interviewees.

The interview started with an explanation of the purpose of the research, and a general introduction of the researcher. The interviewees were then invited to

introduce themselves and the background of their organisations and accounting systems. Quite often, this led to a discussion of issues or problems with data quality in AIS. Then, the interview became more structured when more specific questions from the interview protocol were asked. Although the interview protocol was used to guide the progress of the interview, interviewees were still encouraged to discuss other relevant issues, and to expand or challenge the interview questions. Furthermore, the sequence of interview questions was based on the interviewees' responses (Carson et al. 2001) rather than the order of the interview protocol, which gave the respondents the chance to cover new and important issues in their own words.

In summary, cross-sectional multiple case studies were conducted using a systematic approach for data collection from multiple sources. The next section of the thesis covers the two pilot case studies, which assisted to refine the case study design and data collection process.

3.6 The pilot case studies

Two pilot case studies were conducted prior to the formal data collection process, in accord with the recommendation that conducting a pilot study is the final preparation for data collection (Yin 1994). It is recommended that pilot case studies help in determining the usefulness of and assessing the reliability and validity of interview questions in order that researchers can refine their data collection plans with respect to both the content of the data and the procedures to be followed before subsequent case studies are done (Eisenhardt 1989; Parkhe 1993; Yin 1994). Furthermore, it is considered that pilot case studies provide some conceptual clarifications for research designs as well (Yin 1994). Two pilot case studies were used to test the appropriateness of case study protocol and measures to be used in the thesis research.

It is recommended that the selection of pilot cases be based on convenience, access and geographic proximity (Yin 1994). Two Brisbane based organisations were selected for the thesis pilot studies; firstly, because Brisbane was the closest big city to where the researcher was based. Secondly, it was considered that the pilot sites

could well represent real cases, and that most of the relevant data collection issues could be encountered at these sites. Finally, personal contact with some senior management existed at those two sites. Therefore, the organisation of case interviews was easier. The case study protocol developed for this research was refined based on the pilot studies, which included the modifications of the interview protocol structure, minor variations to the theoretical framework, and some refinements to the interview questions. The detailed description and data analysis of those two pilot case studies are included in Chapter 2. In the next section, the analysis procedures for the seven main case studies are discussed.

3.7 The case study data analysis procedures

It is generally considered that qualitative modes of analysis are concerned primarily with textual analysis (whether verbal or written) (Myers 1997, 2003). However, there has not yet evolved a clear and accepted set of conventions for qualitative data analysis (Robson 1993, p. 370). The challenge in qualitative data analysis is to make sense of and draw conclusions from the enormous amount of qualitative data (Hussey & Hussey 1997). Miles and Huberman (1994) have defined qualitative analysis as consisting of three concurrent flows of activity: data reduction, data display, and conclusion drawing/verification. Furthermore, they consider that analysing qualitative data may involve 'quantifying' and 'non-quantifying' approaches. Both of these approaches were used in the case study data analysis of the research for the thesis. Data analysis is the process of examining, categorising and tabulating data, providing answers to the research question (Yin 1994). Therefore, the major part of the case data analysis of this thesis concerned coping with the large amount of data, and organizing these data into meaningful categories for confirmation/ disconfirmation with the theoretical research framework, facilitated by cross-case and within case analyses (Wollin 1996).

3.7.1 Data preparation

The data collected from the case studies was examined, compiled and combined with other evidence, in order to answer the research problems and research questions, that

is, multiple levels and types of data analysis was employed in this research. In order to prepare case study interview data for analysis, the tape-recorded data was transcribed, and those transcripts were then verified with the original tapes for completeness. Data from in-depth interviews was analysed primarily using non-quantifying approaches; a comprehensive analysis incorporating NUDIST (Non-Numerical, Unstructured Data Indexing, Searching and Theorizing) software to ensure that all relevant data associated with each in-depth interview was captured. The utilization of NUDIST assisted in managing and coding the data, mainly using data categories identified in the literature review, while remaining vigilant for other categories. This software program facilitated the analysing of the transcription by highlighting important issues, quotes and generating memos. *Memos* in this software are brief theoretical notes or little insights that the researchers achieve as they proceed with the analysis (Berg 1989). These were then sorted and combined to arrive at broader theoretical statements.

The first step with NUDIST was the creation of an indexing system based upon the categories of data developed with reference to the theoretical research framework. Then those categories were arranged in a 'tree' format that showed relationships among categories of data, and this hierarchical arrangement of categories allowed the demonstration of relationships between conceptual categories, higher and lower level categories and specific sub-categories (Richards & Richards 1991). This software relieved the researcher of some of the laborious tasks that followed from the coding process and ensured that all the data which was collected was accounted. (Richards & Richards 1994).

3.7.2 Coding

It has been noted that information relating to a particular category or code can be quickly extracted for analysis (Miles & Huberman 1994; Yin 1994). Thus, during case study interviews of this research, some codes were developed to allow the easy categorisation of textual case study data, and therefore facilitate the analysis process. There were three main categories for the codes of this research: DQ factors, company demographics, and stakeholder (interviewee) information. An

additional miscellaneous category was also developed for coding data that did not fit into the main categories. These codes were then converted into an index and entered into the NUDIST database.

3.7.3 Data analysis

In order to investigate the factors that impact upon data quality in accounting information systems in the case study organisations, both within-case, and across-case analysis was conducted. In theory within-case analysis is often done before cross-case analysis, when a multiple case study strategy is adopted for research design (Yin 1994; Perry 1998). Therefore, the case study analysis started with the analysis of each individual case, in which the cross stakeholder analysis within one case was included. The across-case analysis of all case organisations was then followed, with the focus of the factors being confirmation and disconfirmation.

3.7.4 Within-case analysis

Within-case analysis began with some demographic information of each case. This consisted of the general background of the organisation and the nature of the organisation's accounting information systems. The discussion of the organisation included the general information about organisational size and structure, which could assist the reader to obtain fundamental knowledge of the organisation, and to assist the further analysis of the case study information. The nature of the AIS is particularly important for this research, because it was one of the proposed critical factors, and could have impacted on many other factors. Hence, it was necessary to include some basic characteristics of the AIS at the beginning of each case analysis. Following the above general information, stakeholders involved in the case study were then listed. As discussed before, there were at least three to five stakeholders from each case organisation who participated in the case study.

The case study participants' rating or ranking of the predefined factor list was then presented for each case. This list was generated by a summary and combination of the literature review and pilot case studies' findings, and was designed to collect

quantitative data to triangulate the qualitative interview data. At the end of each interview, the interviewee was shown a list of factors and asked to rate the importance of those factors on a ten-point scale with ten as the most important and one as the least important. Not all interviewees were asked for rate the factors. Some of the interviewees from the first few case organisations were asked to rank the factors, and some others were asked to simply indicate factors that they believed to be critical factors rather than rating factors. In Chapter 4 of this thesis, a table of interviewees' responses of those factors for each case was presented in the within case analysis section, and the mean of their ratings was also included for each factor where possible. The purpose of the table was to provide an overview of different stakeholders' perspectives of the same factor within one case, and the overall responses for each factor by using the mean of ratings from all stakeholders of each particular case. The table also highlighted the 'new' factors suggested by the individual stakeholder that were not included in the original list. Although some of those 'new' factors had been mentioned in similar terms in other disciplines such as general management, they had not been identified as the critical factors for data quality in particular accounting information systems.

The selected cases from both large and SMEs were then analyzed further using qualitative data. The reason for not including all seven cases' in-depth qualitative analysis was because the selected cases could well present similar types of other cases. Therefore, it was unnecessary to describe all the cases in detail. The within-case analysis was focused on cross-stakeholder analysis. The method is further detailed in Chapter 4.

3.7.5 Cross-case analysis

Cross-case analysis was used to gain insights into the factors from summaries and analyses of the findings from all seven cases. The intention of cross-case analysis is to generate insights, and not to prove anything or draw generalisations (Yin 1994). Insights into each of the factors and their impact on data quality in accounting information systems were drawn from similar themes and patterns that emerged from the within-case analysis (Carson et al. 2000). Cross-case analysis focused on the

analysis of each factor from cross case respondents, and was divided into three major parts. The 'new' factors that were identified by the case study participants were fist discussed, as they were one of the main contributions of the case studies. Then the analysis of the factors that were confirmed by the case studies was followed by the supportive evidence from each case study and a detailed description and /or definition of each factor. Finally, some factors that were not quite supported by case studies were discussed.

3.7.6 Use of quotations

It has been recommended that quotes from case study participants be used in both within-case and cross-case analysis to assist the reader to gain qualitative insight into the issues being studied (Patton 1990). Quotations from each of the interviews were frequently used to aid the presentation of interviewees' opinions. It was a useful instrument to confirm/disconfirm the proposed framework and to justify conclusions about differences between stakeholders in within-case analysis, and between cases in cross-case analysis. The final step in the data analysis of the case studies was to build conceptual/theoretical coherence through comparisons of the proposed research model with the case study findings.

In brief, in order to analyze the case study data, interviews were transcribed and NUDIST software was used to facilitate the analysis of qualitative data. Individual case descriptions were presented at the beginning of each case in within-case analysis, followed by both qualitative and quantitative cross stakeholders' analysis within each individual case. Then, to achieve reliability, cross-case analysis was conducted to provide detailed analysis for the individual factor by studying differences and similarities between case organisations and stakeholder groups. The use of quotations from interviews helped to obtain qualitative insight into each case study. Following the above case study data analysis procedures, empirical evidence from case studies was used to:

(a) Evaluate the relevance of the various components of the theoretical research framework of critical success factors for data quality in accounting information systems;
(b) Confirm or disconfirm the proposed list of factors from the literature and pilot case studies, which help to shape the theory; and
(c) Examine and build internal validity by using both qualitative and quantitative evidence collected from the case studies.

Survey methodology

To apply the process of triangulation it has been suggested that active data collection methods (communicative methods) can often be supplemented with passive data collection methods (such as written or observational methods) to overcome limitations associated with each type (Davis & Cosenza 1988). Thus, in order to further develop and test the research model, two large scale surveys were conducted in the fourth phase of this research after the case studies.

Surveys can provide quick inexpensive, efficient, and accurate means of assessing information about the population (Zikmund 1997). In contrast to case studies, survey questionnaires have certain advantages:

- They reach a geographically dispersed sample simultaneously and at a relatively low cost;
- Standardised questions make the responses easy to compare;
- They capture responses people may not be willing to reveal in a personal interview;
- Results are not open to different interpretations by the researcher (Davis & Cosenza 1988; Zikmund 1997).

Survey methodology was used to answer the last two research questions that attempt to determine the rank order of the critical success factors identified by the case studies, and explore what has been done by the real world regarding those factors in a broader range of organisations. The cross sectional design was then chosen using

mail questionnaires and survey techniques, because they have the ability to economically describe features of large numbers of people or organisations (Easterby-Smith et al 1991, p. 35). This suited the purpose of this phase. The thesis can further be classified as *correlational,* a form of descriptive study that involves collecting data in order to determine whether, and to what degree, an association exists between two or more quantifiable variables (Gay & Diehl 1992). This approach describes in quantitative terms the degree to which variables are associated.

3.8 The development of the survey instrument

The survey questionnaire for this research was designed to address the third and fourth research questions, and was used to capture information about:

5) The rank order of the critical success factors that could be identified from the case studies; that is, how organisations consider the importance of each of those critical success factors;
6) The variations in the level of CSF that have been achieved in organisations; that is, what particular level of those factors organisations actually achieved in practice.

As no existing survey instrument for factors that impact on data quality in accounting information systems was found in the literature, the design of the survey instrument was based upon several sources of data, including previous instruments and research framework developed by other researchers from the relevant literature, and case study findings. The variables of the questionnaire that was used to collect information were identified from the analysis of the case studies and the literature.

The questionnaire comprised five parts (a copy of which is included in Appendix II). The first part consisted of some definitions it was felt that respondents might have needed while answering the questionnaire. It identified some terms used in the survey that might have caused confusion. They included the meanings of the terms *data quality, information users, data suppliers, top management, middle management,* and *non-management*.

The second part included preliminary questions. Respondents were first requested to indicate their main role in relation to AIS, then to categorise their AIS, and finally to evaluate the quality of data in their AIS. This part was designed to capture the information of some very important variables, such as respondents' primary function to AIS, which assisted the identification of the stakeholder groups respondents belonged to. Next, the AIS categories information was captured in question B, which divided the AIS into three categories: *developed in house, commercial software package,* and *customized package*. The respondents were then requested to rate the overall quality and some particular attributes of data quality in AIS in their organisations. The rating scales used were from 1 = very low, 2 = low and 3 = neutral, to 4 = high, and 5 = very high. The four attributes for the measurement of data quality were *accuracy, timeliness, completeness,* and *consistency*. Although this information was not used to answer the research questions, it was suggested by one of the senior managers from the professional body that administered the survey distribution during the pre-testing stage that this would provide valuable information for further study.

Section A was the third and major part of the questionnaire. All factors identified by the case studies and literature were listed in this section with detailed definitions of each. Some of those factors had few sub-factors. There were two columns, where Column 1 was for the importance of the factors and Column 2 was used to evaluate the performance. In detail, respondents were requested to rate the importance of each factor in ensuring data quality in AIS from their perceptions and opinions in Column 1. They were asked to list the actual performance (achievement) on each of those factors of their organisations in Column 2. For each factor, respondents were requested to indicate their viewpoint of its importance using a five-point scale (Table 3.5): *not important, little importance, average importance, very important,* and *extremely* in Column 1. Similarly, there was also a five-point scale for Column 2, from *poor, fair, good, very good,* to *excellent* (Table 3.6) that was used to measure the performance. In addition, a category of *not applicable* was included for performance to give respondents an option if they were not able to provide answers for particular factors.

Table 3.5 Scale for importance

Scale	Not important	Little importance	Average importance	Very importance	Extremely Important
Score	1	2	3	4	5

Source: developed for this research

Table 3.6 Scale for performance

Scale	Not applicable	Poor	Fair	Good	Very good	Excellent
Score	1	2	3	4	5	6

Source: developed for this research

The next short *Section B* was about the most important and least important factors. The respondents were asked to review the factors listed in Section A again, and select the top three most important critical success factors for DQ in AIS, write them in order of importance by indicating the question number in Section A and repeat the same process for the three least important factors.

Section C, which was the last part of the survey, consisted of some questions about demographic information of respondents and organisations. It was designed to capture information about some independent variables from the size, industry type, location of the organisation, to the job function and level of job responsibility of the respondent, which was then used to categorise the participants and their organisations.

3.9 Sampling strategy

Accounting and IT professionals were chosen as the target respondents of the survey; because they are the major AIS stakeholders and are likely have better understanding of data quality issues in AIS than other stakeholders. The population for the study can be defined as all accounting and IT professionals who work closely with accounting information systems at the selected Australian organisations.

The best possible available frame of this population would be some professional body. For this research, the sampling frames were lists of members of the CPA Australia and the Australian Computer Society (ACS). Because the respondents of the survey were targeted as those members who had experiences with AIS in their organisations, random sampling was not suitable for this research. In relation to sample size, a sample of 1000 was targeted for each professional body.

A non-probability judgment/purposive sampling technique was adopted, in which the selection of the sample was based on the judgment about some appropriate characteristic required of the sample members. It is suggested that this technique allows the researcher to select a sample to serve a specific purpose, even if this makes a sample less than fully representative (Zikmund 1997). The CPA Australia's member profile was used to select the suitable targeted accounting professionals. In CPA Australia, there are three levels of the membership; associate CPA, CPA, and fellow CPA. Only CPAs and fellow CPAs were targeted, as they were more likely to have experiences with AIS. At the same time, some other categories of the member's profile were also put into consideration in the sample selection process. For ACS, there is a database that contains the members who have finance and accounting interests nationwide, which was used to distribute the questionnaire, as it was considered they were the best fit of IT professionals for this research. This judgment sampling technique was chosen to safeguard the specific objective of the research, which was to investigate AIS stakeholders' perspectives of critical success factors for data quality.

3.10 Pre-test of the instrument

Once the mail questionnaire had been developed and reviewed, prior to the data collection pre-tests were conducted to ensure the instrument was valid for final data collection. It is considered that pre-testing is an important part of any research design, ensuring the data collection process is sound (Zikmund 1991), which can be used to identify problems with the data collection instrument to avoid compromising the validity of the research (Davis & Cosenza 1988). It is generally accepted that an instrument that is valid in content must draw representative questions from a

universal pool (Cronbach, 1971; Kerlinger, 1978). The design of the questionnaire of this study utilised several sources of data, including previous instruments developed by other researchers, the research framework developed from the relevant literature, and the analysis of the findings of the case studies. Moreover, in order to ensure the validation and reliability of the instrument, a pilot test of the representatives of the respondents was conducted.

Pre-testing for this research involved administering the questionnaire to representatives of the survey respondents. In order to obtain feedback from the people that had the closest fit with the targeted survey respondents as well as from a wider range, IT/IS and accounting professionals and academics participated in the pre-testing process. Some case study participants were also chosen to assist in the conduct of the pre-test because of their familiarity with the study. After pre-testing, a number of changes and additions were made to the instrument. These included:

- Refining of some of the questions to increase clarity and remove ambiguities;
- Adding of some additional items to achieve greater integrity; and
- Changes to some of the measurement scales.

The information obtained from the pre-tests was used to alter the questionnaire to achieve higher validity. Pre-testing also involved a preliminary analysis of the data collected, ensuring that the data collected was appropriate for testing the research model and therefore addressing the problem (Zikmund 1991).

3.11 Survey data analysis

After the data had been collected, several interrelated procedures were performed to summarise and rearrange it. The raw data collected from the survey was transformed into useful information that could assist to answer the research questions. In order to convert the raw data into information, it had to be edited and coded so it could be transferred to a data storage medium (Zikmund 1997). The completed questionnaires were coded and entered into a software program SPSS (*Statistical Package for Social Sciences*) for Windows 10.0 for analysis. A range of data analysis methods was

employed for the survey data. These included descriptive, paired sample t-tests, as well as one-way ANOVAs with post-hoc comparisons.

In order to conduct certain analysis needed for the survey data, it is recommended that clarifications should be made as to whether liker scales, as employed in the questionnaire of this study, represent interval data. In many social science fields, a Liker scale is deemed to be an interval scale. For example, Zikmund (1997 p GL-8) defines an interval scale as:

> "A scale that not only arranges objects according to their magnitudes, but also distinguishes this ordered arrangement in units of equal intervals."

The adoption of this definition for the thesis study meant that data collected and measured on the five-point Liker scales of the questionnaire was appropriate for analysis in terms of interval scales. Respondents' perceptions of importance and performance for each factor were both measured on 5-point scales, and used as dependent variables throughout the analysis for hypothesis testing, which is discussed next.

To test the first alternative hypothesis that there is a significant difference between the perceptions of importance and the actual performance of critical factors for accounting information systems' data quality, a paired comparison t-test was utilised. For each factor, the paired t-test assessed whether the mean of the perception of importance was significantly different from the mean of actual performance. The paired t-test, also referred to as the repeated measures or the dependent-samples t-test, is used when data are from one group of participants (Coakes & Steed, 1999). Paired samples are defined as pieces of sample data consisting of a pair of numbers, and the paired t-test applies a one-sample t-test with the null hypothesis H_0: u=0 to a population of paired differences (Weiss, 1995). The testing of the first hypothesis was considered suitable for the use of the paired t-test because two sets of ratings came from the same group of survey respondents. In addition, for each factor, the same respondent evaluated the paired samples of the importance and performance.

Therefore, for comparing the paired sample means of the perception of importance and performance, the paired t-test was deemed to be appropriate.

One-way between groups ANOVAs with post-hoc Tukey comparisons were employed to test the second and third hypotheses, as to whether there were any variations between different stakeholder groups and different sized organisations in relation to their perceptions of the importance of factors impacts on data quality in AIS. ANOVA was used because it was appropriate to compare the means of more than two groups (Coakes & Steed, 1999).

For the second hypothesis that tests the difference of the means between different stakeholder groups, there were five groups: information producers, information custodians, information users, data managers, and internal auditors. The third hypothesis includes the investigation of whether there is any significance between four groups of different sized organisations (i.e. very small, small, medium and large). The f- value test was used together with the Tukey post-hoc test to indicate whether there was any significant difference between the groups and what these differences were. The f-value and post-hoc analysis tests are explained as (Coakes & Steed, 1999):

> "The F-ratio is the ratio of between-groups variance to within-groups variance. A significant F-value tells us that the population means are probably not all equal. Because you reject the null hypothesis if any pair of means is unequal, you need to locate where the significant differences lie. This requires post-hoc analysis … Post hoc analysis is when you hunt through the data for any significance. That is, you want to do an entire set of comparisons."

There are quite a number of studies in management, quality management and information systems areas that have used ANOVA, MANOVA, and F-values to investigate the impact of critical factors on certain issues. ANOVA is a powerful tool when comparing variance between groups. Because of the suitability justification above and the existing research adoptions, ANOVA and F-value were appropriate for the testing of the second and third hypotheses of this research.

3.12 Ethical considerations

Ethical issues were taken into consideration throughout both the case study and survey phases of this research. Ethical considerations relate to the proper conduct of the research process and are critical for any research (Davis & Cosenza 1988, p. 456). It is generally accepted that they should usually be considered as part of a research design (McDaniel & Gates 1991). Furthermore, it is considered that each person involved in research has certain roles and responsibilities (Davis & Cosenza 1988). There are certain rights and obligations of the researcher. While researchers should maintain high standards to ensure that data is accurate, and they should not misrepresent data, they are also required to protect the right to confidentiality of research participants (Zikmund 1997). Thus, it is considered that the primary ethical consideration of researchers is to protect participating organisations and individuals from any possible disadvantages or adverse consequences that may result from the research (Emory & Cooper 1991).

The following steps were taken to ensure these ethical issues were addressed:

- For the case studies, the participating organisations and interviewees were assured that the information they provided was totally confidential. The ethical consideration was included in the document that requested the conduct of the case study, as well as the letters to the individual interviewees;
- For the survey, there were ethical statements in the covering letter that was sent out with the questionnaire. The respondents to the questionnaire were assured that their responses would be kept confidential.

Details of actions for ethical consideration include guaranteeing the respondent's right to privacy, and further reassurance that the names of the participating respondents and organisations will be disguised and not revealed in any manner (Aaker, Kumar & Day 1998). Furthermore, promises are made not to discuss confidential information with anyone, and to take good care of the relevant documentation. To address the issues of informed consent and confidentiality, the

ethical guidelines of the Research and Higher Degrees Committee of the Faculty of Business of University of Southern Queensland were followed in this research. The acknowledgement of ethical practices has enhanced the quality of this research.

3.13 Conclusion

This chapter established the research methodology of data collection to answer the research questions identified in Chapter 2. Selection and justification of the case study and survey methodologies for this study has been discussed, and the detailed research design presented. The chapter has described the two methodologies respectively. For the case studies, selection of case sites with theoretical and literal replication was discussed first, and the determination of the number of the cases, interviewees and units of analysis. This has been followed by the description of case study data collection procedures, which included sources of data, case study protocol and the fieldwork for data collection. Then the pilot case studies have been discussed. Finally, an outline was provided of how the data were prepared and analysed within each case and across all cases. For the survey methodology, the development of the survey instrument was described first, followed by a discussion of the sampling strategy. The pre-testing for validation of the instrument was then included, and the last section was the survey data analysis procedures. The chapter concludes with a discussion of the ethical considerations of the research. The next chapter presents the analysis of two case studies and the development of the preliminary research framework.

4 Case study data analysis

4.1 Introduction

Chapter 3 described the case study and survey methodology for the data collection stage of this study. In turn, this chapter describes how the collected case study data was analyzed. Seven case studies were carried out as described in Chapter 3. Each case in this chapter is examined as a whole to obtain an understanding of the opinions and perspectives of the respondents from each individual organisation as to what are considered to be the important factors in the case. Using this within-case analysis has the potential to aid in-depth views of the issues and their impact on each particular case organisation. The background of each case organisation is also described. Then, cross-case analysis was used to analyze the similarities and differences of the seven cases, which also include the variations between large organisations and small to medium organisations (SMEs). Furthermore, the variations between five different stakeholder groups were also examined.

There are nine sections in this chapter, as shown in Figure 4.1. The next section, that is Section 4.2, contains a brief overview of the data analysis techniques employed. In Section 4.3, a brief outline of all the cases is given, and then the details of the case study respondents are summarised in Section 4.4. Within case analysis for each case is discussed in Section 4.5, followed by the cross-case analysis, which includes an analysis of variations between organisations and different stakeholder groups in Section 4.6. Based on the within case analysis and cross-case analysis a set of factors that impact upon data quality in AIS is identified in Section 4.7. In summary with the main findings from the case studies, a refined research framework is proposed in Section 4.8. Finally, Section 4.9 provides the conclusion to the chapter.

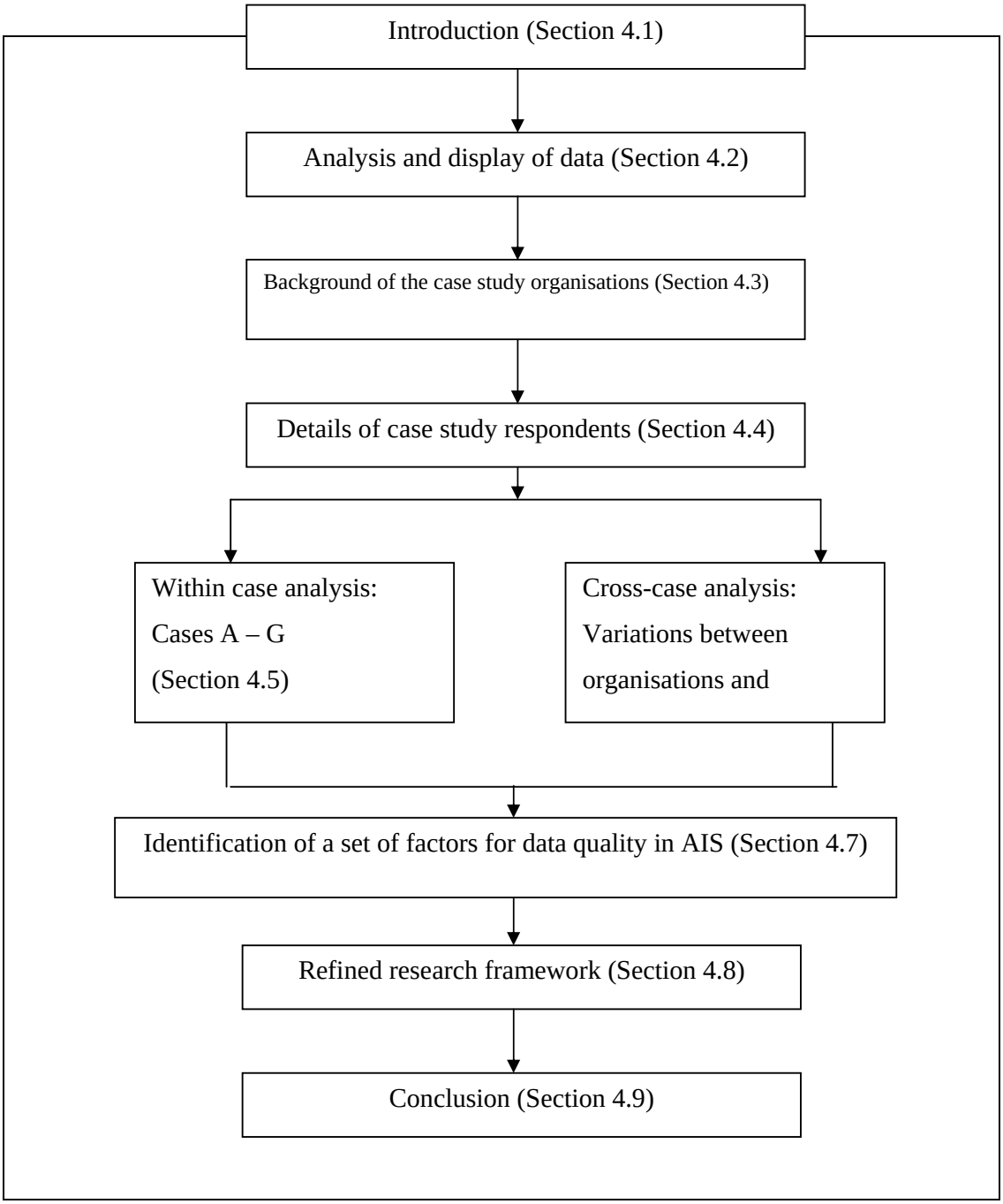


Figure 4.1 Chapter 4's outline with section numbers in brackets

Source: developed for this research

4.2 Analysis and display of data

4.2.1 Analysis techniques

All case study interviews together with the additional documents obtained from the case study organisations as described in Chapter 3 were transcribed and entered into *NUDIST*, a software package for qualitative data analysis,. A very intensive content analysis of those documents and interview transcripts was conducted. All transcript material was coded (Neuman 1997) according to the research framework developed in Chapter 2 and the refined interview protocol questions (Appendix I). An *index tree* was also developed to aid in categorising and grouping of the qualitative materials.

