An Empirical Investigation of Factors Influencing Organisations to Improve Data Quality in Their Information