4.2.2 Use of quotations

Direct quotations from the case study interview transcripts (Patton 1990) were used in this chapter to illustrate the factors or sub-factors which could assist in explanation building (Miles & Huberman 1994). Quotations from case study interviewees represented their own opinions, perceptions, and experiences regarding particular factors or situations. They also provide the respondents' true feelings and beliefs on certain issues. Therefore, these quotes have the potential to assist readers to obtain insights into the respondents' understanding of the phenomena. Quotes are presented in quotation marks identified by the case name and the respondent's position title.

4.3 Background of the case study organisations

As discussed and justified in Chapter 3, seven Australian organisations were selected for the case study in this research. Four of them were chosen from large organisations, and three from SMEs. As there is no one set of criteria to distinguish large organisations and SMEs, for the purpose of the case study analysis of this research, employee number was use to define the size of the organisations. Although criteria defining organisations as large, medium and small vary, in this research organisations with more than 2000 employees were categorised as large while those organisations with fewer than 2000 employees were categorised as Small to Medium Enterprises (SMEs). In order to respect the privacy of the participating organisations

and individual interviewees they were not identified by their real names or actual position titles. Organisational employee numbers, annual revenue and assets were rounded rather than using exact number. The cases were referred to as Case A through to Case G. Table 4.1 provides an overview of the seven case organisations. It includes a description of each organisation, the number of employees, the annual revenue, total assets, number of accounting information systems staff, and the period when interviews were conducted.

Table 4.1 overview of case organisations

Case	**Description**		**Number of employees**	**Annual revenue ($'000)**	**Total assets ($'000)**	**Number of AIS staff**	**Interview period**
Large	**A**	Federal Government department	2,500	16,000	300,000	100	Sept. 2000
	B	Government funded research institution	6,400	800,000	1,300,000	300	Sept. 2000
	C	Public utility	4,000	905,000	880,000	80	Sept. – Oct. 2000
SMEs	**D**	Higher educational institution	1,200	98,000	139,000	50	Sept. – Oct. 2000
	E	Educational enterprise	100	<10,000	<10,000	5	Nov. 2000
	F	Federal agency	400	57,000	23,000	5	Dec. 2000
	G	Private national agricultural enterprise	250	350,000 (consolidated)	200,000 (consolidated)	80	Dec. 2000 – Feb. 2001

Source: developed for this research

The cases included a federal government department, an educational enterprise, a government funded research institution with many divisions across Australia, a state public utility that is merging to an ERP system, a private national agricultural enterprise, with headquarters in provincial Queensland but operates nation-wide, and a federal agency. While Cases A, B, C, and D are large organisations, Cases E, F and G are SMEs. The criteria for selection and justification of these cases were presented in Chapter 3 when case study methodology was discussed. The case study interviews were carried out between September 2000 and February 2001.

4.4 Details of the case study respondents

Table 4.2 below summarises the case study respondents who were the different AIS stakeholder groups interviewed in the seven cases. The table gives details of participants, their positions/ work roles, their organisations, and the stakeholder group they belong to. The data for the large organisations includes all the categories of stakeholders while the data for the small to medium sized enterprises only includes a few of the stakeholder groups. These were information producers, information custodians and information consumers.

Table 4.2: Summary of case study interviews

Stakeholder Category	**Position within the organisation**						
	Large organisations				**SMEs**		
	A	**B**	**C**	**D**	**E**	**F**	**G**
Information producers	Financial system manager	System accountant manager	Director of finance	Accountants	CFO & Accounting officer	CFO	System accountant & Manager of finance
Information custodians	IT manager	IT manager	IT manager	IT manager	IT manager	IT manager	IS manager
Information consumers	Senior manager	Senior manager	Senior manager	Users	General user	User	N/A
Data / database managers	Data manager & DA	DBA	DBA	DA	N/A	N/A	N/A
Internal auditors	Internal auditors	Internal auditor	Director of internal audit	Internal auditors	N/A	N/A	Internal auditor

Source: developed for this research

In brief, there were three steps in the case study data analysis. Within-case analysis of individual cases was carried out first. This included a general description of each case and its AIS, the stakeholders that participated in the research and a summary of the stakeholders' rating of the importance of the factors. There were also detailed within case across stakeholders analyses of Cases A, B, E and F as the representatives of the different sized organisations. Secondly, across-case analysis of

all those factors was conducted. Lastly, a summary of major findings from the case study analysis was prepared, and a set of factors that impact upon the data quality of the respective accounting information systems was identified.

4.5 Within case analysis

This section describes the within case analysis, before the discussion of detailed findings of individual case, a summary of some background information for each case is provided in Table 4.3, which gives an overall picture for each case organisation. It includes the general background information, like the nature and the size of the case organisations, and their accounting information systems.

Table 4.3 Summary of case study organisations' general background and AIS

Cases	General background	Accounting information Systems
Case A	o A government department o Employs around 2,500 staff located in a head office and regional offices throughout Australia o Approximately 100 staff of IT professionals, most of whom are located at the head office	o There is a financial management framework and a performance culture in which managers are directly accountable for financial and operational performance o Outsources IS functions with a large global IS services company o Aims to work towards the implementation of a stable IS platform
Case B	o A large government funded research institution with its head office in a capital city o Has around fifty branches across the whole country o Employs approximately 64,000 people and annual revenue is almost $800 million o Has about 300 financial staff in fifty different divisions	o A corporate finance department in the head office o All of the divisions have their own finance areas o The corporate finance department is responsible for setting policy and maintaining the overall accounting system o Use one large centralised accounting system, which is a single integrated package o The package used is produced by a local company
Case C	o A public utility o One primary role is transport leadership, More than 4000 staff within the organisation, 80 AIS personnel o The financial branch is located at its head office o A number of geographical divisions, each has a number of permanent staff involved in accounting tasks. o An internal audit unit separates from finance.	o Uses SAP R/3 o The objectives of the AIS: enhance the accounting data's integrity, and to improve the financial capabilities of the organisation o Over 20 employees in the Finance Branch at the head office o Outsources the processing of accounts payable, accounts receivable, and some of the fundamental operating systems.
Case D	o A higher educational institution o has about 18,000 student o Offers courses in the areas of Arts, Business, Commerce, Education, Engineering and Science in professional and vocational subjects. C o Courses were offered at levels from Certificate to Masters and Doctorate. o Has hundreds of cost centers o Each cost center has the ability to produce their own profit	o Centralised finance services and HR departments o Has financial officers who work in each individual academic unit o The current package for AIS is called *Prophecy* used about 10 year o Moving towards a software package called *PeopleSoft*, a web-based system that uses the graphical user interface system of *Windows*,

	and loss account	
Case E	o An education and training infrastructure company that partners with universities and professional education providers to market and deliver their courses over the Internet to students. o Headquartered in Asia but has a world wide presence. o Services include the conversion, hosting and delivery of courses over a dedicated server network, and student marketing and support throughout the world. o A medium sized organisation with approximately one hundred staff.	o Uses a lower-end, off-the-shelf financial accounting software package performs the organisation's entire accounting information function o Divisions have their own local budget and they run a division in the software package for each of those divisions. o AIS has been upgraded twice during the past two years. o AIS not serving the growing needs of the organisation due to multi-jurisdiction and multi-currency reporting requirements o Requires a further upgrade in about 6 to12 months.
Case F	o A Commonwealth agency o Has a head office and regional offices in all the major states' capital cities o A total of around 400 staff, five are working directly with the accounting information systems. o The total net accrual expenditure is around $56 million, against a budget of $56 million o Prepares its first accrual-based budget for 1999-2000 as part of the first Commonwealth-wide accrual budget o An internal audit of administration in all offices over the course of the year	o Uses an ERP to comply with the requirements of the accounting regulations to meet applicable accounting standards o Resource Management Information System is on a *UNIX* minicomputer o Using an *Oracle* database for financial, payroll and HR o Uses an Intranet system o Does not have desktop access to the Internet or external email systems for security reasons
Case G	o A private national agricultural enterprise. o Very diversified financial activity o A senior financial executive who looks after the corporate financial analysis that focuses on forecasting and monthly reporting o financial trading administration managers, who are responsible for producing performance reports and monthly reports	o Had the old *JD Edwards (an ERP system)* since 1994, but wasn't set up in recommended format in a lot of the areas o Upgrading their version of *JD Edwards* o A few legacy systems o Has about 340 users of the finance system,150 of them are working daily

4.5.1 Case A

Summary of cross stakeholders analysis (Case A)

Table 4.4 Stakeholders rating of the importance of the factors (Case A)

Category	Factors	Stakeholders						
		Info producer	Info custodian	Info user	Info manager		Internal Auditor	Mean
					DA	Director		
AIS Characteristics	**Nature of the AIS**	5	3	1.5	?			**3.17**
DQ characteristics	**DQ policies & standards**	7	7	10	10	2nd	✔	**8.50**
	DQ controls & approaches	8	8	9	?			**8.33**
	DQ vision	8	7	3		3rd	✔	**6.00**
	Internal control	8	8	6.5	10		✔	**8.13**
	Input control	8	9	10	9		✔	**9.00**
	Understanding of the systems and DQ	8	6	9	10	5th	✔	**8.25**
	Continuous improvement	5	6	5	20		✔	**6.50**
Stakeholders' related factors	**Top management's commitment**	10	8	8	10	1st	✔	**9.00**
	Middle management commitment			* 9				
	DQ manager		?	?			?	
	User focus	10	8	8			✔	**8.67**
	Employee relations	5	7	7.5				**6.50**
	Information supplier quality management	8	4	6	10	4th	✔	**7.00**
	Audit and reviews	8	8	8	9	8th	✔	**8.25**
Organisational factors	**Training**	8	6	10	10	6th	✔	**8.50**
	Org structure	3	4	6	9			**5.50**
	Org culture							
	Performance evaluation & rewards	3	4	3	5			**3.75**
	Manage change	8	8	9			✔	**8.33**
	Evaluate cost/benefit tradeoffs	6	9	3	10			**7.00**
	Teamwork (communication)	8	8	5	10	7th		**7.75**
	Risk management		*					
External factors	**External factors**	3	3	1	10			**4.25**
Overall		**6.85**	**6.55**	**6.43**	**9.43**	**N/A**	**N/A**	**7.12**

Source: analysis of field data

Legend: 1, 2, 3 …= Rating of the importance {1 as not important at all, 10 as extremely important}

1st, 2nd …= Rankings of the factors by the stakeholder

? = The stakeholder wasn't sure / clear about the factor

✔ = Critical factors viewed by the stakeholder

* = New factors suggested by the stakeholder (shade)

At the end of the interviews with stakeholders, each of them was asked to rate a list of factors that generated from the preliminary research framework on a ten point scale for the importance of those factors, where ten was extremely important, and one was not important at all. Table 4.4 summarises the scores given by different stakeholders in Case A. As Case A was one of the first case studies conducted, one of the stakeholders simply selected the critical factors from the list, and another stakeholder ranked the critical factors, rather than rating them.

Findings of Case A

The information producer addressed accuracy and the timeliness of financial information both as important aspects of the AIS. Although it was found that it was difficult to simultaneously achieve both accuracy and timeliness, the information producer considered it to be a high priority to process financial transactions and collect accounting information correctly and on time.

AIS characteristics

In order to better understand the system that had been addressed by the information producer in Case A it was interesting to find that financial accounting respondents also highlighted the importance of systems. Traditionally, accounting professionals were not very interested in systems issues (Hall 1998). However, in this case study organisation, information producers believed that to be able to have high quality information, one must understand the systems.

> I think if you can understand the systems, the better you understand the better the quality is…the basic understanding of any system is essential to high quality.
>
> Financial Systems Manager (Case A)

The usage and the usefulness of the information were believed to have an impact on the information quality. The IT manager noted:

> One of the problems is it isn't fully used, and hopefully it should improve the quality of your data after you re-use its code. But on the other hand, you have a system that is being used by a lot of people, and therefore, all the bugs should have been found in it.
>
> IT Manager (Case A)

Other areas of concern, from the technical point of view, were the integration of different systems, and the maturity of the systems. As mentioned by the information custodian:

> One of the problems we have today is how do we integrate our different systems together, because we have different areas?' It was also found that the old technology was probably more difficult to integrate than newer technologies. In addition, the new system, which used *new technology* was found to produce more useful information and reports than the old system.
>
> Technology within the system might effect how accurately that data is checked and processed. For example, a newer system would probably make it easier to report. So we are looking at projects which improve the availability of data like moving data into a warehouse, because with the older systems the report ability is not as good as the newer ones.
>
> IT Manager (Case A)

Organisational factors

Communication within the organisation was perceived to be an issue that might cause data quality problems:

> I think when you find things aren't going well in an organisation, it always comes back to the same problem. It is communication. Everybody complains of not knowing what is going on, not being told the right things.
>
> Senior Manager (Case A)

It was believed that the organisational culture would have impact on data quality, however, in Case A it seemed that organisational traditions had less impact than before.

> I think I would have said once upon a time tradition was important but I think technology and everything in the world has changed that dramatically in the last few years, I think tradition has gone out the window and organisational culture seems to have gone.
>
> IT Manager (Case A)

This finding is essence as it addressed the importance to keep effective organisational culture and traditions, while people put more focus on technology changes. Although technology has changed significantly, it should not be the reason to 'through away' the organizational culture and traditions.

Stakeholders' related factors

Employee turnover was found to have an impact on accounting information quality. The financial system manager was concerned that high turnover might cause the loss of organisational knowledge, and results in increased training costs. He noted:

> The turnover has a bad effect on data quality. We don't have a very high turnover, but X (name of another organisation) does have a very high turnover. They suffer for it. I think anybody who has a high turnover must be suffering. You are losing knowledge all the time, and you are paying for re-training.' Incentives such as bonuses have been used to solve the employee turnover problem. This is why we pay bonuses to all our IT people. The bonus we pay is a retention bonus. So if you are still here in 12 months time, you will get a 10% bonus. If you leave within the twelve months, you don't get the bonus. So it is our view, we want to retain good people and that is a deliberate ploy.
>
> Financial Systems Manager (Case A)

It was believed that *human errors* had much more impact on accounting information quality than *system failure*.

> From one area, a lot of data quality is affected by how accurately the information is entered into the system by business users of system. Well, the systems get more complex,. However, a well designed system, old or new, should be able to accommodate.
>
> IT Manager (Case A)

From the findings of Case A, it is clear that different stakeholder groups have different focuses on data quality. It was found that IT professionals were more concerned about systems and technical issues. They seemed to have confidence about the newer technology, and have greater trust in the systems' abilities to produce high quality information. Even when they were considering organisational issues, they still related those issues to the systems. IT professionals seemed to be more systems-orientated.

On the other hand, however, accounting professionals were more concerned about the human related factors' impact on information quality, such as communications and staff turnover. Even when they were talking about systems issues, their focus was still from the human perspective, rather than the technological perspective. They believed that people's understanding of systems would impact on the quality of the information which systems produced.

4.5.2 Case B

Summary of cross stakeholder analysis (Case B)

At the end of the interviews with the stakeholders, each respondent was asked to rate a list of factors that had been generated from the preliminary research framework on a ten point scale for the importance of those factors. Ten was extremely important, and one represented not important at all. Table 4.5 summarises the scores given by different stakeholders in Case B.

Table 4.5 Stakeholders rating of the importance of the factors (Case B)

Category	Factors	Stakeholders					Mean
		Info producer	Info custodian	Info user	DBA	Auditor	
AIS Characteristics	**Nature of the AIS**	7	10	?	3	7	**6.75**
DQ characteristics	**DQ policies & standards**	8	7	10	10	8	**8.6**
	DQ controls & approaches	9	7	1	2	10	**5.8**
	Role of DQ and DQ manager	7	7	1	2	5	**4.4**
	Internal control	8	8	3	6	8	**6.6**
	Input control	9	6	7	3	8	**6.2**
	Understanding of the systems and DQ	7	8	8	3	6	**6.4**
	Continuous improvement	6	6	2	5	10	**5.8**
Stakeholders' related factors	**Top management's commitment**	7	8	9	5	10	**7.8**
	User focus	5	8	4	5	10	**6.4**
	Employee relations	5	7	4	5	8	**5.8**
	Information supplier quality management	10	7	6	3	6.5	**6.5**
	Audit and reviews	7	6	2	3	7.5	**5.1**
Organisational factors	**Training**	10	8	8	3	10	**7.8**
	Org. structure & culture	5	4	8	6	10	**6.6**
	Performance evaluation & rewards	5	6	1	1	5	**3.6**
	Manage change	7	7	5	8	10	**7.4**
	Evaluate cost/benefit tradeoffs	8	9	6	6	7	**7.2**
	Teamwork (communication)	6	8	4	3	7	**5.6**
External factors	**External factors**	7	6	3	5	5	**5.2**
Overall		**7.15**	**7.15**	**4.84**	**4.35**	**7.90**	**6.30**

Source: analysis of field data

Legend: 1, 2, 3 … = Rating of the importance {1 as not important at all, 10 as extremely important}

? = The stakeholder wasn't sure / clear about the factor

Blank = the stakeholder did not rate the factor or the factor wasn't included

Findings of Case B

Systems and stakeholder related factors

The interaction between systems and people has always been an interesting and important issue in systems implementation, and it would be likely to impact on the quality of the information.

System controls and human controls

Both built-in systems controls and stakeholder related human controls are important in ensuring information quality. The case study findings provide some insights about interrelationship between those two types of controls.

> We can ensure that the checks and balances that we can put in the systems are operating properly. But in terms of the type of information that gets entered, well, you can't check everything. So you have to [rely on people]. You can check certain things that give a certain amount of assurance that things are OK.
>
> Internal Auditor (Case B)

While IT people thought systems controls were more important, accounting professionals thought differently. Accountants tended to believe that human process controls were more important than system controls. They believed that human related factors had much more influence on accounting information quality. They argued that although IT people could build in many controls into systems, at the end of the day it still relied on people to enforce those rules and controls. Furthermore, there were some human related factors that the computer could not control. As an extreme example, the information entry person's mood on the day might have an impact on the quality of information they entered into a system. Although systems had built-in controls, there were some errors that systems could not control. As a very simple example, systems can set up rules like telephone numbers must be numeric and have eight digits, but they can not prevent someone inputting the wrong phone number, even though the data has passed systems check of being eight digits and numeric. The findings indicated that both systems and human controls are important in

ensuring data quality, the organization can not only rely on one type of control in their data quality management.

Education and training – human investment

Organisations normally spend millions of dollars on buying, configuring, and upgrading systems. The human investment (that is, education and training of the people who were using the system) is often under-estimated. Human investment is considered to be of the same importance as the system investment, because when people do not have the necessary skills to implement and control the system, even 'perfect' systems would not be able to produce high quality information. From the existing literature and confirmed by this research, it is clear that lack of appropriate education and training can cause serious problems for an organisation by having an adverse impact on information quality. However, education and training are only infrequently addressed in real world practice, as many organisations easily find reasons or excuses for avoiding adequate and sufficient training for their staff. Similarly, Case B had issues of under-resourcing for education and training.

> Probably training is an area where we are under resourced – that is a problem and our organisation has gone through a number of different fads over the years. We used to have central training units, and then it was decided that each division was responsible for its own training. And of course it has fallen down, and we recognised last year that we needed to – because it not just how to use the system, but you need to incorporate policies and procedures and best practice.
>
> System Accountant Manager (Case B)

Being aware of lack of training, they undertook an exercise in 2000 and a small group of four people from the head-office provided a series of training courses to staff of the different divisions.

> We traveled around the country and we did training in each location, and it was very well received and it is really what people have needed and wanted. But we are not resourced to do it. We have to stop our other work to go and do that, so it is an issue that this organisation needs to address.
>
> System Accountant Manager (Case B)

Although appropriate documentation sometimes might fix problems caused by lack of training, people preferred face-to-face contact as they received more than when they just read the documents. Of course, whether people were willing to read the documents was also a cause for concern. Even if someone read the documents very thoroughly, how much he/she could understand, and furthermore, how well they would be able to apply that understanding to their work would still be very hard to control.

> So yes, it [training] is very important. If people don't know what they are doing, what they are supposed to be doing, they at least need good documentation to follow. However, people don't want to read documentation. They want to be told.
>
> Senior Manager (Case B)

Old (stable) vs. n*e*w (functional) systems

The nature of the accounting system might have impact on the information it produces. If the system was old and mature, the users would normally have more confidence. As the system accountant in Case B commented:

> I have been involved with the system since its implementation, so I am very comfortable with it and what happens in it and we have rigorous reconciliation.

On the other hand, when a new system was installed, people would be likely to feel frustrated. It was hard to implement a new system, bed it down and get it to do exactly what its users needed it to do. The old system would probably be very stable because of the amount of time it had been in use and because most of the problems had been picked up.

However, at times organisations do have to implement new systems because technology had changed and so had business needs.

> At the moment we are actually doing a review, talking to all of our finance people in our divisions. It is a business needs review to see if the system we have now is meeting our requirements. So we will either decide whether to stay with it or to change to something else.
>
> IT Manager (Case B)

Organisational factors

There are number of organisational factors may impact on data quality. In this section, two organizational factors that had distinct findings – organisational structure and policies and standards are discussed.

Organisational structure

In Case B, the structure of the system's distribution was influenced by the organisational structure. As the organisation comprised fifty different branches, the information system was decentralised. This required many people responsible for managing different parts of the whole information system.

Each division was responsible only for its own division's system, and the head office provided divisions with instructions, such as what divisions needed to do, and the things that needed to be reconciled. However, it seemed that the control of this type of system was difficult. As one of the head office managers stated:

> But we have to basically rely on them to do it, whereas if it were more centralised, it would be a smaller group of people, and we would be able to have more control.

Policies and standards

The role of policies and standards could perform in improving information quality was examined. It was found from Case B that only having policies and standards in place is not sufficient, the enforcement of those standards and settings is as important as having them.

Case B had what was called finance directions, an internal document outlining the rules and regulations. They also had to abide by the Australian accounting standards, and as it was a statutory authority, they had different Acts of Parliament that dictated

what they needed to do. In addition, because the government provided the majority of their funding, they had to follow some specific regulations from the government.

While there were no specific policies for information quality, Case B had some general policies, which covered the information quality content. For example, they had an end-of-month schedule that everyone had to follow to ensure they had end of month reports that were produced to meet certain deadlines. However, it was found that there were difficulties to reinforce those policies. It seemed that people assume if there was polices and standards in place, then they would be automatically followed, which was not always the case. The findings from Case B suggested that the focus of the organisation should switch to the actual implementation of the policies and standards, and furthermore the assessment and evaluation of their implementation.

There were also external factors that organisations could not control but that influenced information quality.

External factors

It is hard for organisations to avoid the impact of some external factors that they have no control of. Especially in today's global economy, organisations are affected by other organisations, government regulation, important social and political events and many other external factors. The outside world of the organisation now has much more impact on an organisation's operation, systems, and information quality. The finding from the case suggested that because of the increasing influence by the external factors, the organisation's skills in managing those external issues have become very important. It was found that people must first have an awareness of external issues, and then get a deep understanding of them and their impact on the organisation.

> If there is change, I guess everyone has to be on board with the change, or at least know what their responsibilities are and what they need to do. So things need to be well-planned and well-documented, so that if we just suddenly change everything and there hasn't been enough thought about what procedures need to change, it will cause serous problems.
>
> Internal Auditor (Case B)

> Sometimes technology dictates changes to procedures and policy … when you are going to make a change like that, you have to think through all the consequences before launching into it.
>
> DBA (Case B)

In addition to technological changes, legislative changes was perceived to be another important external factor that impacted on the systems, processes, and the quality of the information. A good example is the Goods and Services Tax (GST) that was introduced by the Australian government last year.

> Changes in legislation: I mean we suddenly find that we have to record. Well, GST was a big change for us, because before we were exempt from the wholesale sale tax regime in Australia. And then all of a sudden, we had to start recording and collecting and paying GST. So that was quite a big change to our systems and the way we record the transactions. So I guess we are experiencing some information quality issues and problems at the moment because of the GST.
>
> System Accountant Manager (Case B)

However, some external factors' impact would be for only a short period of time, while others may have longer term influence.

> There will be a period like that, but it just a matter of easing them in … I guess the difficulty is being able to anticipate all the different types of situations you are going to come across, when you haven't had them before. So you think you have them planned.
>
> Senior Manager (Case B)

4.5.3 Case C

Summary of cross stakeholder analysis (Case C)

At the conclusion of the interviews with the stakeholders, each of them was asked to rate a list of factors that generated from the preliminary research framework on a ten point scale representing the importance of those factors, where ten represented

extremely important, and one was not important at all. Table 4.6 summarises the scores given by the different stakeholders in Case C.

Findings of Case C

Table 4.6 Stakeholders rating of the importance of the factors (Case C)

Category	Factors	Stakeholders					Mean
		Info producer	Info custodian	Info user	DBA	Auditor	
AIS characteristics	**Nature of the AIS**	7	9	5	7	5	**6.6**
DQ characteristics	**DQ policies & standards**	9	9	9.5	2	8	**7.5**
	DQ controls & approaches	7	9	8	9	8	**8.2**
	DQ vision	10	8	5	6	6	**7**
	Internal control	9	10	10	3	9	**8.2**
	Input control	9	9	9	9	8	**8.8**
	Understanding of the systems and DQ	8	9	9	9	8	**8.6**
	Continuous improvement	6	9	9	7	7	**7.6**
Stakeholders' related factors	**Top management's commitment**	8	9	9	8	9	**8.6**
	DQ manager	3	?	?	7	?	**5**
	User focus	7	8.5	8	8	1	**6.5**
	Employee relations	7	10	9	8	7	**8.2**
	Information supplier quality management	10	7	9.5	8	5	**7.9**
	Audit and reviews	6	9.5	9	3	6	**6.7**
Organisational factors	**Training**	9	10	9.5	9	9	**9.3**
	Org structure	5	7	8	4	6	**6**
	Org culture				8		**8**
	Performance evaluation & rewards	10	7	8	5	5	**7**
	Manage change	10	10	9	8	7	**8.8**
	Evaluate cost/benefit tradeoffs	10	6	9	7	6	**7.6**
	Teamwork (communication)	10	10	9	8	6	**8.6**
External factors	**External factors**	8	5	5	3	5	**5.2**
Overall		**8**	**8.55**	**8.33**	**6.63**	**6.55**	**7.54**

Source: analysis of field data

Legend: 1, 2, 3 …= Rating of the importance {1 as not important at all, 10 as extremely important}

? = The stakeholder wasn't sure / clear about the factor

Blank = the stakeholder did not rate the factor or the factor wasn't included

Compared to other stakeholders, the auditor provided the lowest overall rating (6.55) for the factors. Not surprisingly, the information custodian's assessment was the most favorable. At 8.55 which was close to extremely important and higher than others. It should be noted that the information producer gave the highest rating (10) for six factors. Those full score factors are mainly organisational factors, which indicates that working as the liaison between the AIS and other parties within the organisation, the information producer had a better understanding of the organisational issues than his colleagues.

Based on stakeholders' perceptions of the importance of the listed factors, Table 4.6 indicates that overall, most factors were well regarded by interviewees, except for the categories of *data manager* and *external factors*. With a 7.54 overall rating it was close to a 'High' assessment. In fact, ten of 21 factors were rated at 8 or higher, with t*raining* being the most critical factor (mean = 9.3). *Change management* and the *input controls* were also seen as very critical with the mean of 8.8. There factors were followed by *top management commitment, teamwork* and *understanding of the systems and DQ* (mean = 8.6).

4.5.4 Case D

Summary of cross stakeholder analysis (Case D)

At the conclusion of the interviews with the stakeholders, each of them was asked to rate a list of factors that generated from the preliminary research framework on a ten point scale representing the importance of those factors, where ten was extremely important, and one was not important at all. Table 4.7 summarises the scores given by different stakeholders in Case D.

Findings of Case D

Table 4.7 shows that, overall, stakeholders in Case D rated the factors well. The rating of 7.45 indicates that overall factors were considered 'very important'. None

of the 21 factors received an overall assessment of 5 or lower, and only two factors (external factors, and audit and reviews) approached that level. *DQ policies and standards* received the highest mean assessment of 9.5. This indicates that Case D recognised that having appropriate DQ policies in the first place and had a fundamental assurance of ultimate high quality information output. *Top management commitment* was also regarded as one of the most critical factors, with an assessment mean of 9.25, which is consistent with the findings of the other case studies in this research.

From the stakeholders' viewpoint, Table 4.7 depicts reasonable consensus in the ratings by different stakeholders of the importance of the factors impacting upon data quality in AIS. The clear inconsistency was between User 2 and other stakeholders. User 2 had put '0' for two factors: audit and reviews, and external factors, whereas others rated them from 4 to 10 which resulted in User 2 having the least favorable rating with an overall assessment of 6.29. In contrast to Case C, while the internal auditor had the lowest overall rating, in Case D, internal auditors' overall assessment was the most favorable at 8.55. This might have been because of the more personal experiences that internal auditors in Case D had acquired with AIS. They both mentioned that they have been working with the AIS for quite a number of years, and had been working as other systems' related professionals before becoming internal auditors in Case D, which had helped them have a broader view of the whole system.

Table 4.7 Stakeholders rating of the importance of the factors (Case D)

Category	Factors	Stakeholders							Mean
		Info producers		Info custodian	DA	Info users		Internal auditors	
		Accountant	Payroll officer			User 2	User 1		
AIS Characteristics	**Nature of the AIS**	✔ 4th		8	8	5	10th	8	**7.25**
DQ characteristics	**DQ policies & standards**	✔	✔ 4th	10	8	10	1st	10	**9.50**
	DQ controls & approaches	✔ 5th		7	5	5	16th	7	**6.00**
	Role of DQ & DQ manager	✔ 3rd	✔ 9th	8	3	6/0	18th	7	**6.00**
	Internal control	✔ 2nd	✔ 3rd	9	9	6	17th	10	**8.50**
	Input control	✔ 6th	✔ 3rd	10		6	11th	10	**8.67**
	Understanding of the systems and DQ	✔	✔ 7th	9	7	6	9th	8	**7.50**
	Continuous improvement	✔		9	6	6	14th	8	**7.25**
Stakeholders' related factors	**Top management's commitment**	✔ 1st	✔ 10th	7	10	10	19th	10	**9.25**
	User focus	✔		5	6	10	5th	7	**7.00**
	Employee relations	✔	✔ 2nd	7	7	6	13th	7	**6.75**
	Information supplier quality management	✔		8	6	5	7th	5	**6.00**
	Audit and reviews	✔	✔ 8th	7	5	0	15th	10	**5.50**
Organisational factors	**Training**	✔ 7th	✔ 5th	8	9	6	4th	10	**8.25**
	Org structure & culture	✔		7	8	0/10	3rd	10	**8.33**
	Performance evaluation & rewards	✔		9	4	10/0	20th	8	**7.00**
	Manage change	✔	✔ 6th	10	5	10	6th	8	**8.25**
	Evaluate cost/benefit tradeoffs	✔		6	9	10	8th	10	**8.75**
	Teamwork (communication)	✔ 2nd	✔ 1st	10	8	6	2nd	8	**8.00**
	Physical environment	*							
External factors	**External factors**			7	4	0	12th	10	**5.25**
Overall		**N/A**	**N/A**	**8.05**	**6.68**	**6.29**	**N/A**	**8.55**	**7.45**

Source: analysis of field data

Legend: 1, 2, 3 … = Rating of the importance {1 as not important at all, 10 as extremely important}
1st, 2nd … = Rankings of the factors by the stakeholder
✔ = Critical factors viewed by the stakeholder
* = New factors suggested by the stakeholder (shade)
? = The stakeholder wasn't sure / clear about the factor
Blank = The stakeholder did not rate the factor or the factor wasn't included

4.5.5 Case E

Summary of cross stakeholders analysis (Case E)

Table 4.8 Stakeholders rating of the importance of the factors (Case E)

Category	Factors	Stakeholders				Mean
		Info producer		Info custodian	Info user	
		CFO	Acc Officer			
AIS Characteristics	**Nature of the AIS**	8	7	5	8	**7**
DQ characteristics	**DQ policies & standards**	10	10	8	10	**9.5**
	DQ controls & approaches	8	6	9	7	**7.5**
	DQ vision	8	5	10	8	**7.75**
	Internal control	10	6	5	10	**7.75**
	Input control	7	7	10	9	**8.25**
	Understanding of the systems and DQ	7	8	10	7	**8**
	Continuous improvement	9	7	8	10	**8.5**
Stakeholders' related factors	**Top management's commitment**	8	10	7	5	**7.5**
	DQ manager	5	5	6	8	**6**
	User focus	10	5	8	10	**8.25**
	Employee relations	7	6	6	5	**6**
	Information supplier quality management	8	7	10	10	**8.75**
	Audit and reviews	8	7	7	9	**7.75**
Organisational factors	**Training**	7	8	10	7	**8**
	Org structure			7		**7**
	Org culture	10	5	7	10	**8**
	Performance evaluation & rewards	7	5	6	7	**6.25**
	Manage change	9	5	9	10	**8.25**
	Evaluate cost/benefit tradeoffs	7	7	2	8	**6**
	Teamwork (communication)	8	6	7	6	**6.75**
External factors	**External factors**	9	5	4	7	**6.25**
Overall		**8.10**	**6.52**	**7.32**	**8.14**	**7.50**

Source: analysis of field data

Legend: 1, 2, 3 …= Rating of the importance {1 as not important at all, 10 as extremely important}

At the conclusion of the interviews with the stakeholders, each of them was asked to rate a list of factors that generated from the preliminary research framework on a ten point scale for the importance of those factors, where ten represented extremely

important, and one was not important at all. Table 4.8 summarises the scores given by different stakeholders in Case E.

Findings of Case E

Data quality was a priority in Case E's AIS. As the CFO stated:

> We have to monitor our cash balances fairly closely and it [data quality] is definitely one of the highest priorities. We have forecasts that need to be met, so we need to give ourselves early warning signals if a part of the business looks like it is not performing. The numbers will tell us that hopefully, so we can address the issue.

Case E transferred a lot of its funds electronically, and that seemed easier to control than the traditional method. Typically, any transfer required two approvals from two senior people. Therefore, *Input controls* had been addressed as the most important control.

> I prefer to get it right on the way in. I have to review it. You have to trust your information at the end of the day and if you don't you are going to spend a lot of time worrying about it.
>
> IT Manager (Case E)

There was no formal *performance evaluation or rewards* for employees' data quality control activities in Case E. Instead, they tried to employ well-trained and experienced personnel to prevent the possible DQ problems. What they did was to put the DQ requirement as part of the job descriptions and it worked as a negative incentive: 'You do it right or you get sacked.' At the same time, Case E's managers also made efforts on keeping good *personnel relations*:

> The person who is working there - they need to keep happy as much as possible. Part of that is getting paid at market rates. Also the personal relationship, and the teamwork is quite important. They have to know you are responding to their questions quickly, so they don't feel lost.
>
> CFO (Case E)

On the other hand, because it is a young company and expanding very rapidly, the people that had done a good job normally had opportunities for promotion. If they were doing a good job and conducting high quality controls, they would be recognised by senior management.

In relation to responsibility for data quality, *top management commitment* to data quality was seen as most important:

> It is management commitment to it and management review of how things are going. At the end of the day they should be the ones who have to ensure it works properly. The pressure and the resources, the sorts of hard answers and decisions have to come from there [top].
>
> General User (Case E)

Because it was a medium sized organisation, Case E did not have a middle layer of management. Therefore, the implementation responsibility ongoing from day to day rested with the people at the front end.

There was usually a *timing pressure* from each of the *information customers*, both internal and external customers. For example, a board meeting normally had a deadline as to when everything needed to be presented, which might be every quarter or each fortnight. There was also some monthly reporting that needed to be done by a certain day every month, as well as statutory annual reporting. Because timing was the major influence for this type of information and reports, sometimes the deadline might suffer inaccuracy of information. Realistic timing deadlines were still the major concerns in Case E.

To set up a data quality manager position was seen as unnecessary for the company at the moment, as although some stakeholders believed that to have such an individual or a team, as quality manager would help, they could not afford it as a growing medium sized company. Therefore, duties to ensure the quality of

accounting information were assigned to the individuals who were doing the relevant work.

> I think each person has to actually be their own data quality manager for that part of their job that requires high quality data. At the end of the day the information is going to come from a source somewhere and they have to be responsible for that quality themselves.
>
> IT Manager (Case E)

Furthermore, in Case E, it was believed that having a DQ manager position would not make a significant difference.

> The people at the front end who are responsible whether they are answering to someone called data quality manager or someone doing the data quality manager function, I don't think it makes any difference.
>
> CFO (Case E)

As the opposite to the traditional data entry, Case E captured most of their information online. In most circumstances the *raw data supplier* was the data entry person as they inputted raw data into the system. In order to manage the quality of data from suppliers, Case E established a position called 'account relationship manager', who had all the details needed and did all the communication back and forth between the technical staff and clients.

> What they do is normally they make sure the clients are inputting the correct information into the system to make the system work correctly. So they are doing quality control of all the data the clients are entering. So they know the system.
>
> IT Manager (Case E)

Therefore, *input controls* were divided into two main parts, the systems controls and the human controls:

> When we set the system up it was as easy to use as possible for our clients to use to input their data. Now it of course has all the edit checks and balances for the data that they actually enter. But you can't always put in 100% controls. That is just impossible … the account

relationship managers' job is to oversee the information to make sure that what they are doing is what they are meant to be doing. So it is a manual look over the quality.

IT Manager (Case E)

Table 4.9 Stakeholders rating of the importance of the factors (Case F)

Category	Factors	Stakeholders			Mean
		Information producer	Information custodian	Information user	
AIS Characteristics	**Nature of the AIS**	10	8	8	**8.67**
DQ characteristics	**DQ policies & standards**	7	8	8	**7.67**
	DQ controls & approaches	7	5	8	**6.67**
	DQ vision	5	5	8	**6**
	Internal control	9	7	10	**8.67**
	Input control	9	10	8	**9**
	Understanding of the systems and DQ	10	7	9	**8.67**
	Continuous improvement	8.5	7	8	**7.83**
Stakeholders' related factors	**Top management's commitment**	7	6	7	**6.67**
	Middle management commitment	✔		10	
	DQ manager	10	4	9.5	**7.83**
	User focus	8	4	8	**6.67**
	Employee relations	6	7	9	**7.33**
	Information supplier quality management	2	3	8	**4.33**
	Audit and reviews	8	8	8	**8**
	Personnel competency	*			
Organisational factors	**Training**	9	8	9	**8.67**
	Org structure	6	3	8	**5.67**
	Org culture	7	7	9	**7.67**
	Performance evaluation & rewards	6	6	5	**5.67**
	Manage change	8	7	9	**8**
	Evaluate cost/benefit tradeoffs	3	2	9	**4.67**
	Teamwork (communication)	8	7	10	**8.33**
	Physical environment			10	
	Risk management	8-9			
External factors	**External factors**	4	5	8	**5.67**
Overall		**7.16**	**6.09**	**8.34**	**7.20**

Source: analysis of field data

Legend: 1, 2, 3 … = Rating of the importance {1 as not important at all, 10 as extremely important}

1st, 2nd … = Rankings of the factors by the stakeholder

✔ = Critical factors viewed by the stakeholder

* = New factors suggested by the stakeholder (shade)

Blank = the stakeholder did not rate the factor or the factor wasn't included

There are some important points that could be drawn from Case E. These are summarized below:

- Competent personnel are as important as a suitable system;
- Input control is the most important control, and in the online transaction environment, it should be incorporated with data suppliers' quality management;
- It is hard to have DQ manager positions in small and medium sized organisations. However, they should include DQ manager functions into the relevant staff's job functions who should be responsible for ensuring DQ in AIS.

4.5.6 Case F

Summary of cross stakeholders analysis (Case F)

At the conclusion of the interviews with the stakeholders, each of them was asked to rate a list of factors that generated from the preliminary research framework on a ten point scale representing the importance of those factors, where ten represented extremely important, and one was not important at all. Table 4.9 summarises the scores given by different stakeholders in Case F.

In Table 4.9, the shading indicates the new factors that were identified by some participants from case studies, which have not been included in the original list. Therefore, some stakeholders might not have rated them. However, if they have mentioned those factors or similar terms during the interview, this is represented in the table as a tick.

Findings of Case F

AIS characteristics

In the past, Case F had two separate packages for their AIS. It was found that after they installed SAP, they had been making improvements, so now they had integration of the AIS into their core business system.

The CFO in Case F addressed the importance of *documentation*, and distinguished between two sets of documentation. One was system documentation, and the other was user documentation. He believed that user documentation should be structured, so it would not be one large document.

> For example, I want to know who's got the delegation to approve this purchase order, on the Intranet, that will be one click on the object, one click to expand the hierarchy, and then click on the link to where the information stored. So I hope within 3 clicks, they will be able to go where exactly they need to go. Although the information is stored elsewhere, this tool allows us to consolidate information into one store available for all staff.

In regard to system documentation, he noted:

> With the system documentation, which we are preparing on the intranet, we are trying to make it easier for people to refresh their knowledge. Or if they come up with transactions that they haven't used for 3 months, that they can access the information. One of the problems we have with the documentation is that it's not kept up to date.

DQ characteristics

Is DQ a top priority?

In terms of what the system was able to produce for end-of-year financial statements, data quality was seen as a priority in Case F. That was a purely external focus, because they did not want a qualified audit statement for their annual financial reports. In terms of management accounting focus, data quality was seen as less of an

issue, because their internal accounting process was very simple, and they had very stable staff who have been able to perform quality controls. Data quality was a priority in terms of continuous improvement efforts, so as to produce more useful information on an incremental basis over time.

Understanding of the systems and DQ

Knowledge of system linkages was seen as very important. As to where that knowledge should come from, the CFO noted:

> Well, in theory, it should be written down, but in practice, it's the combination of your system knowledge and your organisation knowledge.

Furthermore, he commented on who should have that knowledge:

> The primary person in that chain - the technical term is the system accountant. Because the system accountant knows what the collection is, how it is processed and disseminated. And that's the problem with our organisation.

Interestingly, while they did not have a position of 'system accountant', the CFO saw himself as the system accountant:

> I am everything. We each have state officers. We have someone collecting it. But in terms of maintaining SAP, how this information comes in, how it is classified, structuring the general ledger, control over the main reporting package that we use, it's me and one other. There will be two of us who have that knowledge.

The CFO was concerned that the organisations could not improve the quality of the information without actually understanding of how the system worked, and what was required. That might take a certain amount of time to find out, especially for new staff. Someone might be an accountant, and know how SAP worked, but it would not be the same in the new organisation.

Input controls

Regarding data input with SAP, in Case F, they configured the system so that certain information was mandatory with system checks.

> The example would be with GST. When we introduced GST, we trained everyone. We told everyone that this is a field they have to fill in called 'the tax code'. And we made that field mandatory, and then by having drop down fields. But the problem is they've still got to choose the right one.
>
> CFO (Case F)

The information producer believed that the input control was the most important stage, because the most important quality control should be at the input stage when the information was entered. They set up certain procedures as well as system constraints to ensure only valid data could be entered.

Internal controls

As to whether the human or system internal controls were more important, the CFO believed that it should be a mixture of both human and system controls. However, he also tended to think that the human aspects are harder to control. The human element that was found to be most critical was *trust*. He thought that no matter what procedures and system controls the organisation might have in place, if you were unable to ensure the staff were confident to make the right processing decisions, and they had the trust to do that, then all your other system controls would not matter.

> I've been the auditor. I used to audit against all these controls, and after many many years, I realised that the most important control is trust. Because I can break any payment systems, I can break any control systems that you give me. And on that basis, the control systems, although fantastic, if you don't have good people who you trust …
>
> CFO (Case F)

Therefore, the CFO concluded that it was the individual that would have most impact on data quality. Internal controls would not work without trusted individuals.

Stakeholders' related factors

Top management commitment

Although top management commitment was important for data quality, the CFO believed that they would not have too much impact on actual data quality, because they could not have direct influence.

> They can ask for it, but they can't actually get it themselves. And they would not know whether what they were getting was accurate. Most of the top people, top management, are not trained accountants. If I told them this is what our policies are, this is how I would be treated. Unless the auditor says so, they are not going to believe me.

It then came back to the issue previously discussed before: i.e. trust is the most important thing.

> In our organisation, I have the responsibility to make wherever decisions I feel are necessary. And if think that I need support, I go to senior management.
>
> CFO (Case F)

The information custodian saw top management commitment to data quality as very important. However, top management was not seen to perform a critical role in ensuring data quality.

> Obviously, they (top management) need to promote, and expect high data quality. But that's about all.
>
> IT Manager (Case F)

Employee turnover

How to maintain IT staff was seen as a major problem. The employee turnover in some industrial is very high, and it may impact on the operation of the systems and the information quality. This was particularly true for some IT professionals.

Because of the significant pay difference, some IT people came to obtain the necessary training from one organisation, and then went to another higher paid organisation, or took a contract job.

> When we installed SAP 3 and half years ago, I wasn't here. The team who were here all left within 10 weeks … they saw the money, and they took it. At that time, we were one of the two government agencies that lived in Canberra. All the big agencies were preparing for it. These people took jobs as contractors, and earned lots more money.
>
> General User (Case F)

Middle management's commitment to DQ

> You can get to the senior managers, who've just seen in front of them the information. They assume that what they have is accurate. So, it is important to get that information right, and it's the person in the middle who does that.
>
> IT Manager (Case F)

It was believed that the person in the middle, who was responsible for linkages, was the key to information quality.

User involvement

In regard to whether information producers were asked what users want, or told users what they needed the CFO's answer was: 'It's a bit of a combination.' Furthermore, he added that it was probably more for him to advise users of what they should be managing. The reason for that was because the information producers were normally the few trained accountants on the corporate management side who understood the user's real needs. It also seemed that the CFO in Case F was somewhat opposed to user involvement, and his reasons were:

> It can't be left to the users, because the users are powerless. The users only get what they are given. The users could require additional information, but they can't actually get that additional information without the person, or the people, the team in the middle, someone responsible for saying: "Yes, we are meeting statutory requirements, and yes at least asking the question, how can we improve what we are reporting.

Organisational factors

Initial training

While training in many organisations is under-resourced, Case F was trying to establish a systematic tool to provide new and existing staff members with a better way to learn new things and to find out the necessary steps and knowledge to handle the system and perform their work.

> We currently have a tool, which we are working on to stop this. When a new employee comes in, they will have the tool. It's a very simple intranet based tool, which hopefully will capture the entire business process starting from which form has to be used to how this system has been configured to how to access reports. New people come into the organisation, we continue to have that. A lot of people doing processing may have general business knowledge, but they are not accountants. So we have to explain them, that in SAP you must have a debit and credit. You must have an invoice document and then a separate payment document.
>
> IT Manager (Case F)

Risk management

Case F set risk assessment based on their information needs. Because the risk of having an external link somewhere in the network is greater than the risk that they are willing to accept their core business being corrupted, there are no external links to their core business network.

> For national security, we do not have any external links to our network. I have to walk outside my room and logon to a stand alone PC to get my emails. We don't have desktop Internet access. When I want to send the payment file to our bank, I get a floppy disk from the UNIX box, and I go and stick this in the stand alone PC. Some background of why we have done that. First of all, they have a minimum problem with viruses. When the 'I love you' virus came up, the top management was very delighted, because the only infections of the virus were run on stand alone PCs, and it never got onto their network.
>
> CFO (Case F)

Teamwork

The Case F stakeholders rated teamwork very highly. They also addressed the importance of communications in being able to create good teamwork.

> The biggest challenge is the strategic view to get everyone aware of why we need to collect this information and what the benefits are. And communication of why we collect the information, and then the communications as to the benefits after we've collected that.
>
> IT Manager (Case F)

4.5.7 Case G

Summary of cross stakeholders analysis (Case G)

At the end of the interviews with the stakeholders, each of them was asked to rate a list of factors that generated from the preliminary research framework in a ten point scale for the importance of those factors, where ten was extremely important, and one was not important at all. Table 4.10 summarises the scores given by the different stakeholders in Case G.

Findings of Case G

In considering the importance of the factors, Table 4.10 indicates that the overall rating from all stakeholders was 7.84. Nine of the 23 factors received an overall assessment of 8.5 or higher (that is, the factors were close to 'extremely important'). *Input control* was rated as the most important factor with a mean score of 9.25, followed by *understanding of the systems and DQ* at an assessment of 9.

Only two received an assessment lower than 6.5. The rating of *audit and reviews* was the lowest at 5.75. Another factor that received low assessment was *information supplier quality management*, which was 6.25. This is explainable as Case G did not have many external information suppliers, and internal departments seemed to work closely with each other (with the score of 8.5 for teamwork and communication), and

therefore did not appear to need to address the importance of information suppliers' quality management.

From the stakeholders' viewpoint, Table 4.10 indicates that while there was not a large discrepancy between the ratings of the different stakeholders, two information producers, the manager of finance and the system accountant, provided a higher assessment of the important factors than other stakeholders. The information custodian had the lowest assessment at 7.33, which was a bit abnormal. By looking into the details of the information custodian's individual ratings for each factor, it was found that he gave some 'soft' factors a very low rating. Examples are 4 for *internal controls* and *DQ manager*, 5 for *audit and reviews*, *training* and *evaluation of cost/benefit tradeoffs*. This again illustrates that information custodians valued less for 'soft' components of the AIS, but were more focused on the 'hard' part of the system, as in this case the *nature of the system* was rated at 8, as well as *input controls*.

Change management

Because of the special systems changing situation that Case G was experiencing, an important issue that needed to be addressed in particular was change management. Case G was changing its text-based systems to a *Windows* based graphical interface. However, some people still liked the old systems. For instance, data entry operators preferred the old fashioned screen because it was all in the mouse and they were very forward on the keyboard. They had their hand on the keyboard and could flick through quickly whereas as soon as the organisation brought in *Windows*, then it became *point click, stop click*. Therefore, they were expecting a few problems with the changing process, as people that were entering data eight hours per day were affected and putting up some resistance. On the other hand, management tended to like the *Windows* based product better because it was a *point and click* and drop down box system that best suited their needs.

Table 4.10 Stakeholders rating of the importance of the factors (Case G)

Category	Factors	Stakeholders				Mean
		Info producer		Info custodian	Internal auditor	
		Manager of finance	System accountant			
AIS Characteristics	**Nature of the AIS**	9	9	8	8	**8.5**
DQ characteristics	**DQ policies & standards**	8	8	8	8	**8**
	DQ controls & approaches	8	8	8	7	**7.75**
	DQ vision	9	9	6	7	**7.75**
	Internal control	10	10	4	10	**8.5**
	Input control	10	10	8	9	**9.25**
	Understanding of the systems and DQ	8	9	10		**9**
	Continuous improvement	8	8	10	8	**8.5**
Stakeholders' related factors	**Top management's commitment**	5	5	10	8	**7**
	Middle management commitment	10				
	DQ manager	9	9	4	6	**7**
	User focus	10	9	8	8	**8.75**
	Employee relations	10	10	8	7	**8.75**
	Information supplier quality management	10	0	7	8	**6.25**
	Audit and reviews	5	5	5	8	**5.75**
Organisational factors	**Training**	7	7	5	8	**6.75**
	Org structure	9	9	9	7	**8.5**
	Org culture				8	**8**
	Performance evaluation & rewards	-	7	9	5	**7**
	Manage change	8	8	8	7	**7.75**
	Evaluate cost/benefit tradeoffs	8	8	5	7	**7**
	Teamwork (communication)	8	8	9	9	**8.5**
External factors	**External factors**	10	10	5	8	**8.25**
Overall		**8.45**	**7.90**	**7.33**	**7.67**	**7.84**

Source: analysis of field data

Legend: 1, 2, 3 …= Rating of the importance {1 as not important at all, 10 as extremely important}
Blank = the stakeholder did not rate the factor or the factor wasn't included

In order to overcome the potential problems the changes may cause, the organisation created a new term of 'power users', who were skilled users of the systems and had influence on other users, as well as having extensive training and knowledge of the new systems. The system changing team first identified potential power users, and then focused on training and education for those users only. After those users gained

enough knowledge and confidence of the new system, they then became the power users, and went back to the section that they were working at, and acting as the promoter and trainer of the new system. As they were users of the system themselves, they were normally familiar with the general users' concerns and could explain things in a way that could be easily understood by other users. Case G was experiencing a big change problem in their system. Therefore, change management was critical to the success of the implementation of the new version of the system. The method they had employed of using power users to speed up and smooth the changing process seemed to work quite well.

4.6 Cross-case analysis

The section presents the findings of all seven case studies on the whole. Table 4.11 provides an outline of across-case analysis. It includes all factors identified by case studies and the literature review and their overall assessments in each individual case.

To assist in arriving at an overall assessment of the important factors that impact upon data quality in AIS, the analysis of the seven cases has been summarised in Table 4.11. Qualitative analyses together with quantitative ratings were employed to create the summary. The overall assessment for 26 identified factors across different cases as shown in Table 4.11 provided a complete picture of the case studies' results.

It is clear that some factors were not supported by all the cases, while some others had inconsistencies across cases. Two factors that were visibly not supported by all cases were: *establish DQ manager position*, and *external factors*. Especially for *establish DQ manager*, five out of seven cases rejected it completely, and the other two seemed to have serious concerns about it. The conflicting findings across cases exist for three factors: *appropriate organisational structure, performance evaluation (measurement and reporting)*, and *evaluate cost/benefit tradeoffs*. For those three factors, four to five case organisations of a total of seven were either not certain about the factor or declined it.

Table 4.11 Summary of case studies findings

Factors \ Cases	Large organisations			SMEs			
	A	**B**	**C**	**D**	**E**	**F**	**G**
Top management commitment to DQ	✔	✔	✔	✔	✔	✔	?
Middle management commitment	✔	-	✔	✔	✕	✔	✔
Education and training	✔	✔	✔	✔	✔	✔	✔
Clear DQ vision	✔	?	✔	?	?	✔	✔
Establish DQ manager position	✕	✕	✕	✕	✕	?	?
Appropriate organisational structure	✕	✕	?	✔	?	?	✔
DQ policies and standards	✔	✔	✔	✔	✔	✔	✔
Organisational culture	✔	✔	✔	✔	✔	✔	✔
DQ controls	-	✔	✔	✔	✔	✔	✔
Input controls	✔	?	✔	✔	✔	✔	✔
User focus	✔	?	✔	✔	✔	✔	✔
Nature of the AIS	✕	✔	✔	✔	✔	✔	✔
Effective employee relations	✔	?	✔	✔	?	✔	✔
Management of changes	✔	✔	✔	✔	✔	✔	-
Performance evaluation (measurement and reporting)	✕	✕	✔	?	✔	?	?
Information supplier quality management	✔	✔	✔	✔	✔	✕	?
Continuous improvement	✔	?	✔	✔	✔	✔	✔
Teamwork (communication)	✔	?	✔	✔	✔	✔	✔
Evaluate cost/benefit tradeoffs	?	✔	✔	✔	?	✕	?
Understanding of the systems and DQ	✔	✔	✔	✔	✔	✔	✔
Risk management	✔	✔	-	-	-	✔	✔
Personnel competency	✔	✔	✔	✔	✔	✔	✔
Physical environment	-	-	?	✔	-	✔	✔
Audit and reviews	✔	?	✔	?	✔	✔	✕
Internal controls	✔	✔	✔	✔	✔	✔	✔
External factors	✕	?	?	?	?	✕	?

Source: analysis of the case studies data

Legend: ✔ = the factor that supported by the case study

✕ = the factors that not supported by the case study

? = serious conflict findings of the factors exist within the case

\- = N/A

For the remaining factors, although to some extent conflicts still existed across all cases, the agreement across cases seems greater than the difference. In particular,

four factors received unreserved support from all cases, they are: *education and training, DQ policies and standards, organisational culture,* and *personnel competency*.

From a comparison of different sized organisations, Table 4.11 depicts consensus in the overall assessment of the factors by large organisations and SMEs. There appears to be no major disagreement between different sized organisations regarding the perceptions of the importance of factors that impact on data quality in AIS. From an overall viewpoint, this consistent finding from large organisations and SMEs provides an opportunity to identify a set of important factors for data quality in AIS in general across different sized organisations.

4.7 Identification of a set of important factors that impact on data quality in accounting information systems

Following the within case cross stakeholders and cross-case analyses a set of factors was derived. Some of those factors were similar to those found in the literature, while some other factors were 'new'. Each of the listed factors is discussed in this section. First there is an examination of the 'new' factors that were identified by two pilot case studies and seven main case studies, which are not specifically addressed as important factors in the relevant literature.

4.7.1 'New' factors

The 'new' factors discussed in this section were the factors that have been identified by this study. It is to be noted that the concepts of those factors were not new. They have been mentioned by studies in other fields in similar or slightly different terms. However, they have not been particularly addressed as being important factors for data quality in AIS. These factors have been 'discovered' by the pilot and main case studies of this study as possible critical factors in ensuring accounting information quality. Table 4.12 shows the 'new' factors and the case studies / stakeholders that have identified the particular factor.

Table 4.12 'New' factors and the cases that have identified those factors

'New' factors	The Case that identified the factor
Teamwork (communication)	Pilot cases
Organisational culture of focusing on DQ	Pilot cases
Understanding of the systems and DQ	Pilot cases
Risk management	Case A: the information producer
Middle management's commitment to DQ	Case A: the information user
Physical environment	Case D: the information producer
Personnel competency	Case F: the information producer

Two pilot cases have suggested three 'new' factors that are critical for ensuring DQ: *teamwork, organisational culture, understanding of the systems* and *DQ*. Those factors were then added to the list of the proposed factors that were found in the seven main case studies. Stakeholders interviewed in the main case studies have further identified another four factors that may impact on DQ in AIS. Those factors are*: risk management, middle management commitment, physical environment,* and *personnel competency*. Each of these factors is addressed in detail next.

Teamwork between accounting and IT professionals

Teamwork requires everyone involved with the systems working as a team and to have sufficient communication. The teamwork is not only within the department, but also between different departments. More often, people in different sections within the organisation lack sufficient communication to be able to work as a whole team, rather than only working within their own small area. Furthermore, communication is also an issue between different professionals, such as, accounting and IT professionals. In the case organisations, it could often be heard that accounting professionals would complain about new technology, and could not get enough support from the IT professionals. IT people would complain about business people not knowing what they really needed, and ask about irrelevant matters that were already provided by the system. This lack of teamwork had the potential to cause data quality problems.

Risk management

Risk management can be defined as the awareness of and level of commitment to the reduction of the consequences of poor DQ on AIS. Awareness of risk enables identification of key areas and critical factors to ensure DQ in AIS. The following two quotations that were extracted from comments provided in the interviews demonstrates the awareness of the importance of having risk assessment in the case organisations:

> We made the decision not to have external links. We set risk assessment based on our information needs. And the risk of having the external link somewhere in the network was greater than the risk that we were willing to accept of having our core business corrupted.
>
> CFO (Case E)

> One of the things they need to keep in mind these days and particularly in the Public Service organisation is cost effectiveness and risk management. Just because there is a risk doesn't mean you go and spend $1,000,000 to fix it. You have to do things like risk analysis to determine the level of risk that the organisation is willing to wear if you like and those risks impact on the quality information being processed, quality of the decisions that are made by the system and all those sorts of things.
>
> IT Auditor (Case A)

Middle management commitment to data quality

It appears that middle management plays a very important role in ensuring data quality. It was found from the case studies that to be able to have high quality data, there have to be effective procedures at middle management level. In relation to data quality, middle managers are the people who report to top management the overall DQ performance, and supervise the day-to-day individual employee DQ performance. Although in small organisations, middle management might not exist, for Medium and large organisations, case study results show that the acceptance of responsibility of data quality performance by middle managers is essential in the organisation hierarchy level in ensuring the quality of data.

Personnel competency

This factor relates to the competency of individual personnel that are responsible for AIS. For instance, there are highly skilled and knowledgeable employees in both the technical and business areas. It is suggested by the case participants that organisations employ well-trained, experienced and qualified individual personnel at all levels, from top management to middle management to employees in order to have high quality information outcomes. Personnel competency also tied with the education and training, highly qualified individual need to be trained to understand more about the organisations' special operation environments and cultures. The experience and knowledge of personnel is fundamental to the successful implementation of the systems and DQ controls, as one of the information producers who had been working at different roles before he became the CFO stated:

> Let's gets down to an understanding of the individual, the qualifications and the experience of the people. I have come from a very wide background, which means that I can see the auditor perspective, the user perspective, the financial accounting perspective, and the system perspective. A lot of people come from organisations where the implementation of new systems has failed because they did not have trained experienced personnel.
>
> CFO (Case F)

To get to the stage of only having competent staff is not the end of the story. They also need to be placed in suitable positions, supported with appropriate training, as well as properly rewarded. As the internal auditor, Case G stated:

> It comes back to the things we said before, to have the right staff at the right job, appropriately rewarded, and an understanding of what their role is in the total process.
>
> Internal Auditor (Case G)

Physical environment

A pleasant physical working environment such as a modern environment with air-conditioning and sufficient office space has been found to be a factor that might influence data quality performance. Management theories certainly explain the need

for employees in general to have adequate working conditions (Hawthorne studies (Mayo 1933)). Previous studies in the areas of data quality and accounting information systems have not identified the physical environment as being a possible factor that may impact upon data quality.

This factor was initially identified in one of the case studies and was later verified by some of the other case studies. For example, lack of air-conditioning facilities in warm climates impacts upon the efficiency of an employee and therefore, may further impact upon the degree of care taken of the quality of the data.

> No air-conditioning in hot weather? I think that would be terrible. It would be terrible to sit there trying to do functional accounting, reporting to a group or something with no air-conditioning.
>
> User (Case F)

> Yeah! Look I think certainly if people don't have a good environment to work in, then they're not happy. They're less motivated about all sorts of things. I'm sure that's the case … I absolutely do think that's true. How much of a role it plays I don't know - I mean how big of a percentage. But I think generally the environment that you work in does impact on the quality of the work that you produce.
>
> Director of Finance (Case C)

Some reservations about how much of a role the working environment can play is noted. The quotation above from the director of finance in Case C is typical of these concerns. While the physical environment does have some impact on the quality and productivity of work, it also depends on the extent of people's expectations, and the coordination of other human related management efforts. Some of the interviewees did not fully support this factor and believed that one should perform the job duties regardless of the working environment.

> Because if you a good employee you will always do good, no matter whether you're working at a high temperature or not, or freezing. You still need to do the job. Yes, I guess there's a comfort factor if it's too hot or too cold. That's a comfort factor. But if you're in an office and you don't like the color of the walls, then that shouldn't affect you, but that's not a comfort thing.
>
> DBA (Case C)

Organisational culture of focusing on DQ

The case study analysis shows that if there is a culture within the organisation to promote DQ, as there must be high quality data in accounting information systems; this has significant impact on the data quality outcomes. Within a good data quality focus organisational culture, it is likely that there is a commitment from the top management that would lead to more resource allocation, and it is likely to have more controls in place. In addition, employees who are working in organisations in which such culture exist, will likely put more effort into ensuring data quality than those working in organisations that do not focus on data quality issues. Therefore, it supported by the cases' findings that an organisational culture of focusing on data quality would be likely to lead to a high quality of information output.

Understanding of the systems and DQ

The evidence from the case studies suggested that an understanding of how the system works, and the importance of data quality by everyone involved in accounting information systems, is critical for ensuring data quality in AIS. This covers three main components:

1. Understanding how the system works (technical competence)
2. Understanding the importance of data quality and its relation to business objectives (perception of importance)
3. Understanding the usefulness and usage of information (the right information to the right people at the right time in the right format. < the 4 Rs>)

To have a complete picture of how systems work could help AIS stakeholders understand the influence of their work on others in the organisation, as well as how other people's activities may affect their areas. This is an excellent opportunity to address the importance of the teamwork.

> We do not have to completely understand what systems can do. What my job is now is: I have to put this piece of information in. It doesn't give me any benefits, but it gives the

> benefits to someone else. But if I don't understand my little job here, I don't really care. I don't have to write organisation drivers to put that information in the first place, to put it in accurately in the second place or to put it in consistently in the third place.
>
> IS manager (Case G)

Linking data quality activities to an organisation's business objectives can increase the awareness of data quality issues, and provide the motivation for data quality control activities. And finally the four Rs identified by one of the interviewees are a good summary of the important points that need to be addressed regarding the usability and usefulness of the information. The four Rs signify 'the right information to the right people at the right time in the right format'.

4.7.2 Traditional factors that were confirmed by the case studies

Other factors that exist in the current relevant parent literature in similar terms and specified by the case studies as particularly important for data quality in accounting information systems are:

- Top management commitment to DQ
- Education and training
- Clear DQ vision for the entire organisation
- DQ policies and standards
- DQ controls
- Customer focus
- Nature of the AIS
- Employee relations
- Change management
- Data quality supplier quality management
- Continuous improvement
- Audit and reviews
- Internal controls

Many of the factors have already been included and discussed in Chapter 2, when the relevant parent literature was reviewed. Therefore, the detailed definitions of those factors would not be discussed here.

4.7.3 Factors that have conflict findings from the case studies

There are three factors from the proposed list that were found to have seriously conflicting findings from different case studies. This section provides analyses of those factors that have inconsistency across cases, which are:

- Appropriate organisational structure;
- Performance evaluation (measurement and reporting);
- Evaluation of cost/benefit tradeoffs

Organisational structure

It is assumed that a suitable organisational structure can help produce high quality information. For example, it is considered that a centralised organisational structure would be likely to have better DQ controls. However, in was found that in large organisations, which have divisions located in different geographical areas, it is difficult to have centralised responsibility for DQ, because parts of their AIS functions are performed by the individual divisions. Therefore, organisations should incorporate different DQ control approaches according to their organisational structures to obtain better DQ outcomes.

Performance evaluation and rewards

Performance evaluation includes measurement and reporting. On the one hand, DQ results need to be measured, which is performance evaluation, evaluation of employees, management and relevant sections' / department's DQ performance. On the other hand, there is also a need to establish DQ reporting systems. They should include both appropriate formal and informal reports and reward/penalty systems for DQ positive/negative incentives.

From the existing literature, performance evaluation should be crucial to ensure DQ. However, in the real world it is not always the case. First of all, it is very hard to measure data quality. Different people have different perspectives as to what is high quality information, and it is hard to evaluate data quality. Secondly, it has been found that it is not easy to establish a good rewards /penalty system for data quality, due to a variety of reasons, such as, lack of resources, lack of management awareness and support. Sometimes, it is just impossible to establish data quality positive/negative incentives.

> It is a difficult question really because it is often one part of their functions. It is difficult because what you need to do is to evaluate the accuracy of the data they are entering and how do you evaluate, and say 'yes, this person is 88% accurate'. How intrusive or how much time does it take evaluating what they are doing and is that taking up more time away from the things they do? It becomes very difficult.
>
> DBA (Case B)

Evaluate cost/benefit tradeoffs

Evaluation of tradeoffs includes having systematic cost/ benefit analysis of data quality controls and activities in order to maximise benefits at minimum cost. There are some cases and stakeholders that supported this factor. For instance, DBA from Case B stated:

> This is based on the idea of rather than saying 'what have we got', we say 'does it do the job?' The first question is what's new and what we can get to replace what we have got. Sometimes it may be driven by user requirements, which is fine, but you have to trade that off. How important is that compared to cost and all these sorts of things. Cost/benefits need to be done.
>
> DBA (Case B)

However, some cases and stakeholders either did not support the importance of *evaluation of cost / benefit tradeoffs* or had serious concerns about it. It might have been because cost/benefit analysis is not a common practice in the case organisations, and people in those organisations lacked understanding of what

constitutes analysis of cost / benefit tradeoffs. The shortage of the expertise and knowledge has caused some organisations to be unaware of the importance of cost/benefit analysis, as well as unwilling to conduct it.

4.7.4 Factors that are not supported by the case studies

There are two factors that are not supported by the case studies. They are:

- External factors;
- Establish the DQ manager position

External factors

External factors are those factors that the organisations don't have controls on, such as change of legislation, new competitors, and change of market and economy. Nowadays, organisations have to operate in more and more complex external business and social environments. There are many external factors that might impact on organisations' overall performance. However, the findings from the case studies illustrate that most of the interviewees did not believe external factors had too much influence on data quality performance in AIS. The following two quotations from case studies could well represent AIS stakeholders' viewpoints on external factors.

> I don't think it (change of legislation) will impact much. No, it shouldn't really. It might make it a tiny bit better, because you want to try to become, more comfortable with the data, because you want to get your 10% back from the government. You want to keep it accurate, otherwise you are not going to get it.
>
> IT Manager (Case F)

> I'll put them (external factors) neutral. I mean if you've got everything else in place, change your culture, you should be able to handle those external factors.
>
> IS Manager (Case G)

Establish DQ manager position

From the data quality literature, it is suggested that a Data Quality Manager's position be established to manage the overall data quality. This means appointing a

skilled person or a group of people as data quality manager/s to manage information flow from input to process, and to output. However, all the case studies did not support the establishment of such a position. The most frequently mentioned reasons for the rejection were:

- Data quality is everybody's responsibility.
- It is very hard to have one person to be responsible for the whole system's data quality.

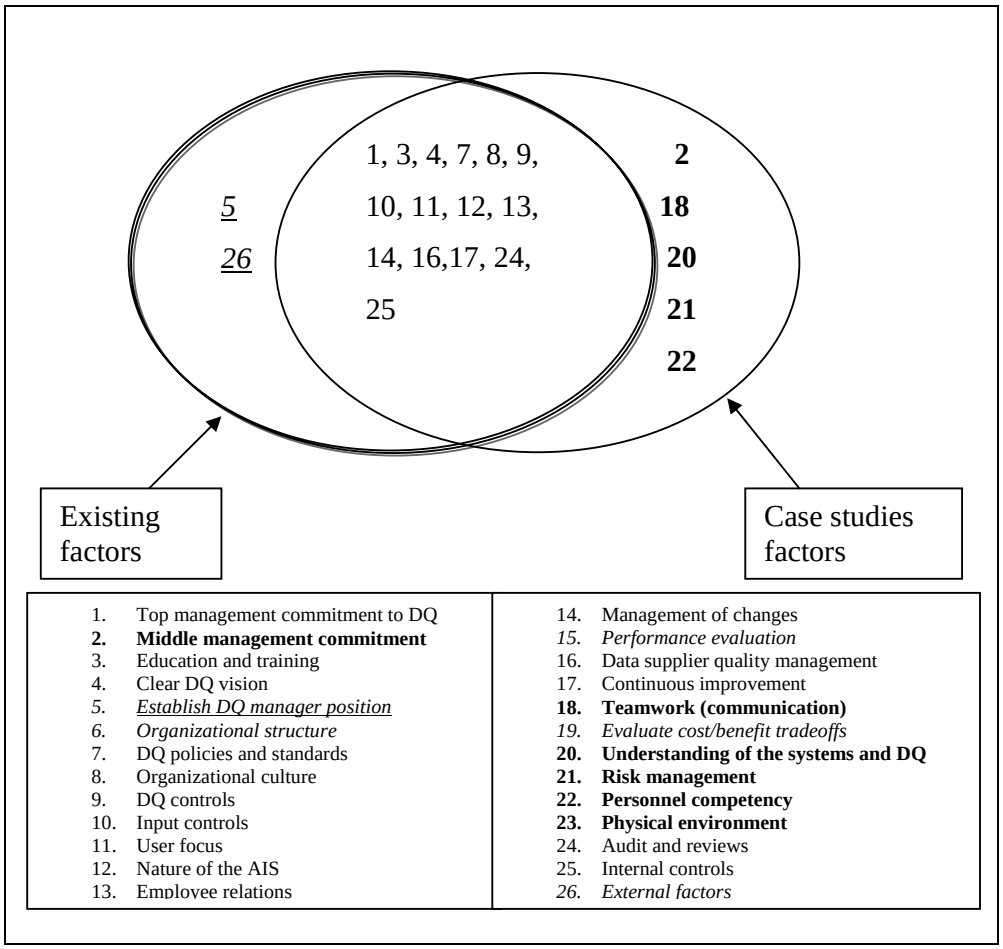
All case studies were conducted in Australian organisations, and the literature that supports the DQ manager position was all from USA. It is quite interesting to find such common rejection of a DQ manager from Australian organisations. It could have been because some US organisations were bigger and more advanced than most Australian organisations, or it might have been because of the different organisational cultures of US and Australian organisations.

4.7.5 Comparison of factors identified by the existing literature and case studies (inclusive & exclusive)

To summarise the discussion, Figure 4.2 provides a comparison of the factors identified by the existing literature and the case studies. It highlights the similarities and the difference between the two sets of factors from the literature and the case studies.

The two components of Figure 4.2 are the factors identified by the existing literature and the factors identified by the case studies. The overlap part in the middle of the figure includes the factors identified by the relevant literature and confirmed by the case studies. However, there were three factors (6, 15, 19) that had conflict findings from the case studies that were supported by some cases but not by others. They were also put in the middle part of the figure, but in the bracket. While the part that does not overlap in the case study factors means those factors were 'discovered' by the case study, they are 'new' factors that have not been addressed as possible factors that may impact on data quality in AIS by the existing relevant literature. There are

also two factors (5, 26) from the pertinent literature that were not supported by the case studies.



Legend: **Bold**: 'new factors' identified by case studies

Italic: factors that have conflict findings from case studies

Italic & underline: factors not supported by case studies

Normal: factors identified from literature review and supported by the case studies

Figure 4.2 Factors identified by the existing literature and case studies (inclusive & exclusive)

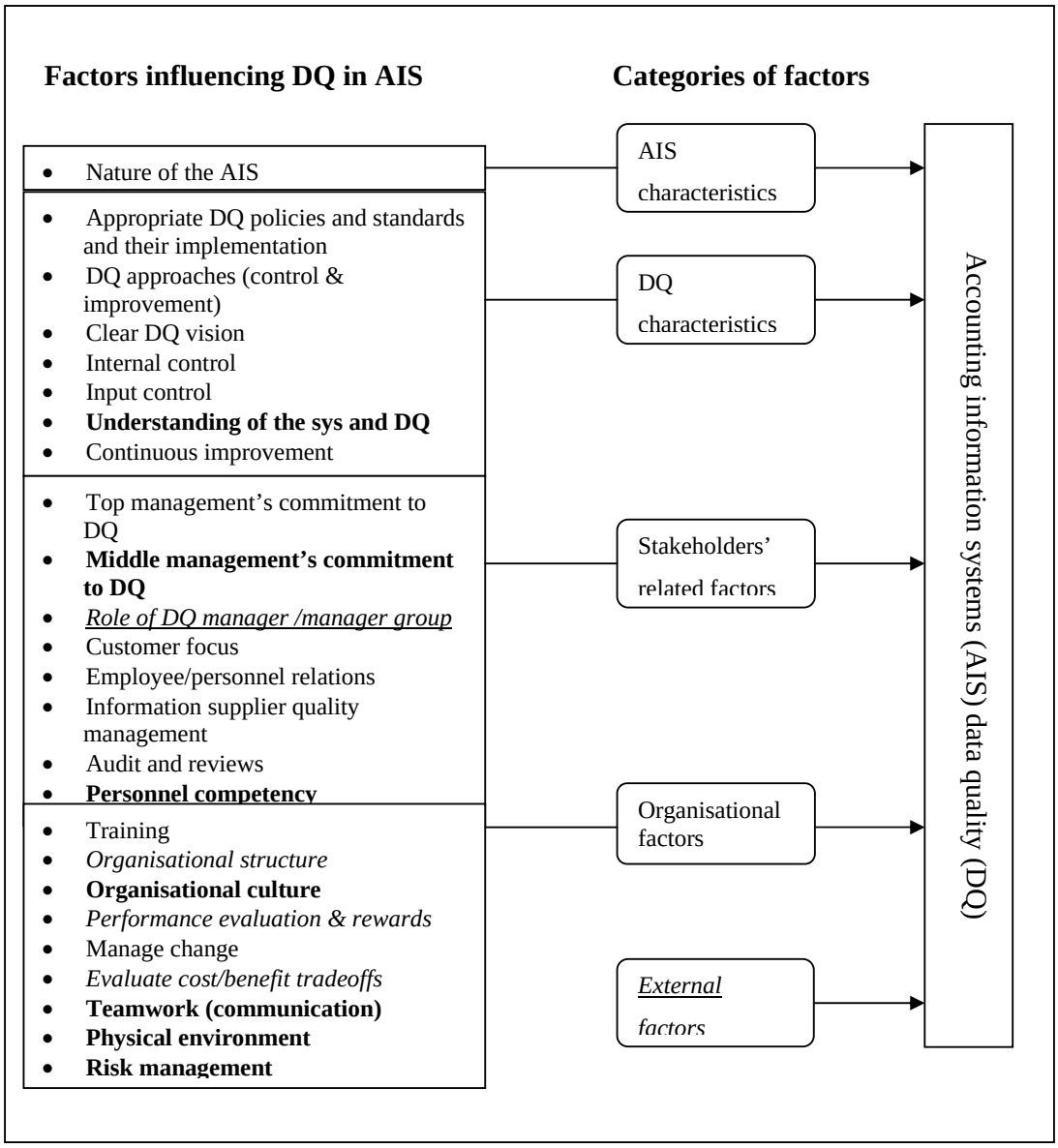
4.8 Refined research framework

Based on the above discussions, in summary with the main findings about the case studies, a refined research framework for factors that impact on data quality in AIS has been proposed in Figure 4.3 to aid the understanding of the issues. Although some factors are not supported or have conflicting findings from the case studies, they are still included in the refined framework in order to be further tested in the next phase – the large scale survey. Given that this refined framework is not the final research framework, but is to be used as the basis for the questionnaire design, therefore, inclusion of all proposed and 'new' factors is deemed to be necessary. The refined research framework represented in this chapter is only part of the preliminary theoretical framework (Figure 2.2) discussed in Chapter 2, the component called: 'critical factors for DQ in AIS'. It is an updated version of Figure 2.4: the model for factors influencing data quality in AIS. The changes made, such as 'new' factors added, were based on the case study analysis as discussed in the previous sections of this chapter. Two other components: 'stakeholder group' and 'dimensions of DQ performance' in the 'preliminary theoretical framework' were not the focus of this chapter; they are to be included in the 'final theoretical framework' in the conclusion chapter (Chapter 6).

4.9 Conclusion

This chapter analyzed the data collected from seven case organisations via 32 in-depth interviews with five data quality stakeholder groups in AIS, which included information producers, information custodians, information consumers, data managers, and internal auditors. The analysis of the data was done by using both within case and cross case analysis facilitated by detailed content analysis. Firstly, the background of the case study organisations was provided together with details of the case study respondents, that is, the different stakeholders involved in the case studies. Secondly, within case analysis for seven case organisations was conducted. Both qualitative and quantitative analyses were included for overall assessment of identified factors and different perceptions across different stakeholders within one case. Thirdly, the findings of all seven case studies were summarised. For each proposed factor, an across cases analysis was provided. According to overall across

cases assessment, factors were divided into groups of *not supported by the case study*, *supported by the case study*, and *have conflict findings across cases*. Those different groups were then discussed in detail in the next section. The detailed discussions of the 'new' factors that have been 'discovered' by case studies were also included. Finally, based on the case study analysis, a refined research framework for the factors that influenced data quality in AIS was proposed. In the next chapter, survey data analysis is presented.



Source: developed for this research

Legend: **Bold**: 'new factors' identified by case studies

Italics: conflict findings from case studies

Italics & underlined: factors not supported by case studies

Normal: factors identified from literature review and supported by the case studies

Figure 4.3 The refined-research framework for factors influencing data quality in accounting information systems

5 Analysis of survey data

5.1 Introduction

In chapter 3, the research design and survey methodology were provided, along with a description of survey administration and sampling strategy. Chapter 4 provided the analysis of the case study data. In turn, this chapter reports on the analysis of survey data.

This chapter has six sections, as shown in figure 5.1. The next section 5.2 contains some demographic information of the survey respondents, follows by overall results of survey respondents that show the comparison of the responses relating to the perceptions of the importance of the factors with the performance of those factors (5.3). The three research hypotheses are tested in section 5.4. Hypothesis one is to discover whether there is any significant difference between the stakeholders' perceptions for the level of importance of the factors and the extent of actual performance. Hypothesis two and three are investigating whether there are any variations of the perceptions of importance between different stakeholder groups and different sized organisations respectively. The set of most critical factors is generated and presented in section 5.5, which is part of the practical contributions of this research. Finally, the chapter concludes with identifying the critical success factors for data quality in accounting information systems by combining the findings of the ranking of mean importance and the most critical factors. The implications of the findings presented in this chapter are discussed more fully in the next chapter.

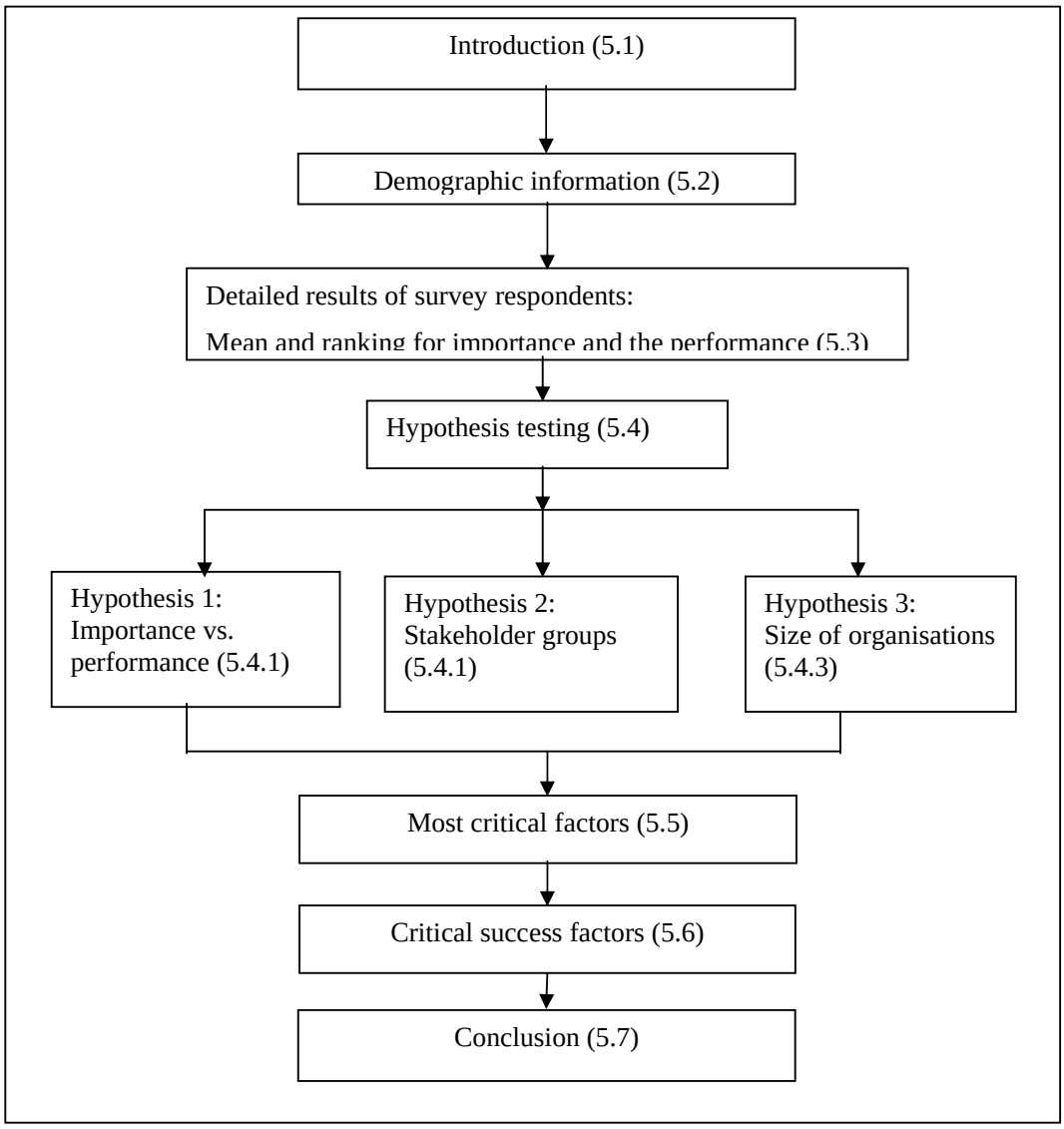


Figure 5.1 Chapter 5's outline with section numbers in bracket
Source: developed for this research

This chapter reports the findings from the third stage, theory testing, of this study. In order to discover which of factors identified from case studies are critical factors, two large-scaled surveys were prepared and sent to accounting and IT professionals in Australia. The questionnaire comprised 25 factors generated from the analysis of case studies that influence data quality in accounting information systems. The respondents were asked to rate each of those factors according to their perception on the importance of each factor in ensuring data quality in AIS, and the actual performance (achievement) on each of those factors. The importance was on a five-

point scale with '5' being the highest rating. The performance was also rated on a five-point scale ranging from 'poor' to 'excellent'. A field was added to indicate the circumstance where the factor was not applicable to the organisation for the performance.

The comparisons of means were employed for the analysis of the overall importance and performance of critical factors. For hypotheses testing, the first hypothesis was tested using a paired comparison *t*-test. Analysis of variance (ANOVA), together with Tukey post hoc comparison tests was executed for testing of hypotheses two and three. In addition, the *p* –value was utilised for all the three hypotheses, which added more precise statistical evidence for the hypotheses testing. The *SPSS* statistical analysis program was used to assist the analysis of the survey data.

5.1.1 Survey Response

A total of 1000 CPA (Certified Practising Accountant) Australia members were surveyed. Because the survey was administrated by CPA Australia, and due to privacy policy restrictions on the disclosure of member information; it was not possible to identify the respondents who had not replied after the first mail out (i.e. the first letter and questionnaire) and the addresses of the undeliverable survey. The second letter, which was the combined thank you / reminder courtesy letter, was printed at the same time as the first letter and questionnaire. It was dated and sent out one week after the first mail out. An estimated 15% of the surveyed members were deemed not eligible or not available to answer the questionnaire for various reasons as detailed below. From the estimated 850 eligible questionnaire recipients, we received 182 completed questionnaires. This makes the response rate approximately 21%.

Several non-responding members of the sample gave the following reasons for non-response:

- Retired;
- No longer or not working with the AIS;
- Moved overseas;

- Company was deemed too small; and
- Don't think to be eligible to answer the questionnaire.

A further 1000 questionnaires were sent to Australian Computer Society (ACS) members. The content of this questionnaire is the same to the one that sent to the members of CPA Australia. Here too two accompanied letters were sent, the first one with the questionnaire, while the second thank you /reminder letter sent some time later. There was an ACS member's database that contains the members that work in the finance area or have the financial /accounting interests. This accountancy interests group of ACS was targeted for the survey. However, it was found later that a large portion of the members in this database were actually only working in the finance or insurance industry as the IT professional, rather than have the direct working experience with finance or accounting systems. This fact made the actual number of eligible members for the survey much less than expected. A large number of correspondents were received from those members indicating that they were unable to participate to the survey because they thought that they were not eligible to answer the questionnaire. Again due to privacy restrictions issues, the ACS was not able to disclose their member's details, and therefore it was not possible to identify the exact number of how many targeted members were not eligible for the survey. According to the amount of the feedback received from the members, an estimated 300 targeted ACS members were not eligible, and probably another 5% of the member's information was out-off date. Among those 650 estimated eligible members, 100 questionnaires were completed and returned. Therefore, the response rate from IT professionals was at around 15%.

Together, a total of 2000 questionnaires were sent to accounting and IT professionals who work in Australian organisations. Because surveys were administrated by Australian professional bodies, and due to privacy policy restrictions of not disclosing member's details; it was not possible to identify the respondents who did not reply to the first mail out. Therefore, from an estimated 1550 eligible questionnaire recipients, a total of 282 completed questionnaires were received. This made the overall response rate 18.19%. All the analysis in this chapter was done on an overall basis (i.e. all the respondents together), which included responses from both CPA Australia and ACS.

5.2 Demographic information

This section describes the demographic information of the respondents in order to highlight the important characteristics of the respondents. Demographic information can aid the understanding and build the possible useful correlations with other survey findings.

5.2.1 Geographical Distribution

The survey covered industry from all Australian states (see Table 5.1). Some respondents preferred not to identify their location in their responses. Table 5.1 showed that the majority of responses came from NSW (113 responses) followed by Victoria (78 responses).

Table 5.1 Geographical distribution of responses

State	Frequency	Percent %
New South Wales	113	40.1
Victoria	78	27.7
Queensland	37	13.1
South Australia	12	4.3
Australian Capital Territory	5	1.8
Tasmania	4	1.4
Unidentified location	15	5.1
Total	282	100 %

5.2.2 Level of job responsibility

Table 5.2 showed the job level of the respondents divided into three main categories: top management, middle management and non-management employees. An important feature of the survey was that the majority of the respondents were from top management (61.5%) and middle management (27.7%). However, the responses from non-management employees (10.8%) provided some insight into the perceptions of non-managerial staff to the importance and performance of the AIS.

Table 5.2 Level of job responsibility of the respondents

Level of job responsibility	Percent %
Non-management employee	10.8 %
Middle management	27.7 %
Top management	61.5 %
Total	100.0 %

5.2.3 Type of Accounting Information Systems

Respondents were asked to classify the type of accounting information systems that their organisations used, in terms of the following classifications: developed in-house, commercial software package, customised package, or other types. As shown in figure 5.2, the majority of 61 percent were using commercial software packages. A sizable proportion of accounting information systems were developed in-house (19%) or customised package (17%).

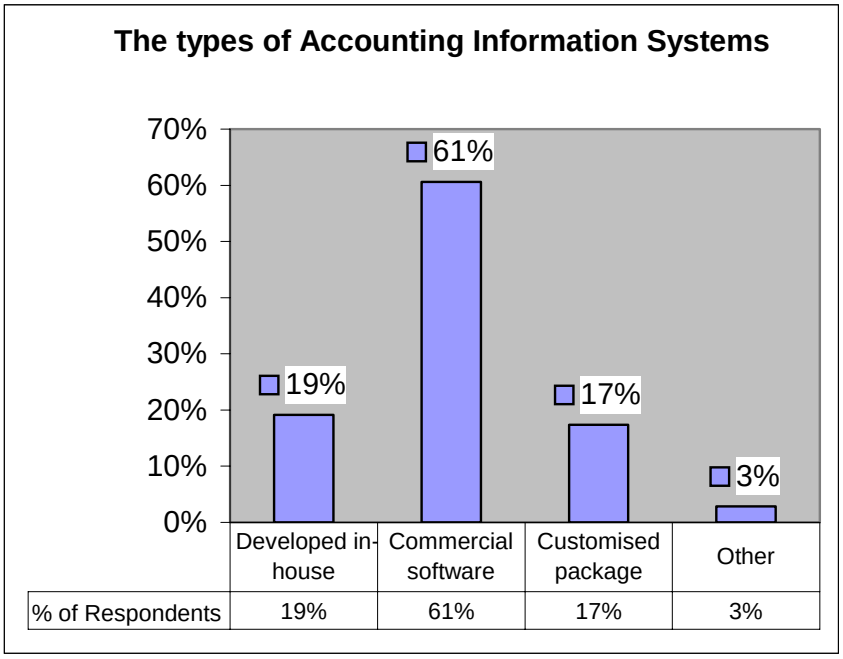


Figure 5.2 Distribution of the types of accounting information systems

5.2.4 Primary job function

The data in respect to primary job function (see Figure 5.3) revealed that the most of respondents were working in accounting and finance area (65%). Approximately 27% of respondents to the survey worked as the information management/ technology professionals. Managing director or CEOs comprised 1% of respondents o It is clear that a large majority (92%) of the respondents' primary job functions fell into the required survey target, as accounting and IT professionals were likely to belong to one of the defined stakeholder groups of this research. The method of how to re-category the respondents into the defined stakeholder groups and the distribution of those stakeholder groups are discussed in Section 5.4.2.

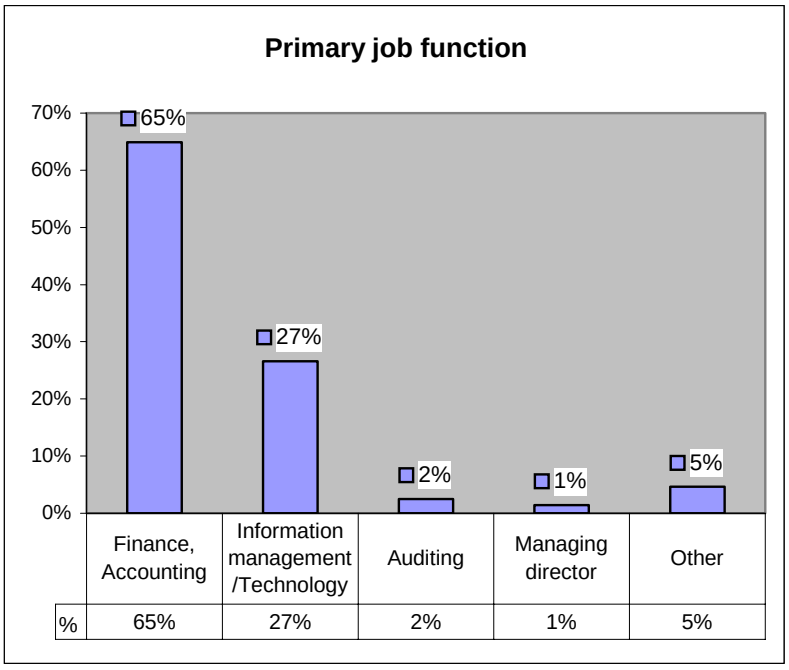


Figure 5.3 Primary job function of respondents

5.2.5 Industry types of the surveyed organisations

Prior to analyzing responses relating to industry type, old categories from the questionnaire were classified into four new categories: *manufacturing, finance and insurance, other service* and *other*. Figure 5.4 showed the demographic breakdowns by industry type of the surveyed organisations. These results show that the majority of the surveyed organisations were from service industry (65%); among them, 22

percent were specialising in finance and insurance. Manufacturing industry was also well represented with about 26 percent.

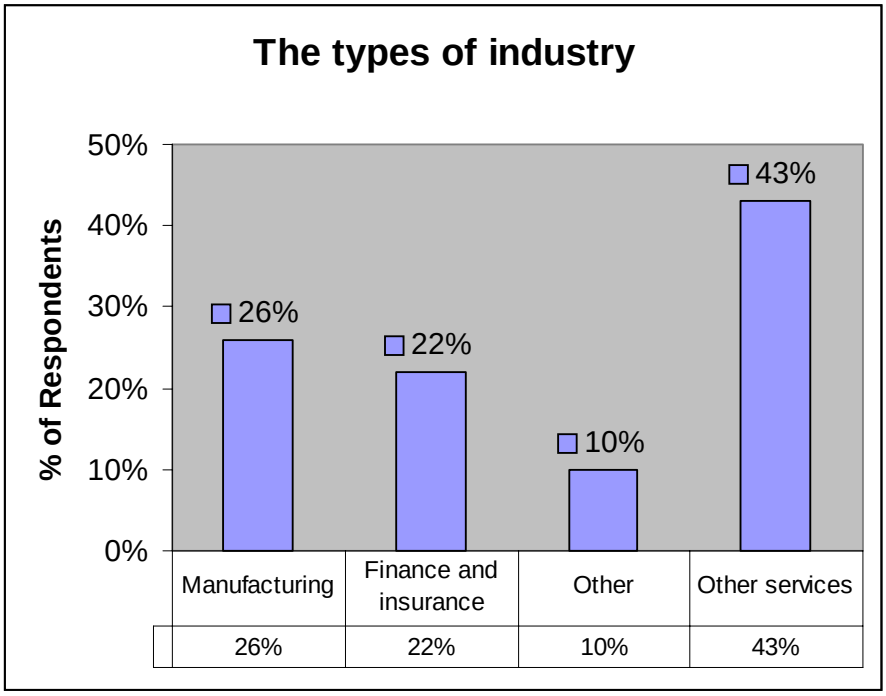


Figure 5.4 Industry types of the surveyed organisations

5.2.6 Operation level

The majority of respondents indicated that their organisation was operating internationally (52.1%), while 25.5% operated at the interstate level. A certain proportion was operating at state-wide level (11.3%), as well as a small number of local (8.9%) organisations (see Table 5.3).

5.2.7 Size of organisation

Three sets of data were collected in regarding the size of the organisation: total assets, the annual revenue, and the number of full time employees. With each of these variables, two more options were added for the respondents not very sure about the figures, as well as for those who were not permitted to disclose the information.

Table 5.3 Operation level of organisation

Operation level	Frequency	Percent %
Local only	25	8.9%
State wide	32	11.3%
Interstate	72	25.5%
Internationally	147	52.1%
Unstated	6	2.1%
Total	282	100%

The survey covered different sized organisations ranged from 5 employees to over 5000. From Table 5.4, it can be seen that more than 23% of the organisations have total assets between 10 to 99 million dollars while more than 30% of organisations have more than 100 million. About one third of organisations' the annual revenue were between 10 to 99 million, with another one third had over 100 million dollars. There are also noticeable proportion of small organisations with the total assets under 5 million dollars (21.6%), and the annual revenue less than 10 million (28.8%).

5.3 Overall analysis for importance and performance

Appropriate analysis of the critical factors distinguishes between the importance of factor and its actual performance. A successful organisation requires high performance on important factors and not to waste resources on factors of low importance. Table 5.5 reflected the viewpoint of respondents and summarises the results of the survey in terms of importance and performance of the factors.

5.3.1 Perceptions of importance

In order to investigate the overall results of the survey participant's responses, the various means for the perception of importance and performance of the CSFs were firstly analyzed. Table 5.5 shows the overall mean for each factor that was obtained to explore the level of importance perceived by the respondents. The results reveal that the importance values ranged from 3.25 that was between ' average importance' and ' very important, to 4.25, which was between 'very important' and 'extremely

important'. When these factors were arranged in order of importance, input controls, nature of the AIS, and top management commitment were perceived to be the three most critical factors, while data supplier quality management, cost / benefit tradeoffs and DQ manager were the three least important factors.

Table 5.4 Total assets, the annual revenue and full time employee numbers

The total Assets	Frequency	Percent %
Under $5 million	61	21.6%
$5 million to $9 million	40	14.2%
$10 million to$99 million	66	23.4%
Over $100 million	87	30.9%
Not sure	10	3.5%
Not permitted to disclose	9	3.2%
Unstated	9	3.2%
The annual revenue	**Frequency**	**Percent %**
Under $5 million	47	16.7%
$5 million to $9 million	34	12.1%
$10 million to$99 million	87	30.9%
Over $100 million	84	29.8%
Not sure	11	3.9%
Not permitted to disclose	12	4.3%
Unstated	7	2.5%
Full time employees	**Frequency**	**Percent %**
Over 5,000	50	17.7%
1,000 - 5,000	18	6.4%
100 – 999	78	27.7%
50 – 99	47	16.7%
10 – 49	58	20.6%
5 – 9	12	4.3%
Fewer than 5	11	3.9%
Un-stated	8	2.8%

5.3.2 Actual performance

The level or extent of the performance of those factors was another aspect that had been investigated. The means for each factor's performance were also shown in Table 5.5. It is very clear that the perception of performance was lower than that of importance in every case. The values ranged from 2.49 to 3.27, which corresponded to a 'fair' lever of practice. Among those factors, the three best-performed factors were number 1: top management commitment that rated much higher than other factors, input controls and physical environment, which were scored equally as number 2. The worst practiced factors were data supplier quality management, risk management, and cost / benefit tradeoffs.

There were some interesting similarities between the first three and least three factors of their importance and performance. Both input controls and top management were ranked within top three, while data supplier quality management and cost / benefit tradeoffs were among the bottom three of perception of importance and practice. This indicated that the importance of the top management commitment to data quality has been well addressed, and this understanding has furthermore turned to well-performed top management commitment in practice. This finding is very much close to what the quality management literature has been focused for a period of time, which means Australian organisations are comparable to the standard management practice in this regards. Input controls are most frequently mentioned and utilised methods in the accounting information systems literature and practice for ensuring data quality. The survey results show that in Australia, most stakeholders in AIS believe that to have the appropriate input controls for ensuring get information correct in the first place is a critical step to achieve high quality outcomes. Furthermore, the encouraging high performance level of input controls by the surveyed organisations gives the confidence of the real practice achievement by Australian organisations of this fundamental factor for data quality management.

Table 5.5 Mean importance and performance with ranking

Factor description	Importance		Performance		Mean difference (I-J)
	Mean (I)	Rank	Mean (J)	Rank	
Top management commitment	4.15	3	3.27	1	0.88
Middle management commitment	4.06	4	3.20	4	0.86
Education and training	3.88	11	2.76	19	1.12
DQ vision	3.78	16	2.75	20	1.03
DQ manager	3.25	25	2.71	21	0.54
Organisational structure	3.54	22	2.86	13	0.68
Policies and standards	3.72	18	2.78	17	0.94
Organisational culture	3.88	11	2.86	13	1.02
DQ controls	3.80	15	2.78	17	1.02
Input controls	4.25	1	3.21	2	1.04
User focus	4.05	5	2.94	10	1.11
Nature of the AIS	4.20	2	3.14	5	1.06
Employee relations	3.95	10	2.85	15	1.10
Management of changes	3.97	9	2.97	9	1.00
Measurement and reporting	3.87	13	2.92	11	0.95
Data supplier quality management	3.51	23	2.66	23	0.85
Continuous improvement	3.72	18	2.68	22	1.04
Teamwork (communication)	4.02	8	3.01	7	1.01
Cost / benefit tradeoffs	3.46	24	2.49	25	0.97
Understanding of the systems and DQ	3.87	13	2.80	16	1.07
Risk management	3.75	17	2.56	24	1.19
Personnel competency	4.03	6	2.97	8	1.06
Physical environment	3.71	20	3.21	2	0.50
Audit and reviews	3.69	21	2.87	12	0.82
Internal controls	4.03	6	3.10	6	0.93

5.4 Hypotheses Testing

In this section, the hypotheses for this research are tested and the results are discussed.

5.4.1 Hypothesis one: importance vs. performance

A test of hypothesis H_1 was carried out to discover whether there was any significant difference between the stakeholders' perceptions for the level of importance and the extent of real practice for each factor individually.

H_1: There is a significant difference between the perceptions of importance of critical factors for accounting information systems' data quality, and actual performance of those factors

The test involved a paired comparison *t*-test. SPSS-Compare Means Procedure was employed. The data was checked to be normally distributed and met the assumptions for using *t*-test. The *t*-test showed that there was a significant difference between the importance and the actual performance for each factor by their organisations (see Table 5.6). In other words, the importance positioned by the organisations on all the critical factors has not been placed into real practice.

It appeared that while the organisations placed a high degree of importance on certain factors, the extent of the performance of those factors were quite differed. The result showed a big gap between the importance and the performance of the critical factors, which indicated that although organisations were aware about the important roles those critical factors could play in ensuring data quality, they failed to execute them to a greater extent into their practice.

The difference between importance and performance means was very clear, with the smallest difference of 0.51 for physical environment, and the biggest gap of 1.24 for risk management. 16 out of 25 factors had the mean difference more than 1.00, which indicated that people may not act as what they think or believe. The values of the test statistic *t* ranged from 8.843 to 19.938, which were much higher than the critical value for a right-tailed test, which is $t_{0.05}$=1.645. Therefore, the value of the test statistic *t* fell in the rejection region of null hypothesis, and supported the alternative hypothesis H_1 that there is a significant difference between the importance and performance. Furthermore, to provide more precise evidence against the null hypothesis, the *P*- value was also included. Table 5.6 showed that the *P* – value for

all factors was 0.000 that was much less than the significance level of 0.05. The data provide very strong evidence that, for each factor, the importance was rated higher than the performance, and signify that there is a significant difference between those two sets of means. *Therefore, hypothesis H_1, that there is a significant difference between the perceptions of importance of critical factors for accounting information systems' data quality, and actual performance of those factors, is supported.*

Table 5.6 Paired sample statistics for mean importance and practice

Factors	Mean importance	Mean performance	*P*-value	*t*	Results
Top management commitment	4.15	3.27	0.000	14.602	Sig.
Middle management commitment	4.06	3.20	0.000	15.069	Sig.
Education and training	3.88	2.76	0.000	17.085	Sig.
DQ vision	3.78	2.75	0.000	16.009	Sig.
DQ manager	3.25	2.71	0.000	11.576	Sig.
Organisational structure	3.54	2.86	0.000	13.042	Sig.
Policies and standards	3.72	2.78	0.000	16.293	Sig.
Organisational culture	3.88	2.86	0.000	16.372	Sig.
DQ controls	3.80	2.78	0.000	16.657	Sig.
Input controls	4.25	3.21	0.000	17.404	Sig.
User focus	4.05	2.94	0.000	17.645	Sig.
Nature of the AIS	4.20	3.14	0.000	16.201	Sig.
Employee relations	3.95	2.85	0.000	18.405	Sig.
Management of changes	3.97	2.97	0.000	17.231	Sig.
Measurement and reporting	3.87	2.92	0.000	14.120	Sig.
Data supplier quality management	3.51	2.66	0.000	17.165	Sig.
Continuous improvement	3.72	2.68	0.000	19.271	Sig.
Teamwork (communication)	4.02	3.01	0.000	17.241	Sig.
Cost / benefit tradeoffs	3.46	2.49	0.000	16.185	Sig.
Understanding of the systems and DQ	3.87	2.80	0.000	17.745	Sig.
Risk management	3.75	2.56	0.000	19.938	Sig.
Personnel competency	4.03	2.97	0.000	17.143	Sig.
Physical environment	3.71	3.21	0.000	8.843	Sig.
Audit and reviews	3.69	2.87	0.000	14.753	Sig.
Internal controls	4.03	3.10	0.000	17.417	Sig.

5.4.2 Hypothesis two: Stakeholder groups

H_2: There is a significant difference between different stakeholder groups in their perceptions of importance of critical factors for accounting information systems' data quality

Main roles of the respondents from the survey were recoded into new categories that fit the defined stakeholder groups of the research framework. There were seven options in the questionnaire for respondent's 'main role relative to accounting information systems', and the respondents were only allowed to choose one of them. Those seven options covered the primary functions of the stakeholder groups of this study, and Table 5.7 showed how those options were converted into the defined stakeholder groups.

Table 5.7 Stakeholder groups and their main roles / primary functions

Stakeholder groups	Main roles / primary functions
Information producers	Create or collect data for the AIS
	Manage those who create or collect data for the AIS
Information custodians	Design, develop and operate the AIS
	Manage those who design, develop and operate the AIS
Information users	Use accounting information in task
Internal auditors	Audit or review data in AIS
Information manager	Manage data and / or data quality in AIS

The distribution of frequencies and percentages of the stakeholder groups from the survey was shown in Table 5.8. There were 36.5% of the respondents belonged to the information custodian group, 28.7% were information producers, and these two groups together consisted the majority of all the respondents (65.2%). It was reasonable as target respondents were from IT and accounting professional bodies, which were likely to be the person that primarily create or collect information and / or operate or develop the systems. Only seven respondents were internal auditors, which had the lowest percentage of 2.5%. This reflected that the audit and review function was not commonly performed by IT and accounting professionals in surveyed organisations.

Table 5.8 Stakeholder groups – frequencies and percentages

Stakeholder groups	Frequency	Percent
Information producers	81	28.7
Information custodians	103	36.5
Information users	56	19.9
Internal auditors	7	2.5
Information managers	35	12.4
Total	282	100.0

In order to investigate whether there are any differences in perceptions of importance of CSFs among the five stakeholder groups, information producers, information custodians, information users, internal auditors and information managers, analysis of variance (ANOVA) was employed as the statistical methodology. The importance of CSFs were being measured on an interval scale, and the stakeholder groups were considered as the factors, therefore, the ratings of all the factors were the dependent variables, with the stakeholders as the independent variable, the variables were tested to be normally distributed so that they are suitable for ANOVA. The results of ANOVA were presented in Table 5.9, together with the means and standard deviations of the factors (used as the dependent variables in the ANOVA) for each stakeholder group.

Table 5.9 Results of ANOVA for differences among the stakeholder groups

Factors	Stakeholders	Mean	Std. Deviation	F-value	Sig.
Top management commitment	Information producers	4.12	.70	0.021	.999
	Information custodians	4.16	.78		
	Information users	4.14	.78		
	Internal auditors	4.14	.90		
	Information managers	4.14	.69		
Middle management commitment	Information producers	4.09	.67	1.492	0.205
	Information custodians	3.97	.79		
	Information users	4.27	.67		
	Internal auditors	4.00	.82		
	Information managers	4.06	.76		
Education and training	Information producers	4.01	.81	2.069	0.085
	Information	3.73	.82		

	custodians Information users	4.02	.89		
	Internal auditors	3.43	.53		
	Information managers	3.88	.96		
DQ vision	Information producers	3.79	.86	0.811	0.519
	Information custodians	3.83	.82		
	Information users	3.75	.96		
	Internal auditors	3.29	.49		
	Information managers	3.69	.87		
DQ manager	Information producers	3.35	1.14	1.241	0.294
	Information custodians	3.26	1.08		
	Information users	3.14	1.20		
	Internal auditors	2.43	.98		
	Information managers	3.20	1.11		
Organisational structure	Information producers	3.58	.87	1.366	0.246
	Information custodians	3.59	.90		
	Information users	3.39	1.04		
	Internal auditors	2.86	.90		
	Information managers	3.57	1.01		
Policies and standards	Information producers	3.71	.78	1.990	0.096
	Information custodians	3.84	.75		
	Information users	3.51	.93		
	Internal auditors	3.17	1.17		
	Information managers	3.71	.87		
Organisational culture	Information producers	3.94	.73	0.653	0.625
	Information custodians	3.88	.91		
	Information users	3.86	.86		
	Internal auditors	3.43	1.13		
	Information managers	3.83	.71		
DQ controls	Information producers	3.86	.72	1.719	0.146
	Information custodians	3.82	.76		
	Information users	3.82	.72		
	Internal auditors	4.14	.69		
	Information managers	3.51	.95		
Input controls	Information producers	4.33	.67	1.237	0.296
	Information custodians	4.25	.78		
	Information users	4.27	.57		
	Internal auditors	4.14	.38		
	Information managers	4.03	.71		
User focus	Information producers	4.21	.68	2.419	0.049
	Information custodians	4.08	.65		*
	Information users	3.94	.83		

	Internal auditors	4.00	.00		
	Information managers	3.80	.83		
Nature of the AIS	Information producers	4.34	.61	1.807	0.128
	Information custodians	4.14	.59		
	Information users	4.12	.67		
	Internal auditors	3.75	.50		
	Information managers	4.20	.76		
Employee relations	Information producers	4.14	.77	2.325	0.057
	Information custodians	3.84	.81		
	Information users	3.84	.86		
	Internal auditors	3.57	.53		
	Information managers	4.06	.76		
Management of changes	Information producers	4.09	.69	0.987	0.415
	Information custodians	3.89	.68		
	Information users	3.94	.69		
	Internal auditors	4.00	.00		
	Information managers	4.00	.71		
Measurement and reporting	Information producers	4.00	.89	2.660	0.034
	Information custodians	3.86	.76		*
	Information users	3.74	.75		
	Internal auditors	2.75	1.26		
	Information managers	4.00	.74		
Data supplier quality management	Information producers	3.80	.74	3.812	0.005
	Information custodians	3.48	.89		*
	Information users	3.15	1.05		
	Internal auditors	3.33	1.21		
	Information managers	3.42	1.00		
Continuous improvement	Information producers	3.81	.77	1.574	0.181
	Information custodians	3.72	.75		
	Information users	3.51	1.01		
	Internal auditors	3.43	1.13		
	Information managers	3.86	.69		
Teamwork (communication)	Information producers	4.23	.61	2.336	0.056
	Information custodians	3.89	.92		
	Information users	3.92	.83		
	Internal auditors	3.83	.41		
	Information managers	4.09	.71		
Cost / benefit tradeoffs	Information producers	3.52	.83	1.005	0.405
	Information	3.46	.88		

	custodians				
	Information users	3.33	1.01		
	Internal auditors	3.00	1.15		
	Information managers	3.60	.88		
Understanding of the systems and DQ	Information producers	4.01	.70	1.843	0.121
	Information custodians	3.83	.67		
	Information users	3.68	.84		
	Internal auditors	3.67	.52		
	Information managers	3.91	.75		
Risk management	Information producers	3.73	.76	0.145	0.965
	Information custodians	3.78	.82		
	Information users	3.71	.92		
	Internal auditors	3.57	1.27		
	Information managers	3.71	.96		
Personnel competency	Information producers	4.00	.83	0.363	0.835
	Information custodians	4.09	.75		
	Information users	3.94	.61		
	Internal auditors	4.00	.58		
	Information managers	4.03	.79		
Physical environment	Information producers	3.67	.84	1.282	0.277
	Information custodians	3.64	.74		
	Information users	3.67	.86		
	Internal auditors	3.86	.69		
	Information managers	3.97	.75		
Audit and reviews	Information producers	3.70	.79	3.845	0.005
	Information custodians	3.71	.87		*
	Information users	3.35	1.00		
	Internal auditors	4.29	.49		
	Information managers	4.00	.91		
Internal controls	Information producers	4.12	.69	0.880	0.476
	Information custodians	4.03	.66		
	Information users	3.92	.78		
	Internal auditors	4.33	.52		
	Information managers	4.00	.79		

Note: Entries in the third column are mean values on a five-point interval scale

Entries in the forth column are standard deviations within the same stakeholder group

Entries in the fifth column are *F* –values between different stakeholder groups

Entries in the sixth column are significance between groups, with * indicating significance at $p<0.05$ level

From the ANOVA results of Table 5.9, it is seen that four of the 25 factors namely, *user focus, measurement and reporting, data supplier quality management*, and *audit and reviews* results showed statistically significant different means between the stakeholders at p= 0.05 level. Another factor *teamwork* was on the marginal scale with F- value of 2.336 and P-value of 0.056. The ANOVA was followed by Tukey post hoc comparison tests whenever the F-values were significant. These were shown in Table 5.10.

The pair-wise comparison of the stakeholders' means by Tukey tests in Table 5.10 showed that *information producers* seemed to have the most of the different ratings from other stakeholders (four out of the five significant means). They had the difference with *information managers* for user focus, with *internal auditors* for measurement and reporting (with the highest mean difference of 1.25), with *information users* for data supplier quality management, and with *information custodians* for teamwork. In all of those four cases, information producers showed better understanding of those issues, as their ratings of those factors were consistently higher than the other stakeholders.

Table 5.10 Tukey post hoc tests for stakeholder mean rating of importance of CSFs

Variable	Stakeholder pair showing significant difference		Mean Difference (I-J)	Sig.
	(I)	(J)		
User focus	Information producers	Information managers	0.41	0.037
Measurement and reporting	Information producers	Internal auditors	1.25	0.023
Data supplier quality management	Information producers	Information users	0.65	0.001
Teamwork	Information producers	Information custodians	0.34	0.039
Audit and reviews	Information managers	Information users	0.65	0.006

Accounting professionals are likely to be AIS's information producers. They perceive more importance of those four factors in ensuring data quality than other groups, which demonstrated that accounting professionals who are performing information producer roles exhibit a more comprehensive understanding along those issues, and in turn, see higher values of those factors in contributing higher quality information as the outcome of the AIS.

The largest mean difference found in the Tukey test was 1.25 with *P*-value of 0.023, which was between information producers and internal auditors for the *measurement and reporting* factor. This is quite surprising because one of the major functions of internal auditors is to evaluate the system and data quality performance and make reports of the implementation of data quality control activities. They are normally the person in the organisation acting like a policeman for checking the appropriateness of the operation of the systems and the quality of information generated from it, and making the regular reports for the performance and problems that may exist. The lack of understanding of the importance for measurement and reporting from the internal auditor groups of this study need to be noted, because they are the safeguard of the ultimate quality information output. There is a need to enhance the awareness of the role, which measurement and reporting could perform in ensuring data quality among internal auditor groups. On the other hand, information producers are those who create or collect data for the AIS, they are at the beginning of the information flow, and likely to be involved in the stage before information goes into the system and the input stage. However, the results showed that information producers were also care about the end of the information flow: quality information output of the systems. This demonstrates that information producers tend to take the ownership of the information. Therefore, they are not only interested in the data that goes into the system, but also the quality information that comes out of the system, which indicates that they have the fully concern of Garbage-in Garbage-out.

Another significant difference in the mean was for *audit and reviews*, which was between *information managers* and *information users*. Information managers tended to believe more that audit and reviews could assist other information quality improvement effort, where information users didn't value it much. This might occur since information managers were likely to have more experiences in auditing and

reviewing the systems and information, while information users were less likely to be involved in those review processes.

It was anticipated that the perception of importance for each factors would differ among different stakeholder groups. However, in the event it was found that only four out of 25 factors showed the significant difference, with another one on the margin. Not only the proportion of the total number of factors that had significant difference was low (16%), but also within those factors that did show a significant difference, the differences were not among all the five stakeholders, in all cases, the differences only existed between two stakeholder groups. *Thus, hypothesis H_2, that there is a significant difference between different stakeholder groups in their perceptions of importance of critical factors for accounting information systems' data quality, is partly supported (for five factors only).* Of the 25 factors, only five (*user focus*, *measurement and reporting*, *data supplier quality management*, *audit and reviews*, and *teamwork.)* were found to be statistically significant among different stakeholder groups, where other factors are not supported.

5.4.3 Hypothesis three: size of organisations

H_3: There is a significant difference between different sized organisations in their perceptions of importance of critical factors for accounting information systems' data quality

Table 5.11 The annual revenue of the organisations

The annual revenue	Size of the organisation	Frequency	Percent	Valid Percent
Under $5 million	***Very small***	47	16.7	17.1
$5 million to $9 million	***Small***	34	12.1	12.4
$10 million to$99 million	***Medium***	87	30.9	31.6
Over $100 million	***Large***	84	29.8	30.5
Not sure		11	3.9	4.0
Not permitted to disclose		12	4.3	4.4
System missing		7	2.5	
Total		282	100.0	

Since there is no one set of clear cut-offs for categorising the size of the organisations, the organisations' annual revenue figures were used as the scales for organisation size for the analysis of this study. The questionnaire has set four scales for the annual revenue: under $5 million, $5 million through $9 million, $10 million through $99 million, and over $100. There were also two additional options provided in the survey for those respondents that were not sure, and not permitted to disclose their organisations' annual revenue figures. Table 5.11 and Figure 5.5 showed the distribution of frequencies and percentages of the annual revenue of the surveyed organisations. For the purpose of this research, those scales could be further categorised as: very small organisations (under $5 million), small organisations ($5 million through $9 million), medium-sized organisations ($10 million through $99 million), and large organisations (over $100 million). Out of the total of 275 valid responses, 30.5% of the respondents were from large, and 31.6% were from medium-sized organisations. As can be seen, while there were only 12.4% and 17.1% for small and very small organisations respectively, the sample of respondents was mainly from large and medium-sized organisations (62%).

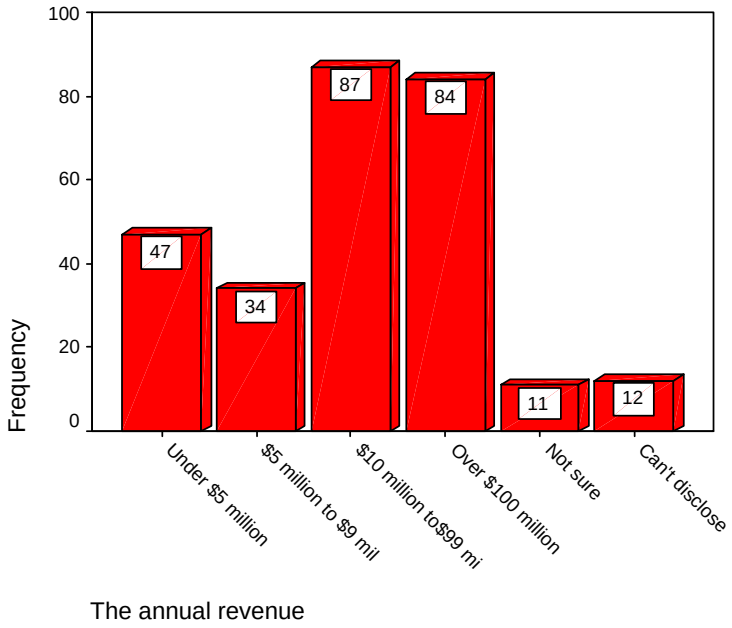


Figure 5.5 The annual revenue of the organisations

ANOVA analysis was used to explore whether there is any differences between different sized organisations in regarding the importance of the critical factors for accounting information systems' data quality. The ANOVA was chosen because the constructs of interest (dependent variables): importance of the factors was measured on the interval scale, and the organisational size was seen as the independent variable. Table 5.12 presented the ANOVA results for different sized organisations' perceptions in regarding to the importance of the critical factors for data quality in AIS.

Table 5.12 Results of ANOVA for different sized organisations

Factors	The annual revenue	Mean	Std. Deviation	*F*-value	Sig.
Top management commitment	Under $5 million	4.19	.74	0.715	0.613
	$5 million to $9 million	3.94	.89		
	$10 million to$99 million	4.15	.69		
	Over $100 million	4.21	.76		
Middle management commitment	Under $5 million	4.04	.84	0.403	0.846
	$5 million to $9 million	3.94	.78		
	$10 million to$99 million	4.13	.68		
	Over $100 million	4.08	.84		
Education and training	Under $5 million	3.76	.92	1.046	0.391
	$5 million to $9 million	4.03	.87		
	$10 million to$99 million	3.99	.80		
	Over $100 million	3.81	.84		
DQ vision	Under $5 million	3.77	.98	0.514	0.766
	$5 million to $9 million	3.68	.88		
	$10 million to$99 million	3.86	.75		
	Over $100 million	3.76	.90		
DQ manager	Under $5 million	3.23	1.09	0.315	0.903
	$5 million to $9 million	3.09	1.10		
	$10 million to$99 million	3.29	1.18		
	Over $100 million	3.23	1.13		
Organisational structure	Under $5 million	3.49	1.02	0.345	0.885
	$5 million to $9 million	3.42	1.03		
	$10 million to$99 million	3.62	.78		
	Over $100 million	3.49	1.06		
Policies and standards	Under $5 million	3.64	.77	0.729	0.602
	$5 million to $9 million	3.50	.88		
	$10 million to$99 million	3.81	.84		
	Over $100 million	3.73	.88		
Organisational culture	Under $5 million	3.83	.96	0.408	0.843
	$5 million to $9 million	3.91	.79		
	$10 million to$99 million	3.95	.87		
	Over $100 million	3.83	.77		
DQ controls	Under $5 million	3.72	.80	0.509	0.769
	$5 million to $9 million	3.74	.67		
	$10 million to$99	3.87	.85		

	million				
	Over $100 million	3.83	.74		
Input controls	Under $5 million	4.19	.74	0.657	0.656
	$5 million to $9 million	4.38	.65		
	$10 million to$99 million	4.29	.66		
	Over $100 million	4.25	.79		
User focus	Under $5 million	3.89	.76	1.013	0.410
	$5 million to $9 million	4.18	.80		
	$10 million to$99 million	4.09	.71		
	Over $100 million	4.08	.70		
Nature of the AIS	Under $5 million	4.20	.58	0.339	0.889
	$5 million to $9 million	4.18	.73		
	$10 million to$99 million	4.24	.64		
	Over $100 million	4.18	.69		
Employee relations	Under $5 million	3.94	.84	1.394	0.227
	$5 million to $9 million	3.97	.87		
	$10 million to$99 million	4.11	.69		
	Over $100 million	3.85	.88		
Management of changes	Under $5 million	3.87	.73	0.955	0.446
	$5 million to $9 million	4.00	.57		
	$10 million to$99 million	4.09	.65		
	Over $100 million	3.92	.76		
Measurement and reporting	Under $5 million	3.91	.73	0.248	0.940
	$5 million to $9 million	3.86	.79		
	$10 million to$99 million	3.95	.82		
	Over $100 million	3.78	.96		
Data supplier quality management	Under $5 million	3.43	.89	0.774	0.569
	$5 million to $9 million	3.39	.99		
	$10 million to$99 million	3.51	.93		
	Over $100 million	3.57	.99		
Continuous improvement	Under $5 million	3.57	.83	0.723	0.607
	$5 million to $9 million	3.79	.64		
	$10 million to$99 million	3.79	.79		
	Over $100 million	3.71	.89		
Teamwork (communications)	Under $5 million	3.82	1.15	1.297	0.266
	$5 million to $9 million	4.09	.63		
	$10 million to$99 million	4.09	.70		
	Over $100 million	4.08	.80		
Cost / benefit tradeoffs	Under $5 million	3.43	1.06	0.055	0.998
	$5 million to $9 million	3.50	.93		

	$10 million to$99 million	**3.45**	**.83**		
	Over $100 million	**3.45**	**.92**		
Understanding of the systems and DQ	**Under $5 million**	**3.89**	**.78**	**0.493**	**0.781**
	$5 million to $9 million	**3.84**	**.63**		
	$10 million to$99 million	**3.91**	**.75**		
	Over $100 million	**3.87**	**.73**		
Risk management	**Under $5 million**	**3.79**	**.98**	**0.412**	**0.840**
	$5 million to $9 million	**3.88**	**.64**		
	$10 million to$99 million	**3.74**	**.80**		
	Over $100 million	**3.65**	**.92**		
Personnel competency	**Under $5 million**	**3.96**	**.95**	**0.844**	**0.519**
	$5 million to $9 million	**4.24**	**.55**		
	$10 million to$99 million	**4.07**	**.74**		
	Over $100 million	**3.96**	**.72**		
Physical environment	**Under $5 million**	**3.81**	**.90**	**0.739**	**0.595**
	$5 million to $9 million	**3.79**	**.77**		
	$10 million to$99 million	**3.67**	**.82**		
	Over $100 million	**3.69**	**.78**		
Audit and reviews	**Under $5 million**	**3.43**	**1.14**	**2.308**	**0.045**
	$5 million to $9 million	**3.50**	**.99**		*****
	$10 million to$99 million	**3.70**	**.79**		
	Over $100 million	**3.92**	**.84**		
Internal controls	**Under $5 million**	**3.79**	**.88**	**2.623**	**0.025**
	$5 million to $9 million	**3.97**	**.53**		*****
	$10 million to$99 million	**4.15**	**.72**		
	Over $100 million	**4.14**	**.67**		

Note: Entries in the third column are mean values on a five-point interval scale

Entries in the forth column are standard deviations within the same sized organisations

Entries in the fifth column are *F* –values between different sized organisations

Entries in the sixth column are significance between groups, with * indicating significance at $p<0.05$ level

The ANOVA results from Table 5.12 showed that only two factors had statistically significant different means between the different sized organisations at p =0.05 level. Those two factors were: *audit and reviews* that had *F*- value of 2.308, and *internal controls* with *F*-value of 2.623. All other factors showed no significant differences in the means among the different sized organisations. Having obtained the ANOVA results, Tukey post hoc multiple comparisons were conducted for the factors that had

the significant *F* - values, to further investigate between what sized organisations there was a significant difference for those factors, which were shown in Table 5.13 and Table 5.14.

Table 5.13 Tukey HSD test of multiple comparisons for 'Audit and reviews'

Dependent Variable	(I) The annual revenue	(J) The annual revenue	Mean Difference (I-J)	Sig.
Audit and reviews	Under $5 million	$5 million to $9 million	-7.45E-02	.999
		$10 million to$99 million	-.28	.535
		Over $100 million	(*)-.49	.032
	$5 million to $9 million	Under $5 million	7.45E-02	.999
		$10 million to$99 million	-.20	.879
		Over $100 million	-.42	.201
	$10 million to$99 million	Under $5 million	.28	.535
		$5 million to $9 million	.20	.879
		Over $100 million	-.22	.619
	Over $100 million	Under $5 million	(*).49	.032
		$5 million to $9 million	.42	.201
		$10 million to$99 million	.22	.619

(*). The mean difference is significant at the .05 level.

Table 5.14 Tukey HSD test of multiple comparisons for 'Internal controls'

Dependent Variable	(I) The annual revenue	(J) The annual revenue	Mean Difference (I-J)	Sig.
Internal controls	Under $5 million	$5 million to $9 million	-.18	.874
		$10 million to$99 million	-.37	.057
		Over $100 million	-.35	.085
	$5 million to $9 million	Under $5 million	.18	.874
		$10 million to$99 million	-.18	.815
		Over $100 million	-.17	.869
	$10 million to$99 million	Under $5 million	.37	.057
		$5 million to $9 million	.18	.815
		Over $100 million	1.54E-02	1.000
	Over $100 million	Under $5 million	.35	.085
		$5 million to $9 million	.17	.869
		$10 million to$99 million	-1.54E-02	1.000

Tukey tests showed that the means were significantly different between very small (the annual revenue under $5 million) and large organisations (the annual revenue over $100 million) for *audit and reviews* factor with a significant *P* – value of 0.032, and mean difference was –0.49, which was the only pair that showing significant difference. From Table 5.13 and Table 5.14, the Tukey post hoc tests of 'audit and reviews' and 'internal controls' factors, it can be seen that all other pair-wise comparisons showed no significant difference. *Therefore, hypothesis H_3, that there is a significant difference between different sized organisations in their perceptions of importance of critical factors for accounting information systems' data quality, is supported for only two factors: audit and reviews and internal controls, not supported for other factors.*

Lack of significant differences among the different sized organisations may be explained on the basis of the spread of the awareness of information quality issues in accounting information systems across all surveyed organisations. It illustrated that the size of the organisations didn't have much influence on their perceptions of the critical factors for data quality. In other words, the level of importance of those factors was similar to surveyed organisations regardless of their sizes. Therefore, it indicates the possibility of generating a set of commonly applicable critical success factors for ensuring data quality in accounting information systems across different sized organisations; this is examined in the next section.

5.5 Most critical factors (MCF) for data quality in AIS

Survey respondents were asked in Section B of the questionnaire to select the top three most critical factors for DQ in AIS from the list of 25 factors in Section A. A number of respondents stated in this section that all 25 factors listed in the questionnaire were important; it was difficult for them to select what were the most important factors. This indicated that the list of factors in section A of the questionnaire were seen as appropriate to represent the respondents' real perceptions of critical factors for AIS's data quality, which further sanctioned the validity of the questionnaire design.

Table 5.15 Ranking of most critical factors

Factors	Percentage agree %	Ranking of most critical factor
Top management commitment	39.0	1
Middle management commitment	11.2	10
Education and training	33.5	2
DQ vision	13.9	8
DQ manager	3.6	22
Organisational structure	4.5	20
Policies and standards	10.3	13
Organisational culture	11.6	9
DQ controls	4.9	19
Input controls	19.2	5
User focus	10.7	12
Nature of the AIS	31.3	3
Employee relations	5.3	18
Management of changes	4.0	21
Measurement and reporting	7.1	15
Data supplier quality management	0.9	24
Continuous improvement	8.0	14
Teamwork (communication)	15.6	7
Cost / benefit tradeoffs	3.1	23
Understanding of the systems and DQ	17.9	6
Risk management	5.8	16
Personnel competency	21.8	4
Physical environment	0.4	25
Audit and reviews	5.3	17
Internal controls	11.2	11

Top ten most critical factors

In order to summarise ranking order for all respondents of the most critical factors, a data transformation was conducted by sum the percentage of the 3 most critical factors to develop a new scale that represented the total percentage agreed on the factors, and therefore would be able to determine the summarised rank ordering for most critical factors base on those percentages. Table 5.15 provided the total

percentage agreed for each factor to be one of the most critical factors from section B of the questionnaire, and the ranking order of those factors based on their summed percentage, with top ten factors being highlighted.

From Table 5.15, it can be seen that the top three most critical factors were:

1) Top management commitment (39%)
2) Education and training (33.5%)
3) Nature of AIS (31.3%)

The remaining factors of the top ten were: 4) personnel competency; 5) input controls; 6) understanding of the systems and DQ; 7) teamwork; 8) clear DQ vision; 9) organisational culture and 10) middle management commitment.

From the responses on the most critical factors, a number of observations could be drawn. The *first* most critical factor, *top management commitment*, indicates that top management participation is crucial for the success of data quality management in AIS. The extent of top management commitment could be considered as a measure of the organisations' commitment to data quality management. This survey result is consistent with most of quality management literature, as successful quality performance requires top management dedicate to the quality goal (Crosby, 1979; Juran, 1989). It is very clear that if an organisation wish for its data quality effort to be of successful, those in top management positions have to provide the initiative for data quality assurance practices and support data quality control activities.

Education and training was ranked as *second* most critical factor. This indicates that education and training of employees and management at all level has been seen as essential in order to have data quality insurance and improvement efforts to be of success. The adequate education and training program can help to create an empowered workforce that leads to better data quality performance.

Nature of the AIS was found as the *third* most critical factor for data quality. As this study was conducted in Australia, therefore, it reflects that Australian organisations believe that the suitable systems/packages are fundamental for producing quality outcome. It shows that people suppose a good system can often automatically generate the high quality information. Therefore, making sure the system has all the important and appropriate features that fit the organisation's needs is necessary and it is also what other data quality improvement efforts counted for.

5.6 Critical success factors for data quality in accounting information system

From the comparison of the ranking of the *most critical factors* in Table 5.15 and the ranking based on the *mean importance* rating in Table 5.5, it is clear that there were some similarities as well as differences. Six out of ten most critical factors are also ranked top ten based on the mean importance rating, and therefore, they are identified as the ***critical success factors*** for data quality in AIS.

First, *top management commitment* is a priority for successful data quality management. Second, in order to have quality information output, one must have a suitable and adequate *accounting information system* in place. Third, *input controls*, as one of the most important controls for AIS is crucial in making sure the quality of the accounting information.

In addition, two other people related factors: *personnel competency* and *teamwork* seem to also have a big influence on data quality of AIS. This might be explained as all the good systems and data quality assurance programs need competent person to implement. Furthermore, competent individuals cannot perform DQ control activities themselves, during those implementation processes; people should work together as a team in order to maximise the outcomes of the data quality improvement efforts. Finally, *middle management* acting as the linkage between top and bottom of the organisation could play an important role in AIS's data quality management.

On the other hand, there are also four factors in the top ten most critical factors were not in the top ten of the overall mean importance ranking. Those factors are: education and training, DQ vision, organisational culture, and understanding of the systems and DQ. Among them, organisational culture has the smallest difference, placed the ninth in MCF, and the 11th in mean importance. Three others have quite large difference between the two sets of ranking, such as the second MCF education and training only ranked as the 11th in according to the mean importance, and the sixth MCF understanding of the systems and DQ just placed the13th in mean importance ranking.

This may reflect that when people are asking about the most critical factors for data quality in AIS, they tend to focus on the few essential issues from an overall picture, which is sometimes different from their evaluation of the importance for the individual factor. When the survey respondents were asked to rate the importance of the factors, they only have five scales for each factor, but by ranking the factors, they can put them in order. For instance, one may give the same 4 rating for both top management commitment and education and training, but rank top management commitment as number 1, and put education and training on the third place of the ranking. Therefore, the design of the questionnaire and the slightly different nature between the rating scales and the ranking order of the listed factors is another reason that may cause some difference between the ranking order of the factors' mean importance and most critical factors.

5.7 Conclusion

This chapter reported the statistical analysis that was conducted on the survey data of this research. The selected statistical techniques for data analysis were identified and explained. Survey respondents' geographical information was provided using descriptive analysis. It was found that most of the factors proposed in the questionnaire were considered to be important.

The paired comparison *t*-test revealed a significant difference of mean importance and mean performance for all the 25 factors. It indicated that there was a big gap

between the people's perceptions of importance and their actual performance. For each factor, mean performance was lower than mean importance. The major areas that lack of practice included: Cost /benefit tradeoffs, Risk management, and Data suppler quality management. There were some commonalities as well as differences in the perceptions of the importance of the factors between different stakeholder groups, and different sized organisations. The ANOVA analysis showed that five factors had significant different means among different stakeholder groups, those factors were: user focus, measurement and reporting, data supplier quality management, teamwork, and audit and reviews. In contrast, there were only two factors (audit and review, and internal controls) revealing differences among different sized organisations.

Finally, the chapter identified critical success factors for ensuring data quality in AIS by combining the ranking results of mean importance and most critical factors. The CSFs influencing data quality in AIS are: *top management commitment*, *nature of the AIS*, and *input controls*, as the top three most critical factors, together with personnel competency, teamwork and middle management commitment that also are deemed to be important. A detailed discussion of the implications of all findings is provided in the next chapter.

6 Conclusion

6.1 Introduction

The objective of this research was to investigate the research problem: *There is a lack of knowledge of critical success factors for data quality in accounting information systems.*

Chapter 1 outlined the research problem describing the importance of data quality management in accounting information systems and its implications for success. The justification for this research was discussed in terms of lack of prior research about critical success factors for data quality in AIS and the possible benefits to research practice.

In turn, Chapter 2 reviewed the extant literature relating to quality and data quality management and identified gaps in the body of knowledge. First, the three parent disciplines of quality management, data quality, accounting information systems were presented (Sections 2.3 to 2.5). Then, the immediate discipline of critical success factors for data quality in accounting information was reviewed. This review revealed that no study has empirically examined the critical success factors that impact upon data quality in accounting information systems and this led to the four research questions shown in Table 6.1**.**

Chapter 3 outlined and justified the appropriateness of the case study and survey research methodologies within the scientific realism and positivism paradigms to investigate what are the critical success factors for the data quality of accounting information systems. The Chapter also detailed the fieldwork for case study data collection, and statistical techniques used for survey data analysis. Finally, ethical considerations of the research were addressed.

Table 6.1 List of research questions for this research

Research Question number	**Research questions**
Research Question 1	*What factors affect the variation of data quality in accounting information systems, and why?*
Research Question 2	*Are there any variations with regard to the perceptions of importance of those factors that affect data quality in accounting information systems between:* *2.1. different major AIS stakeholder groups* *2.2. different sized organisations*
Research Question 3	*What is the actual performance level by real world organisations in practice with respect to the factors that affect data quality in accounting information systems?*
Research Question 4	- *Which of these factors are **critical success factors** to ensure high quality data in accounting information systems?*

Source: developed for this research

Next, Chapter 4 analysed the data collected from seven cases by conducting in-depth interviews with different stakeholder groups within each organisation, which consisted of at least five stakeholders from each large organisation and three from SMEs. Both within and across case analysis was provided, with extensive citations of the case study participants that gave significant insights into the issues that had been addressed.

Chapter 5 analysed the data collected from two large scale surveys sent to CPA Australia and the ACS. The total 282 valid responses from those two surveys were combined and analysed as a whole. The chapter also included the testing of the three hypotheses.

In this *final* chapter, conclusions about each of the four research questions given in Table 6.1 are presented and the specific contributions of this research are identified by comparing the findings from Chapters 4 and 5 to the extant literature in Chapter 2. In turn, conclusions about the research problem are presented and the implications of the research for theory and practice are detailed. The Chapter concludes with a discussion of the limitations of the study and the identification of areas for further research. An outline of Chapter 6 is presented in Figure 6.1.

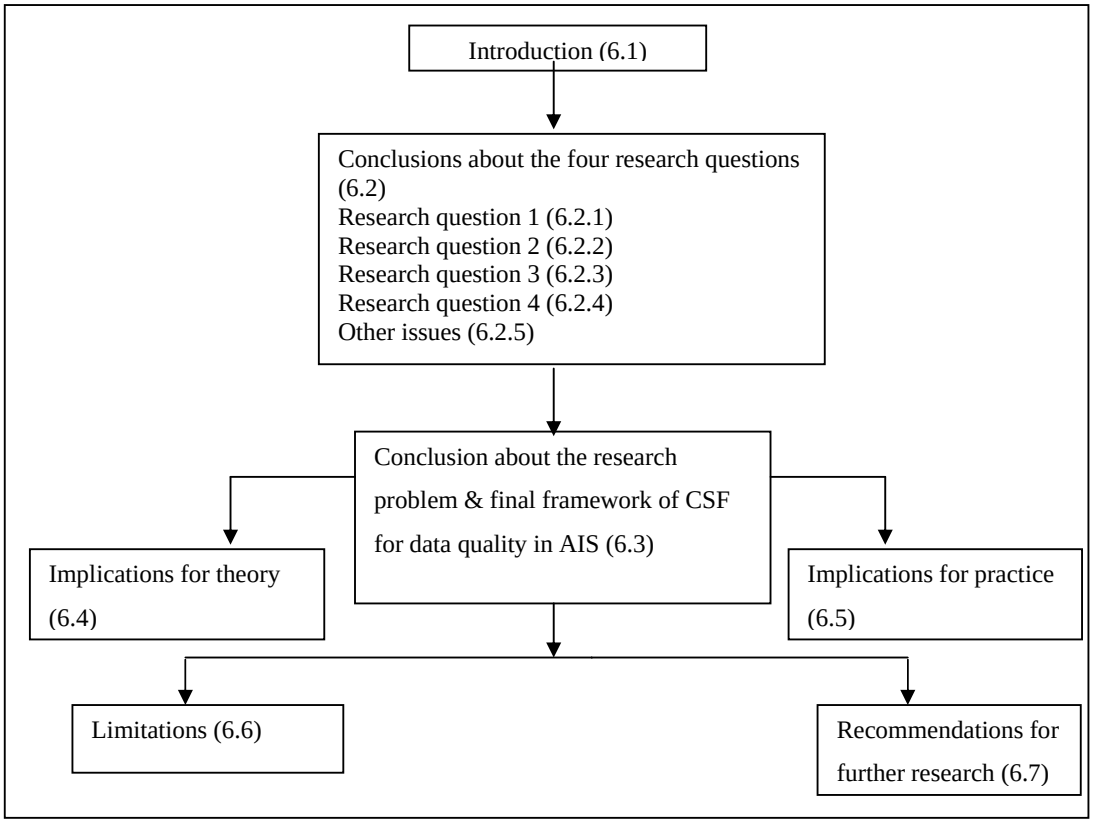


Figure 6.1 Outline of Chapter 6 with section numbers in brackets

Source: developed for this research

6.2 Conclusions about the four research questions

This section presents the conclusions reached about the four research questions. That is, the findings analysed in Chapters 4 and 5 are compared with the literature

presented in Chapter 2. A summary of the main contributions related to the four research questions is shown in Table 6.2.

Table 6.2 Conclusions about CSFs for data quality in AIS (with the extent of previous research about them shown in column iii)

Research question (i)	**Conclusions based on the findings of this research (ii)**	**Made explicit in the extant literature (iii)**
1	Factors that affect the variation of data quality in accounting information systems:	
	1 (a) AIS characteristics	To some extent
	1 (b) DQ characteristics	To some extent
	1 (c) Related factors of stakeholders	To a very small extent
	1 (d) Organisational factors	To some extent
	1 (e) External factors	To some extent
2	Variations in perceptions of the importance of factors that affect data quality in AIS between:	
	2 (a) different AIS stakeholders'	No
	2 (b) different sized organisations	No
3	Actual performance of those factors in real-world organisations	No
4	Ranking order of the most critical factors for data quality in AIS	No
	Critical success factors for data quality in AIS	No

Source: developed for this research from literature review and the analysis of field data

The precise meaning of the contributions listed in Table 6.2:

- where there is 'No' in column (iii) means new areas where no previous research has been conducted;
- where there is 'To some extent' in column (iii) means areas about which there were some mentions in the literature but no empirical investigation; and

- where there is ‘To a very small extent’ in column (iii) means areas about which there were speculations or mentions in passing in the literature, but that received very little attention in the extant literature.

Each research question will be discussed in the subsequent sections. That discussion starts with a brief summary of the literature and findings from the case studies of this research, which answered the first research question. In this section, the term ‘literature’ primarily refers to the parent disciplines of quality management, data quality and accounting information systems that were discussed in Chapter 2. Then, the findings of the survey are discussed to address Research Questions 2-4, as well as the conclusions for the three research hypotheses.

6.2.1 Conclusions about Research Question 1

Research Question 1: What factors affect the variation of data quality in accounting information systems, and why?

This section summarises the findings of Research Question 1 about what factors impact on data quality in accounting information systems. To find out what factors affect data quality in accounting information systems, it was necessary to first examine the factors identified in the relevant literature that have been found to impact on quality and data quality.

Possible factors affect quality and data quality

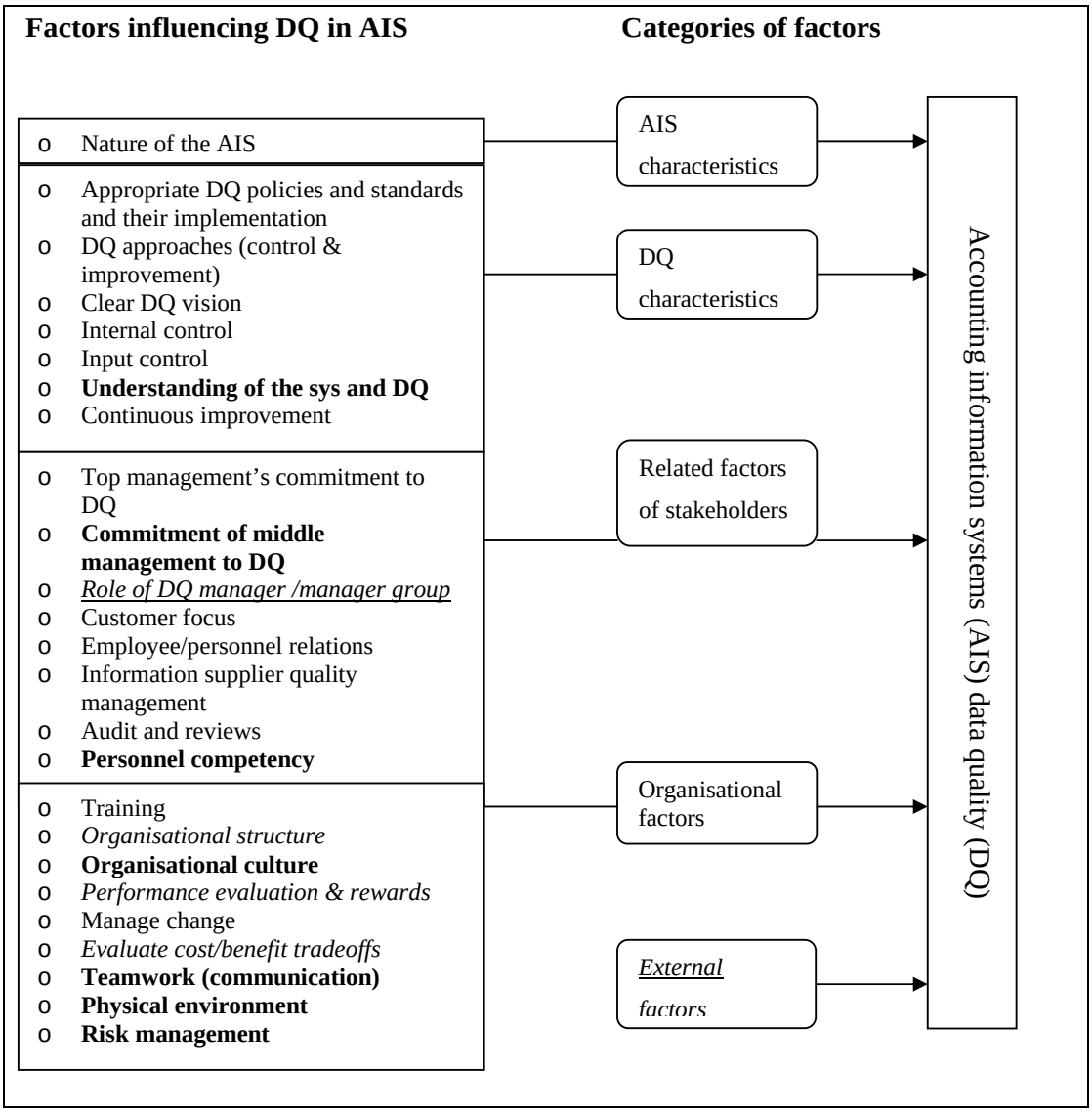
The first factor to consider is the quality management area. The literature about quality management and TQM identify several critical success factors. The literature in the data quality field has recognised some important steps and points in ensuring high quality data. In contrast, the literature about accounting information systems focuses on only two critical fundamental factors for ensuring accounting information quality: internal controls, and audit and reviews. The literature together with the findings from the pilot case studies were combined and summarised to a list of possible factors that may impact on data quality in AIS. This proposed list of factors

was then used as the guide for the data collection of the seven main case studies of this research.

The framework for factors influencing data quality in accounting information systems

After the within case and across case analysis at the end of the Chapter 4 case study data analysis, a framework was developed for factors that may impact on data quality in accounting information systems. The total of 26 factors identified from the case studies was categorised into five groups: characteristics of accounting information systems, data quality characteristics, related factors of stakeholders, organisational factors and external factors.

Some of the factors were 'new' factors that had been suggested by the pilot and main case studies. Although some of those 'new' factors have been mentioned in other disciplines in similar terms and they are not new as concepts, they were specifically identified by this research as factors that may impact on data quality in AIS. Those new factors are discussed in details in the next sub-section. There are also two proposed factors that were not supported by the case studies (external factors and data quality managers). Additionally three factors were found to have conflict findings from the case studies. They are *appropriate organisational structure*, *performance evaluation* (*measurement and reporting)*, and *evaluation of cost/benefit tradeoffs*. Other proposed factors were confirmed by the case studies to be of importance for ensuring data quality in AIS. Figure 6.3 that is copied from Figure 4.3 of Chapter 4 shows the identified factors and the categories they belong to.



Source: developed for this research, copied from Figure 4.3 in Section 4.8

Legend: **Bold**: 'new factors' identified by case studies
Italics: factors that have conflict findings from case studies
Italics & underline: factors not supported by case studies
Normal: factors identified from literature review and supported by the case studies

Figure 6.2 The refined-research framework for factors influencing data quality in accounting information systems

The 'new' factors identified by this study

There are seven factors that have been *identified* by this research that impact on data quality in AIS that have not been reported in previous studies (Section 4.7.1):

- **Teamwork (communication)**, which requires everyone involved with the systems working as a team to have sufficient communication;
- **Risk management**, defined as the awareness of and level of commitment to the reduction of the consequences of poor data quality in AIS;
- **Middle management commitment to data quality** which relates to the essential requirement in large and medium organisations of acceptance of responsibility by middle managers in ensuring data quality;
- **Personnel competency**, which relates to the competency of individual personnel that are responsible for data quality in AIS;
- **Physical environment**, which means a pleasant physical working environment, such as a modern environment with air-conditioning and sufficient office space;
- **Organisational culture of focusing on data quality**, which requires a culture within an organisation to promote data quality, as there must be high quality data in AIS; and
- **Understanding of the systems and data quality**, which includes 1) understanding how the systems work (technical competence); 2) understanding the importance of data quality and its relationship to business objectives (perception of importance); and 3) understanding the usefulness and usage of information (the right information to the right people at the right time in the right format)

That is, this research contributes to the literature by identifying seven factors that impact on the data quality of AIS and are not explicitly discussed in the extant literature.

Conclusion about Research Question 1

In summary, this research *found* that there are 26 factors that can affect data quality in accounting information systems. Many of the factors found in this research are reported in the existing relevant studies in a similar form. However, the existing literature is focused on quality and data quality management in general. This research is some of the first that has attempted to identify critical factors for data quality in accounting information systems in particular. Furthermore, the study discovered some 'new' factors that had not been addressed by the previous literature as critical for ensuring data quality. This research has identified and investigated five categories of factors, and provided a comprehensive list of factors that impact on data quality in accounting information systems. These precise and comprehensive lists of factors and their categorisation are important contributions to the field because no previous research has investigated the factors that affect data quality in accounting information systems in much detail.

6.2.2 Conclusions about Research Question 2

Research Question 2: *Are there any variations with regard to the perceptions of importance of those factors that affect data quality in accounting information systems between:*

- *2.1. different major AIS stakeholder groups*
- *2.2. different sized organisations*

Research Question 2 was examined by seven main case studies, and further tested in the large scale surveys. Case studies were carried out in seven different sized Australian organisations, four of which were large organisations and three of which were SMEs. Major AIS stakeholders were identified and interviewed in each of the case organisations. Factors identified from the case studies were then further tested using two large scale surveys, which were sent to the two largest accounting and IT professional bodies in Australia.

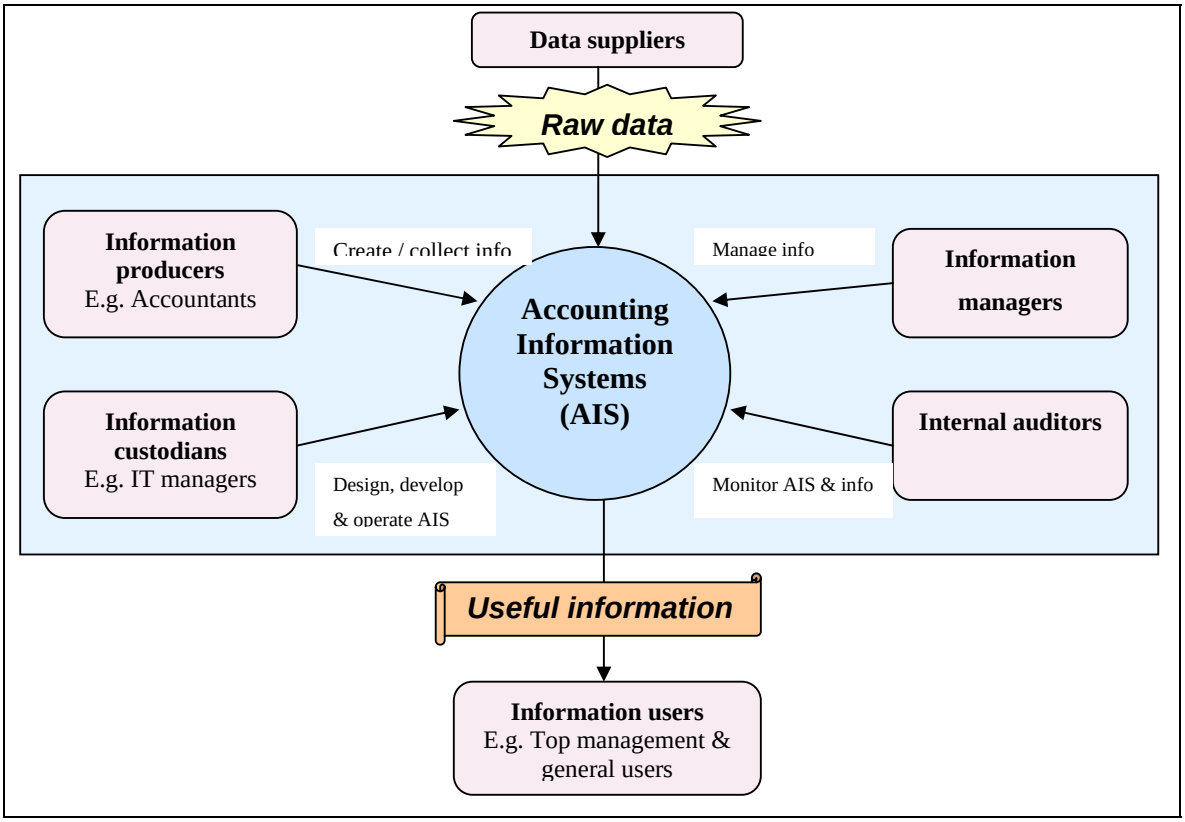
The survey questionnaire was designed based on the findings of the case studies. The decision was made to keep 25 out of 26 factors from the case studies in the questionnaire, since most of them were deemed to impact on data quality in AIS. Many of the factors were kept with the same names, while some had slight changes to make them clearer for the survey respondents. There were also quite a number of factors that included sub-factors that needed to be identified by the case studies. The questionnaire is included in the thesis as Appendix II. The only factor that was eliminated from the survey was external factors. These were not completely erased but rather listed as a sub-factor for change management. This was because the findings of the case studies suggested that external factors themselves would not have too much direct influence on data quality, and because how those external changes were managed would make a difference to data quality.

In order to investigate Research Question 2.1 (*whether there are any variations between different stakeholders' perception of importance on the factors that impact on data quality in AIS*) it is important to first identify the major AIS stakeholder groups.

Stakeholder groups of data quality in accounting information systems

One of the important contributions of this research is the development of a framework for understanding relationships between stakeholder groups and data quality in accounting information systems (see Figure 6.3 copied from Figure 2.3). The literature reports little research about how different stakeholder groups are involved in data quality and accounting information systems. Although there are some studies that have attempted to identify the stakeholder groups (Wang, 1998), and their perceptions of data quality output (Sharks & Darke, 1998), there is a need to develop a framework that shows the relationships between stakeholder groups and data quality in AIS. This research identified five stakeholder groups that were important for data quality in AIS. They are information producers, information custodians, information managers, information users, and internal auditors. In addition, raw data suppliers have also been identified as important stakeholders and have been incorporated into the framework. However, because it is normally difficult

to approach them and sometimes they are external to the systems and organisations, they were not included as participants in the case studies and surveys of this study.



Source: developed for this research, copied from Figure2.3 in Section3.6.3

Figure 6.3 A framework for understanding the relationships between stakeholder groups and data quality in accounting information systems

Conclusion about Research Question 2.1: different stakeholders

As described previously, the extant literature of quality management, data quality and accounting information systems has mentioned some factors that may impact on quality and data quality (Sections 2.3 to 2.5) and stakeholder groups for data quality (Section 2.6.4). However, there is virtually no *empirical* evidence in this literature about how different stakeholder groups would evaluate the importance of the factors that influence data quality in AIS.

In turn, this research investigated the different stakeholders' perceptions of the important factors that impact on data quality in AIS. Different stakeholders were interviewed in the case studies. The findings of the case studies were the combination of those different stakeholders' perceptions that led to the identification of a set of factors that influence data quality in AIS that, which were then tested by the surveys that followed. The precise measure of the difference between stakeholder groups was addressed by examining Hypothesis 2.

Hypothesis 2: **there is a significant difference between different stakeholder groups in their perceptions of important critical factors for the data quality of AIS**

It was hypothesised that different stakeholder groups would have different perceptions of all the 25 factors in the questionnaire. The results indicated that only four factors were found to be significantly different between the stakeholder groups: *user focus, measurement and reporting, data supplier quality management* and *audit and reviews*. All other factors had no significant difference between the different stakeholder groups.

An ANOVA was carried out to test Hypothesis 2, followed by Tukey post hoc comparison tests whenever the *F*-values were significant. Table 6.3 copied from Table 5.10 of Chapter 5 indicated where the differences were between the different stakeholder groups and how much those differences were in relation to their perceptions of the importance of critical factors for data quality in AIS.

The pair-wise comparison of the stakeholders' means by Tukey tests in Table 6.3 showed that *information producers* seemed to have the greatest number of different ratings compared with other stakeholders (four out of the five significant means) namely, the difference with *information managers* for user focus, with *internal auditors* for measurement and reporting (with the highest mean difference of 1.25), with *information users* for data supplier quality management, and with *information custodians* for teamwork. In all of those four cases, information producers showed better understanding of those issues, as their ratings of those factors were consistently higher than the other stakeholders.

Table 6.3 Tukey post hoc tests for stakeholder mean rating of important critical factors

Variable	Stakeholder pair showing significant difference		Mean Difference (I-J)	Sig.
	(I)	(J)		
User focus	Information producers	Information managers	0.41	0.037
Measurement and reporting	Information producers	Internal auditors	1.25	0.023
Data supplier quality management	Information producers	Information users	0.65	0.001
Teamwork	Information producers	Information custodians	0.34	0.039
Audit and reviews	Information managers	Information users	0.65	0.006

Source: developed for this research, copied from Table5.10 in Section5.4.2

Conclusions about Research Question 2.2

To investigate the influence of the size of the organisations on the perceptions of important critical factors, this research has reported findings from both case studies and surveys relating to whether the organisations' size would have an impact. Firstly, from a comparison of case studies of different sized organizations, it appears there is consensus in the overall assessment of the factors by both large organisations and SMEs. Across case analysis shows no major disagreement between different sized organizations regarding the perceptions of the important factors that impact on data quality in AIS. Secondly, the precise measure of the difference between different sized organisations was addressed by examining Hypothesis Three.

Hypothesis Three: ***there is a significant difference between different sized organisation in their perceptions of important critical factors for AIS data quality***

It was hypothesised that different sized organisations would have different perceptions of all the 25 factors in the questionnaire. However, the results indicated that there was only one factor, '*audit and reviews'*, that was found to be different between very small and large organisations. Another factor, '*internal controls'*, had

significant difference among all groups in the ANOVA test, but was not found to have significant difference between any pairs of groups in the following Tukey post hoc multiple comparison test.

In summary, from an overall viewpoint, this consistent finding from different sized organisations provides an opportunity to identify a set of important factors for data quality in AIS in general across different sized organizations.

6.2.3 Conclusions about Research Question 3

Research Question 3: *What is the actual performance level by organisations in practice with respect to the factors that affect data quality in accounting information systems?*

Table 6.4, which is copied from Table 5.5 in Chapter 5, shows the ranking of the factors with respect to overall importance and performance. Table 6.4 included the means of the performance rating and the ranking according to the means. It is clear that the perception of performance was lower than that of the importance of each factor. The values of mean performance ranged from 2.49 to 3.27, which corresponds to a 'fair' level of practice. Among those factors, the three best-performing factors were: top management commitment, input controls and physical environment. The worst practised factors *were data supplier quality management, risk management,* and *cost/benefit tradeoffs*. Furthermore, Research Question 3 was extended to measure the difference between the perception of importance and actual performance of those factors, which was addressed by examining Hypothesis One.

Table 6.4 Mean importance and performance with ranking

Factor description	Importance		Performance		Mean difference (I-J)
	Mean (I)	Rank	Mean (J)	Rank	
Top management commitment	4.15	3	3.27	1	0.88
Middle management commitment	4.06	4	3.20	4	0.86
Education and training	3.88	11	2.76	19	1.12
DQ vision	3.78	16	2.75	20	1.03
DQ manager	3.25	25	2.71	21	0.54
Organisational structure	3.54	22	2.86	13	0.68
Policies and standards	3.72	18	2.78	17	0.94
Organisational culture	3.88	11	2.86	13	1.02
DQ controls	3.80	15	2.78	17	1.02
Input controls	4.25	1	3.21	2	1.04
User focus	4.05	5	2.94	10	1.11
Nature of the AIS	4.20	2	3.14	5	1.06
Employee relations	3.95	10	2.85	15	1.10
Management of changes	3.97	9	2.97	9	1.00
Measurement and reporting	3.87	13	2.92	11	0.95
Data supplier quality management	3.51	23	2.66	23	0.85
Continuous improvement	3.72	18	2.68	22	1.04
Teamwork (communication)	4.02	8	3.01	7	1.01
Cost / benefit tradeoffs	3.46	24	2.49	25	0.97
Understanding of the systems and DQ	3.87	13	2.80	16	1.07
Risk management	3.75	17	2.56	24	1.19
Personnel competency	4.03	6	2.97	8	1.06
Physical environment	3.71	20	3.21	2	0.50
Audit and reviews	3.69	21	2.87	12	0.82
Internal controls	4.03	6	3.10	6	0.93

Source: developed for this research and copied from Table5.5 in Section5.3.2

Hypothesis 1: ***There is a significant difference between the perceptions of the important critical factors for the data quality of accounting information systems and the actual performance of those factors***

Table 6.5 Paired sample statistics for mean importance and practice

Factors	Mean importance	Mean performance	*P*-value	*t*	Results
Top management commitment	4.15	3.27	0.000	14.602	Sig.
Middle management commitment	4.06	3.20	0.000	15.069	Sig.
Education and training	3.88	2.76	0.000	17.085	Sig.
DQ vision	3.78	2.75	0.000	16.009	Sig.
DQ manager	3.25	2.71	0.000	11.576	Sig.
Organisational structure	3.54	2.86	0.000	13.042	Sig.
Policies and standards	3.72	2.78	0.000	16.293	Sig.
Organisational culture	3.88	2.86	0.000	16.372	Sig.
DQ controls	3.80	2.78	0.000	16.657	Sig.
Input controls	4.25	3.21	0.000	17.404	Sig.
User focus	4.05	2.94	0.000	17.645	Sig.
Nature of the AIS	4.20	3.14	0.000	16.201	Sig.
Employee relations	3.95	2.85	0.000	18.405	Sig.
Management of changes	3.97	2.97	0.000	17.231	Sig.
Measurement and reporting	3.87	2.92	0.000	14.120	Sig.
Data supplier quality management	3.51	2.66	0.000	17.165	Sig.
Continuous improvement	3.72	2.68	0.000	19.271	Sig.
Teamwork (communication)	4.02	3.01	0.000	17.241	Sig.
Cost / benefit tradeoffs	3.46	2.49	0.000	16.185	Sig.
Understanding of the systems and DQ	3.87	2.80	0.000	17.745	Sig.
Risk management	3.75	2.56	0.000	19.938	Sig.
Personnel competency	4.03	2.97	0.000	17.143	Sig.
Physical environment	3.71	3.21	0.000	8.843	Sig.
Audit and reviews	3.69	2.87	0.000	14.753	Sig.
Internal controls	4.03	3.10	0.000	17.417	Sig.

Source: developed for this research and copied from Table5.6 in Section5.4.1

It was hypothesised that differences exist between the perceptions of importance and the actual performance of all the 25 factors in the questionnaire. This hypothesis was supported for all factors, as the paired comparison *t*-test showed that there was a significant difference between the importance and the actual performance for each factor (see Table 5.6). In other words, the importance placed by the organisations on all the critical factors has not been implemented in real world practice.

The difference between importance and performance means was very clear, with the smallest difference of 0.51 for *physical environment*, and the biggest gap of 1.24 for *risk management*. 16 out of 25 factors had a mean difference greater than 1.00, which showed a huge gap between people's thinking and the implementation of that thinking.

In brief, it appears that while the organisations surveyed placed a high degree of importance on certain factors, the extent of the implementation of those factors was quite different. The result showed a big gap between the importance and the performance of the critical factors, which indicated that although organisations were aware about the important roles those critical factors could play in ensuring data quality, they failed to execute them to a greater extent in real world practice.

6.2.4 Conclusions about Research Question 4

Research Question 4: *Which of these factors are **critical success factors** to ensure high quality data in accounting information systems?*

In the third theory testing stage of this research, survey respondents were asked to select the top three critical factors for DQ in AIS from the list of 25 factors in the questionnaire. Therefore, a set of the most critical factors was generated from the survey results. The top three critical factors for ensuring data quality in AIS were:

- In first place: top management commitment;
- In second place: education and training;
- In third place: the nature of the accounting information systems.

The remaining critical factors in the top ten were: 4) personnel competency; 5) input controls; 6) understanding of the systems and DQ; 7) teamwork (communication); 8) clear DQ vision; 9) organisational culture and 10) middle management commitment.

From comparing the ranking of the *most critical factors* and the ranking based on the *mean importance* rating, it is clear that there were some similarities, as six out of the ten most critical factors were also ranked in the top ten based on the mean importance rating, and therefore, they can be identified as ***critical success factors*** for data quality in AIS. The first three are:

1) **Top management commitment**, which means top management recognise the importance of data quality in AIS and support data quality activities;
2) **Nature of accounting information systems**, which means to have suitable and adequate systems / packages; and
3) **Input controls**, which means get the information right in its initial phase, that is, input, so as to prevent input errors ("Garbage-In-Garbage-Out")

In addition, three other factors were deemed to be critical success factors for data quality in AIS, although they were not considered to be as crucial as the first three. They are:

4) **Personnel competency**, which means the employment of well-trained, experienced and qualified individual personnel at all levels, from top and middle management to employees. In other words, there should be highly skilled and knowledgeable people in both the technical and the business areas;
5) **Teamwork (communication)**, which means working as a team and having sufficient communication between different departments and within departments, and between different professionals, such as accounting and IT; and
6) **Middle management commitment to data quality**, which means the acceptance of responsibility for data quality performance by middle managers, and having effective procedures at middle management level.

6.3 Conclusions about the principal research problem

From the discussion of the four research questions, it is now possible to address the principal research problem of this research: *there is a lack of knowledge about critical success factors for data quality in accounting information systems.* The findings of this thesis provide an answer to this problem by developing a framework of critical success factors for data quality in accounting information systems, with the full framework presented in Figure 6.4, which is the final research framework of this study.

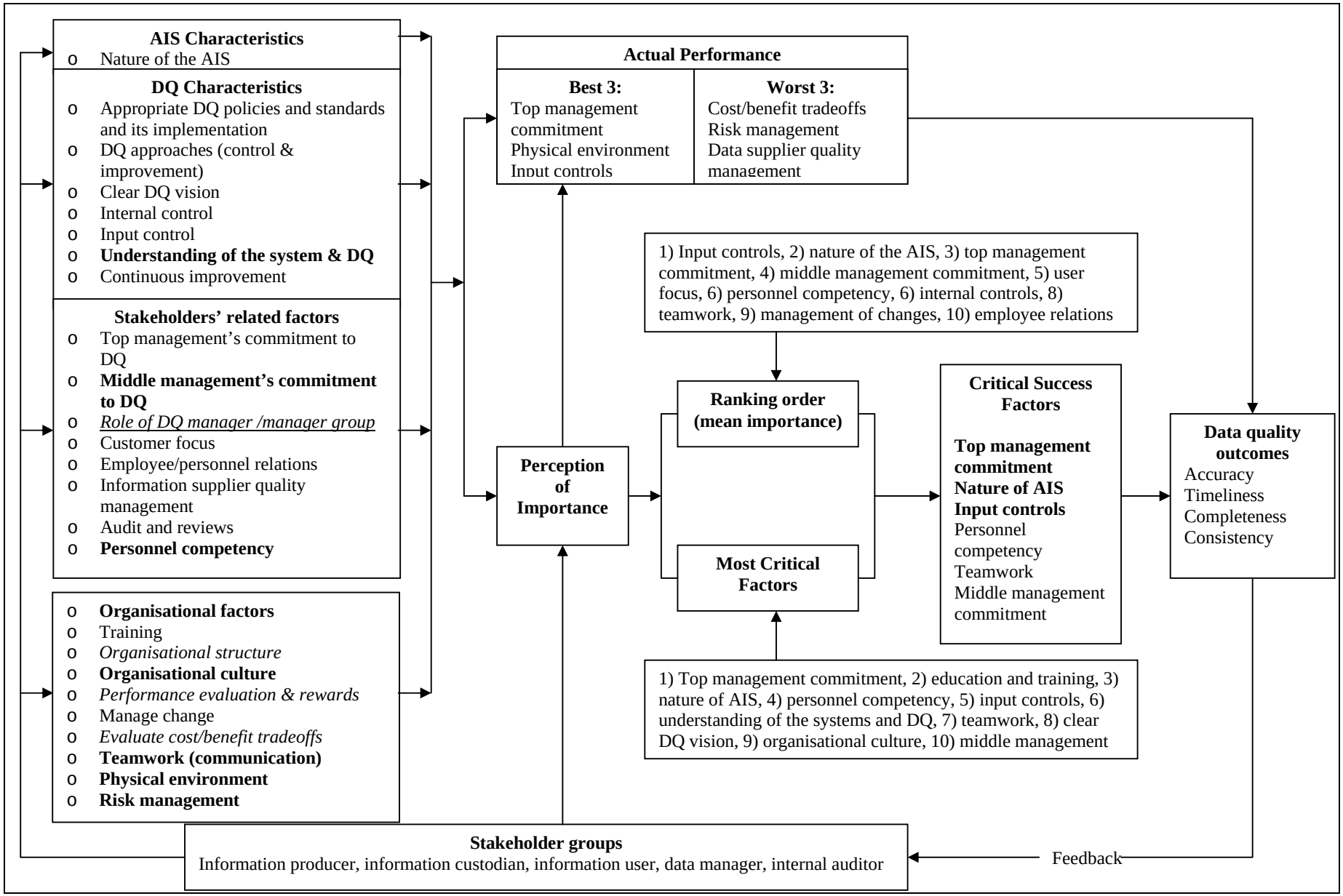
The literature review of Chapter 2 concluded that there was a gap in the literature about critical success factors for data quality in accounting information systems. What factors influence the variation of data quality in AIS was unclear. Based on this gap in the literature and the findings of the exploratory stage of the research, a theoretical framework was developed in Section 2.6 (Figure 2.7). This framework will now be revised taking into account the findings about the four research questions and the three hypotheses. Thus, this final framework is a model of critical success factors for data quality in accounting information systems in Australia (Figure 6.4). The development of this framework is discussed below.

Since there were no studies in the prior literature that identified critical factors for data quality in accounting information systems, at the first exploratory stage of the research, a list of possible factors that influence data quality in AIS was proposed by a detailed and focused literature review and two pilot case studies. Those factors were further divided into five different categories: AIS characteristics, data quality characteristics, stakeholders' related factors, organisational factors and external factors. The factors in those five categories were taken from quality management, data quality and accounting information systems literature given in a preliminary theoretical framework in Figure 2.7.

Next, from the confirmatory stage, the results of the seven main case studies suggested 26 factors that may have impact on data quality in AIS, within those, six were 'new' factors that added to the framework. The case studies confirmed that

most of the proposed factors were deemed to be important and the new list of factors was comprehensive enough to sufficiently represent the important factors that affect data quality in AIS. External factors have been deleted from the final framework because the research findings suggested that the management of external changes would affect data quality rather than the external factors themselves. Therefore, *external factors* were incorporated into *change management factors*.

- Further, in the third stage, two large-scale surveys were used to further develop and test the research framework. Twenty-five factors that were identified in the last stage were evaluated by the major stakeholder groups of data quality in AIS with respect to the perception of importance and the actual performance. Finally, critical success factors for data quality in AIS were identified by integrating the ranking order of the stakeholders' mean importance rating and the most critical factors.


AIS Characteristics
o Nature of the AIS
DQ Characteristics
o Appropriate DQ policies and standards and its implementation
o DQ approaches (control & improvement)
o Clear DQ vision
o Internal control
o Input control
o Understanding of the system & DQ
o Continuous improvement
Stakeholders' related factors
o Top management's commitment to DQ
o Middle management's commitment to DQ
o Role of DQ manager /manager group
o Customer focus
o Employee/personnel relations
o Information supplier quality management
o Audit and reviews
o Personnel competency
o Organisational factors
o Training
o Organisational structure
o Organisational culture
o Performance evaluation & rewards
o Manage change
o Evaluate cost/benefit tradeoffs
o Teamwork (communication)
o Physical environment
o Risk management
Actual Performance
Best 3:
Top management commitment
Physical environment
Input controls
Worst 3:
Cost/benefit tradeoffs
Risk management
Data supplier quality management
1) Input controls, 2) nature of the AIS, 3) top management commitment, 4) middle management commitment, 5) user focus, 6) personnel competency, 6) internal controls, 8) teamwork, 9) management of changes, 10) employee relations
Perception of Importance
Ranking order (mean importance)
Most Critical Factors
Critical Success Factors
Top management commitment
Nature of AIS
Input controls
Personnel competency
Teamwork
Middle management commitment
1) Top management commitment, 2) education and training, 3) nature of AIS, 4) personnel competency, 5) input controls, 6) understanding of the systems and DQ, 7) teamwork, 8) clear DQ vision, 9) organisational culture, 10) middle management
Data quality outcomes
Accuracy
Timeliness
Completeness
Consistency
Stakeholder groups
Information producer, information custodian, information user, data manager, internal auditor
Feedback

Legend:	**Bold**:	'new factors' identified by case studies or names of the major components
	Italics:	factors that have conflict findings from the empirical studies
	Italics & underline:	factor not supported by the empirical studies but need further study
	Normal:	factors identified from literature review and supported by the empirical studies or detailed items for components
	Arrows:	relationships between components

Source: developed for this research

Figure 6.4The final research framework of critical success factors for data quality in accounting information systems

The final research framework provided insights into the research problem in several ways. Firstly, it showed the important factors that could impact on data quality in AIS. The literature has identified some critical success factors for quality management and data quality. However, little attempt has been made to empirically study the critical success factors for data quality in AIS. In turn, this research confirms some of the factors mentioned in the literature and adds a few new factors. Moreover, stakeholder groups of data quality in AIS are important considerations and need more attention. The research framework of this research shows the relationship between stakeholder groups, important factors and data quality outcomes by highlighting stakeholder groups' influence on identifying the important factors, as well as the evaluation of the importance and performance of the factors.

In addition, perception of the importance and the actual performance of critical factors could further lead to different data quality outcomes regarding accuracy, timeliness, completeness and consistency. The ultimate data quality performance output can become important feedback to stakeholders, which will then impact on their perception of the factors that impact on data quality. Subsequently new evaluations of the importance of factors will result in altered actual performance. This constitutes a complete feedback circle loop. These relationships are not examined in this study, as this research focused on identification of the important factors and a further determination of the factors that are critical success factors for data quality in accounting information systems. However, because those relationships are parts of the whole integrated research framework, they need to be investigated by further research.

Lastly, the evaluation of the actual performance of important factors that impact on data quality in AIS was not mentioned in the extant literature and thus was not included in the initial theoretical framework given in Figure 2.7. In turn, actual performance of critical factors became *apparent* in the research framework of Figure 6.4. The identification of the best and worst performance factors is additional to the initial framework.

In brief, the top three critical success factors for data quality in accounting information systems in Australia are: top management commitment, the nature of the

accounting information systems, and input controls. There are five stakeholder groups that are involved in data quality management in AIS, and they are: information producers, information custodians, information users, data managers, and internal auditors. Stakeholders have an impact on the perceptions of the importance and performance of the critical factors, which can then affect the variations of data quality outcomes.

Given that little research has been conducted to investigate critical success factors for data quality in AIS, this research is likely to make both theoretical and practical contributions to the field of data quality and accounting information systems that is discussed next.

6.4 Implications for theory

The findings and contributions of this research have several implications for theory about critical factors for data quality management and accounting information systems, and stakeholders' perceptions of the importance and the performance of those factors. Some of these contributions have been discussed in Section 6.2, and there are other contributions and some implications as well. The research carried out and reported in this thesis has theoretical implications in the following key areas:

- The extension of theory to an area not previously addressed;
- The development of a research framework for critical success factors for data quality in AIS;
- The identification of stakeholder groups for accounting information systems' data quality;

The implications of this research to these theoretical concerns are considered in more detail next.

6.4.1 Extension of the literature

This research made a contribution to the body of knowledge of data quality and AIS by identifying the critical success factors for AIS data quality. The finding of the research helped to find out which factors are more important than others. It filled the research gap on critical success factors of data quality for AIS. This research provides the first in-depth investigation into the factors that affect data quality in AIS. Previous research has highlighted the importance of quality management (Deming, 1982; Black & Porter, 1996; Motwani, 2001) and data quality management (Redmen, 1992; Wang, 1998). There is also literature on identifying and empirical testing of the critical success factors for quality management (Saraph et al., 1989; Flynn et al., 1994; Ahire et al., 1996; Behara and Gunderson, 2001). However, the critical success factors for data quality in accounting information systems remain largely unexplored and unspecified. Therefore, this research is the first empirical and in-depth study that investigates critical factors for ensuring data quality in accounting information systems, which is the extension of data quality theory to an area that has not been previously addressed.

6.4.2 Development of the research framework

One of the weaknesses in the existing body of knowledge regarding data quality was the lack of an explanatory framework and theory building studies on the critical factors that impact upon data quality output. Many studies in the data quality field have focused on the theoretical modeling of controls (Menkus, 1983; Wand & Weber, 1989; Redman, 1998) and measurement/ dimensions of data quality (Ballou et al., 1982, 1985, 1987,1993; Wang & Strong, 1996; Huang et al., 1999). The development and testing of the research framework for critical success factors for data quality in AIS in this study has filled this gap and made certain contributions to theory in data quality and accounting information systems.

Based on a detailed review of the quality management, data quality and accounting information systems literature, it was found that there is a need for theoretical frameworks on critical factors that impact on data quality in AIS because not much

effort has been placed on proposing such a framework specific to accounting information systems. In turn, this research has developed a model of categories of factors impacting upon data quality in AIS and a comprehensive theoretical framework for critical success factors for data quality in AIS. Five categories have been proposed for factors that affect data quality in AIS. They are AIS characteristics, data quality characteristics, stakeholders' related factors, and external factors. These categories are additions to the data quality literature and give further insights into accounting information systems management literature.

The theoretical framework developed in this study was the first such framework built upon empirical study that explored factors that influence data quality in AIS and their interrelationships with stakeholder groups and data quality outcomes. That is, it is now clear which factors impact on data quality in AIS, and which of those factors are critical success factors for ensuring high quality information outcomes. In addition, the performance level of factors was also incorporated into the research framework. Since the actual performance of factors has not been highlighted in other studies, this research adds new theoretical insights to the extant literature.

6.4.3 Identification of stakeholder groups

There are a few studies about the stakeholders in data quality (Strong at al, 1997; Wang, 1998) and some have focused on the stakeholders' perceptions of data quality outputs (Shanks & Darke, 1998). However, this thesis research is the first time that the application of stakeholder groups of accounting information systems' data quality has been studied. The stakeholder groups identified in this research to be involved in accounting information systems are: data suppliers, information producers, information custodians, information managers, internal auditors, and information users.

The framework for understanding relationships between stakeholder groups and data quality in accounting information systems developed in this research provides a picture as to how those stakeholders are related to accounting information systems, and how they contribute to data quality management. In addition, this study also

attempted from the stakeholders' perceptions to evaluate the importance of critical factors and the performance of critical factors for data quality, which is another addition to the extant literature.

Moreover, the final research framework has connected the stakeholder groups with data quality outcomes and identification of factors, and evaluation of the importance and performance of the factors. Prior literature has not shown how the dynamics of networks and relationships work in relation to stakeholder groups in the AIS data quality management process. Thus, this research further extends the literature by adding new insight into the understanding of the overall stakeholder groups' involvement in data quality management in AIS. In brief, the identification of stakeholder groups and their relationship with accounting information systems and data quality outcomes in this research adds to the literature.

6.5 Implications for practice

The previous section discussed the implications for theory. In turn, this section addresses the practical implications of the findings of this research for management and practitioners in IT and accounting areas. In essence, this study is a reminder of the importance of data quality management in accounting information systems. The final research framework of critical success factors for data quality in accounting information systems in Figure 6.4 provides the foundation of practical implications. To be more specific, the findings of this study will make a contribution to practice in the following ways:

6.5.1 Practical implications for organisations

First, the research findings have the potential to help organisations to focus on only the important factors, therefore obtaining greater benefit from less effort. Such an outcome is helpful to organisations in obtaining a better understanding of data quality issues in AIS. There are various factors that impact on data quality for managers to consider. This research provides specific insights into the critical success factors that could have the most positive effect on high quality information

outputs. Management of an organisation should be aware of the most important factors, as well as those factors that have not performed well in practice. Figure 6.2 provides a list of the factors and their categories. Managers can use this as a checklist for their data quality improvement efforts. Moreover, most critical factors for data quality in accounting information systems have been detailed in this research, which managers can use as a guide for focusing their attention and resource allocation.

6.5.2 Practical implications for stakeholders

AIS stakeholders are those who can obtain the most value from the findings of this research. As identified by this study, there are several major stakeholder groups involved in data quality management in AIS, and most of those stakeholders are either accounting or IT professionals. In addition, sometimes one stakeholder can have knowledge of both accounting and IT areas. An example is a systems accountant.

Firstly, this research clarifies the roles of different stakeholders on performance in accounting information systems, which provides stakeholders with a clear image about their positions and how others can also contribute towards high quality information outputs. To keep the whole picture in mind, the collaboration between different stakeholders can then become more efficient. The findings of this research provide first hand information to such AIS stakeholders as the front line practitioner, namely, that they should take an active approach to data quality insurance and improvement activities.

In particular, this study provided IT professionals with knowledge of a specific set of factors that can impact on AIS data quality. This can lead to a deeper understanding of accounting information system data quality issues. This knowledge can assist in developing, maintaining and improving accounting information systems, and aid communication with accounting professionals during those processes.

6.5.3 Practical implications for policy makers

One of the managerial implications of this research is for organisational data quality policy makers. Policy makers would benefit by the insight and information gained by this research as input to the development of policies in relation to data quality, and accounting information systems management. Therefore, this research has the potential to allow policy makers in organisations to be well-informed when developing and reviewing data quality policies.

Moreover, the framework developed in this study gives insights into what stakeholders perceive as important factors that influence data quality in accounting information systems. If this does not correspond with what the policy maker considers to be most important, the policy maker can take various measures to change the importance of various factors. It is recommended to policy makers to pay attention to those critical success factors, and to also keep track of the performance of those important factors. It is recommended that a regular evaluation of important factors is crucial for effective implementation of data quality policies.

6.6 Limitations of the research

AISs have many stakeholders, and different stakeholders may have different perspectives of critical success factors that impact on data quality. This study only included the major stakeholders in AIS: information producers, information custodians, information users, internal auditors, and data managers, because the key stakeholders' perspectives of CSF in data quality are critical. However, other minor stakeholders' perspectives may also be important, and therefore, further research should be conducted.

The study was constrained to Australian organisations; therefore, the conclusions drawn from this study may have a potential problem on generalisability. However, there is some evidence suggested that the differences of data quality issues among Australia, USA, and other western countries are likely to be minor. Although the results of this study are only drawn from Australian organisations, there might be

similar results, if a study was conducted in other western countries. Whether or not there are similarities and differences needs to be further investigated. It is acknowledged that cultural differences may impact upon the results, but these are beyond the scope of this research, and those issues could be addressed by further research.

6.7 Recommendations for further research

There are three recommendations for further research. Firstly, replication of this study in other countries including both developed and developing countries may give interesting insights into international practice. The research on cross-country and across-culture comparison of critical factors that impact on accounting information quality is very important and useful for theory building as well as for practical implications. It can not only advance the literature but also provide a useful benchmark for real-world practice, as organisations nowadays need to become more competitive in order to survive in a more open international trading environment.

Secondly, research into building the relationship between the performance of critical factors and business output is needed. This research focused on identifying the critical factors. Further research that links the performance of those factors to business output can provide a wider picture of the issues and aid towards building an understanding of cause-effect relationships between different variables in data quality management area. The measurement of the business output could be the overall level of quality achieved as well as financial data such as return on investment.

Thirdly, a longitudinal experiment may be useful to further test the theory built in this study. This would be to investigate whether continuous improvement effort on data quality management can lead to better business performance. If there are any variations on performance, an attempt could be made to develop the measurement of how much those variations are caused by improvement activities.

6.8 Conclusion

As the final chapter, this chapter provided the summary of the whole thesis. It discussed the major findings for the four research questions, and compared the findings with the literature to identify the contributions this research makes to the understanding of the critical success factors for data quality in accounting information systems. Next, the research problem was concluded by the development of the final comprehensive research framework. The Chapter then presented the contributions and implications for the theory and practice of this research. Finally, the limitations of the research and recommendations for further research directions were outlined.

In brief, this research has provided an understanding of the importance of critical success factors for data quality in accounting information systems. That is, data quality management is crucial for the successful implementation of accounting information systems. This research has the potential to lift awareness of this important issue. The critical factors identified by the study can serve practitioners in accounting and IT fields as well as management as a useful guide to data quality management activities, and improvement efforts.

High-level data quality management practice is one of the keys to success for many organisations. Specification of the critical success factors of DQ management in AIS can permit managers to obtain a better understanding of accounting information system data quality management practices. If organisations focus on those critical success factors, they may be able to evaluate the perception of data quality management in their organisations' AIS, and ensure the quality of the accounting information. In addition, they will be able to identify those areas of AIS data quality management where improvements should be made, and improve overall data quality in the future.

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Appendix I Interview protocol

Interview Protocol

Critical Success Factors for Data Quality in Accounting Information Systems

Business name:
Interviewee's name:
Business profile:
Location:
Date:
Start time of the interview:
Finish time of the interview:

Section 1: General Information

Please tell me about yourself.

1. Your background.
   1) Education, and working experience
   2) Your experience with accounting information systems

2. Your organisation.
   1) Major industry:
      - Manufacturing
      - Servicing
      - Financial
      - Government
      - Other
   2) Your department
      - Finance, Accounting
      - Information systems /IT
      - Senior Executive
      - Other
   3) Your main role relative to accounting information. Do you primarily:
      - Collect accounting information
      - Manage those who collect accounting information
      - Use accounting information in tasks
      - Manage those who use accounting information in tasks
      - Work as an information systems professionals
      - Manage information systems professionals
   4) Annual revenue dollars
      - over $100 million
      - under $100 million, but over $10 million
      - under $10 million

5) Company total assets
   - over $100 million
   - under $100 million, but over $10 million
   - under $10 million

Section 2: Accounting Information Systems (AIS)

Please tell me something about your organisation's accounting information systems (AIS)? Do you think those category of AIS will influence DQ?

1. How large is the AIS? (Number of different systems /packages; Number of staff)
2. What kind of systems are you using for AIS? SAP? Please name.
3. How old is the AIS? (The age, maturity of the system)
4. What is the organisational structure of the AIS and how you fit in the structure?

Section 3: Data Quality (DQ) in Accounting Information Systems

For each of the following question, does it help to ensure and improve DQ in AIS?

1. Is data quality issue a top priority in your AIS?
2. Do you have DQ polices?
   What kind of data quality polices or standards do you have or adopt?
   Do you think they are appropriate
   Do you think standard and polices are important to ensure DQ?
3. What sort of trainings do you have in data quality?
   - initial training to new employees
   - regular training
4. What data quality controls and improvement approaches do you have in your AIS?
5. What internal controls do you have in your AIS?
6. What input controls do you have in your AIS?
7. What is the role of audit and review in raltion to AIS?
   - internal
   - external
8. What sort of data quality performance evaluation and rewards do you have in your AIS?
9. What employee/ personnel relations do you have in data quality area?

Section 4: Factors

What factors do you think may influence the data quality in accounting information system?

1. Does your organisation allocate enough funds, technical tools, experts, skilled personnel available for ensuring data quality in AIS?

2. Do you have data quality manager or similar roles to ensure the quality of the (accounting) inforamtion?
   If yes, how can he/she help to improve DQ?
   If no, do you think it will help to have one;
   or do you think it is not necessary or impossible?
3. How the top management's role in relation to data quality issues in AIS will impact on DQ?
4. Who are the information suppliers of your AIS? Will information supplier quality management influence the DQ in AIS?
5. Who are the customers of your AIS? Will the different requirements from different customers influence the DQ in AIS?
6. How does your organisation manage change? (Technology, regulation, economy, marking changes)
   Do you think skills to manage change can help to improve DQ?
7. Are there any external factors that you think may influence DQ in AIS?
8. Does your organisation evaluate cost / benefit tradeoffs of DQ in AIS? Are there any incentives for DQ?
   If yes, does it help to improve DQ?

Section 5: Critical Success Factors

We have defined some factors that might impact on data quality of accounting information systems. Which of these factors do you think are ***critical success factors***? Would you be able to give a mark for each of these factors on a **ten - point scale**, 10 as very critical, 1 as not important at all?

1. Top management's commitment to DQ.
2. Appropriate (simple, relevant & consistent) data quality policies and standards & its implementation.
3. Role of data quality
4. Role of data quality manager.
5. Training.
6. Organisational: structure
   : Culture.
7. Nature of the AIS.
8. Data quality (control & improvement activities) approaches and processes
9. Customer focus –user involvement.
10. Employee/personnel relations (employee's responsibility to DQ).
11. External factors.
12. Information supplier quality management.
13. Performance evaluation and rewards (responsibility for DQ).
14. Manage change
15. Evaluate cost/benefit tradeoffs
16. Audit (internal & external) and reviews

17. Internal controls (systems, process), such as: access control and security & segregation of duties
18. Input control.
19. Understanding of the systems and DQ (importance, improvement)
20. Teamwork (between different departments and within departments)(communication)
21. Continuous improvement

Do your think these factors are appropriate? Why, why not?
Which of these factors do you think are critical success factors?

Are there other factors that you think may be important but were not included in this list?

Conclusion:

Is there anything I have not asked that you feel is important when discussing critical success factors of data quality in accounting information systems?

Is there any one else that you would recommend talking to in relation to AIS DQ?

With hindsight what would you have done differently?

Would you like some of the feedback from this research regarding to your organisation's DQ issues or the findings of the research?

If you would like, we will supply a copy of what we believe you told us, and how we have interpreted what you said, so that you can correct the impressions that we have taken from your responses. We will also provide you with factors suggested by other respondents, you could then comment on the responses of others and accept or reject factors.

Thank you very much for your precious time and your valuable help!

Appendix II survey questionnaire

A Nation Wide Survey of the Critical Success Factors for Data Quality in Accounting Information Systems

This survey, which is sponsored by the University of Southern Queensland and supported by the CPA Australia, will produce findings about the critical success factors for data quality in accounting information systems, which should benefit you, your organisation and others in this area.

Faculty of Business
University of Southern Queensland
Toowoomba, QLD 4350, Australia

Queensland Division
CPA Australia
Brisbane, QLD 4000, Australia

There are some DEFINITIONS that you might need while answering the questionnaire

Data Quality (DQ): quality data in **Accounting Information Systems (AIS)** in this research means accurate, timely, complete, and consistent data.

Information users: the users of the accounting information, include both internal and external users. Such as: top management and general users within the organisation (internal), banks and government (external)

Data suppliers: are those who provide raw, un-organised data to the accounting systems, include both internal and external. Such as, other departments within the organisation (internal), and trading partners (external)

Top management: executive or senior management, includes the highest management positions in an organisation.

Middle management: is responsible for implementing the strategic decisions of top management. Middle managers make tactical/short-range decisions.

Non-management employees: who include production, clerical, and staff personnel.

Thank you for participating in this research, please answer the following PRELIMINARY QUESTIONS first

a) Please indicate your MAIN ROLE relative to Accounting Information Systems (AIS); do you PRIMARILY:
(Please tick one box only)

- ❑1 Create or collect data for the AIS
- ❑2 Manage those who create or collect data for the AIS
- ❑3 Design, develop and operate the AIS
- ❑4 Manage those who design, develop and operate the AIS
- ❑5 Use accounting information in tasks
- ❑6 Audit or review data in AIS
- ❑7 Manage data and / or data quality in AIS

b) Which of the following categories best describe the Accounting Information Systems (AIS) in your organisation? *(Please tick one box only)*

- ❑1 Developed in-house
- ❑2 Commercial software package, please specify _____
- ❑3 Customised package, please specify _____
- ❑4 Other: _____

c) Do you receive quality data from your AIS?
How would you rate the overall data quality in AIS in your organisation

❑1 Very Low ❑2 Low ❑3 Neutral ❑4 High ❑5 Very High

c1) Accuracy: the recorded value conforms with the actual value

- ❑1 Very Low
- ❑2 Low
- ❑3 Neutral
- ❑4 High
- ❑5 Very High

c2) Timeliness: the recorded value is not out of date

- ❑1 Very Low
- ❑2 Low
- ❑3 Neutral
- ❑4 High
- ❑5 Very High

c3) Completeness: all values for a certain variable are recorded

- ❑1 Very Low
- ❑2 Low
- ❑3 Neutral
- ❑4 High
- ❑5 Very High

c4) Consistency: the representation of the data value is the same in all cases

- ❑1 Very Low
- ❑2 Low
- ❑3 Neutral
- ❑4 High
- ❑5 Very High

Section A: CRITICAL SUCCESS FACTORS FOR ACCOUNTING INFORMATION SYSTEMS DATA QUALITY

In column 1, please rate the importance of each factor in ensuring ***Data Quality (DQ)*** in ***Accounting Information Systems (AIS)*** from your perceptions and opinions.

In column 2, please rate the actual performance (achievement) on each of those factors by your organisation.

Please complete BOTH Columns 1 and 2	**Column 1 Importance**	**Column 2 Performance**
	Not important ❑1 · Little importance ❑2 · Average importance ❑3 · Very important ❑4 · Extremely ❑5	Not applicable ❑1 · Poor ❑2 · Fair ❑3 · Good ❑4 · Very good ❑5 · Excellent ❑6
A1. **Top management** commitment to Data Quality (DQ): *Top management recognise the importance of DQ in AIS and support DQ activities*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A2. **Middle management** commitment to DQ: *Acceptance of responsibility for DQ performance by middle managers. Effective procedures at middle management level*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A3. **Education and training:** *Providing effective and adequate training for staff to be able to understand and efficiently use AIS in order to obtain quality information*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A3.1. Initial training - new personnel, new / upgrade systems	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A3.2. On-going training - regular training to employees and managers	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A4. Clear **DQ vision** for entire organisation: *Allocate sufficient funds, technical tools, expertise, skilled personnel to ensure DQ. (i.e. see DQ as a top priority)* . .	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A5. Establish **DQ manager** position to manage overall DQ: *Set up a skilled person or a group of people as DQ manager/s to manage information flow: from input to process, and to output*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A6. Appropriate **organisational structure:** *Suitable organisational structure that helps to produce high quality information. (For example: centralised responsibility for DQ)*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A7. DQ **policies and standards:** *Appropriate (simple, relevant & consistent) DQ policies and standards*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A7.1. Establishment of appropriate and specific DQ goals and standards.	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A7.2. Implementation /enforcement of policies and standards.	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A8. **Organisational culture** of focusing on DQ: *Promote the DQ culture within the organisation that there must be high quality data in AIS*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A9. **DQ controls:** *Have appropriate DQ controls, approaches, and adequate processes for DQ improvement activities*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6

Please complete BOTH Columns 1 and 2	Column 1 Importance Not important / Little importance / Average importance / Very important / Extremely	Column 2 Performance Not applicable / Poor / Fair / Good / Very good / Excellent
A10. **Input controls:** *Get the information right in its initial phase, i.e. input, so as to prevent input errors (Garbage-In-Garbage-Out)*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A11. **User focus:** *Focus on information users' needs and their quality requirements. Enable active participation from users to ensure and improve DQ*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A12. **Nature of the Accounting Information Systems:** *Suitable systems / packages*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A12.1. Intuitive and easy to use	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A12.2. Automatically performs as much validation of data as possible (based on business rules etc.) . .	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A12.3. Adequate and sufficient documentation for people to follow	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A12.4. Ease of modification / upgrade	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A12.5. The system is mature (stable)	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A12.6. The system is up-to-date (adopt new technology)	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A16.7. Level of the integration and system interpretability	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A12.8. Effective data management approach, such as, centralised database, and data warehouse	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A13. Effective **employee relations:** *High employee self-satisfaction, job security, and career development. 'Happy, fulfilled employees produce higher quality work.'*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A14. **Management of changes:** *Organisation's abilities and skills to manage internal and external changes.*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A14.1. Internal changes: such as, organisation re-structure, introducing the new technology, personnel changes	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A14.2. External changes: such as, government regulations, technology, economy, and market changes	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A15. **Measurement and reporting**	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A15.1. Measuring DQ results: performance evaluation. - Evaluate employees, management and relevant sections / department's DQ performance	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A15.2 Establishing DQ reporting systems : performance recognition. - Establish appropriate formal and informal reports and reward/penalty systems for DQ positive/negative incentives	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A16. **Data supplier quality management:** *Have effective DQ management relationships with raw data suppliers*	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6
A16.1. Have agreements about the acceptable level of quality of raw data to be supplied (availability, timeliness, accuracy, completeness)	❑1 ❑2 ❑3 ❑4 ❑5	❑1 ❑2 ❑3 ❑4 ❑5 ❑6

Please complete BOTH Columns 1 and 2	Column 1 Importance					Column 2 Performance					
	Not important	Little importance	Average importance	Very important	Extremely	Not applicable	Poor	Fair	Good	Very good	Excellent
A16.2. Provide regular DQ reports and technical assistance to data suppliers	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A17. **Continuous improvement:** *Continuous and consistent improvement of system and human DQ controls*	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A18. **Teamwork (communication):** *Working as a team and have sufficient communication*	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A18.1. Between different departments and within departments	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A18.2. Between different professionals, such as, accounting and IT	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A19. Evaluate **cost/benefit** tradeoffs: *Have systematic cost / benefit analysis of DQ controls and activities in order to maximize benefits at minimum cost*	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A20. **Understanding of the systems and DQ:** *Understand how the systems work, and the importance of DQ by everyone that is involved in AIS*	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A20.1. Understand how the systems work (technical competence)	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A20.2. Understand the importance of DQ and its relations to business objectives (perception of importance)	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A20.3. Understand the usefulness and usage of information (the right information to the right people at the right time in the right format <4Rs>)	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A21. **Risk management:** *Identify key risk areas and key indicators of DQ and monitor these factors*	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A22. **Personnel competency:** *Employ well-trained, experienced and qualified individual personnel at all levels, from top, middle management to employees. For instance, highly skilled and knowledgeable person in both technical and business areas*	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A23. **Physical environment:** *Pleasant physical working environment, such as a modern environment with air-conditioning, and adequate office space*	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A24. **Audit and reviews:** *Independent internal and external audit on the systems and the DQ to ensure that appropriate controls are in place. Regular reviews on DQ*	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A25. **Internal controls:** *Adequate internal system and process controls*	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A25.1. Systems controls, such as, access control and security	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6
A25.2. Human and process controls, such as, segregation of duties	❑1	❑2	❑3	❑4	❑5	❑1	❑2	❑3	❑4	❑5	❑6

Section B: MOST IMPORTANT AND LEAST IMPORTANT FACTORS

Please review the factors listed in section A, select the **top three** most important critical success factors for DQ in AIS, write them in order of importance by indicating the question No. in section A (for example, A19 or A20.2 etc.); please repeat for the **three least** important factors.

The three **most important** factors

1st: _____
2nd: _____
3rd: _____

The three **least important** factors

1st: _____
2nd: _____
3rd: _____

Section C: DEMOGRAPHIC DETAILS

C1. What industry does your organisation belong?
(Please tick one box)

- ❑1 Manufacturing
- ❑2 Services
- ❑3 Finance and insurance
- ❑4 Government
- ❑5 Education
- ❑6 Other:_____

C2. In what sector does your organisation operate?
(Please tick as many as apply)

- ❑1 Local only
- ❑2 State wide
- ❑3 Interstate
- ❑4 Internationally

C3. Where is your department/section based?
City _____
State _____

C4. What is the approximate value of the total ASSETS of your organisation?
(Please tick one box)

- ❑1 Under $5 million
- ❑2 $5 million to $9 million
- ❑3 $10 million to $99 million
- ❑4 Over $100 million
- ❑5 Not sure
- ❑6 Not permitted to disclose

C5. What is approximate value of the annual REVENUE of your organisation?
(Please tick one box)

- ❑1 Under $5 million
- ❑2 $5 million to $9 million
- ❑3 $10 million to $99 million
- ❑4 Over $100 million
- ❑5 Not sure
- ❑6 Not permitted to disclose

C6. How many full time employees are there in your whole organisation?
(Please tick one box)

- ❑1 Over 5,000
- ❑2 1,000 - 5,000
- ❑3 100 - 999
- ❑4 50 - 99
- ❑5 10 - 49
- ❑6 5 - 9
- ❑7 Fewer than 5
- ❑8 Not sure

C7. What is your primary job function?
(Please tick one box)

- ❑1 Finance, Accounting
- ❑2 Information Management/Technology
- ❑3 Auditing
- ❑4 Other: _____

C8. What is the level of your job responsibility?
(Please tick one box)

- ❑1 Non-management Employee
- ❑2 Middle Management
- ❑3 Top Management

C9. How many years has your organisation been in operation?
_____ Years

C10. How many years have you had experience with AIS?
_____ Years

If you would like a copy of the summary of results from this study when they become available, please complete:

- ❑1 Electronic copy
  E-mail: _____
- ❑2 Hard-copy
  (Please attach a copy of your business card)

If there is anything else that you would like to tell us about data quality in accounting information systems, please use the space provided below.

Your contribution to this research project is very greatly appreciated. Please return your questionnaire in the reply paid envelope provided. If the envelope has been mislaid, please forward to:

Ms. Hongjiang Xu
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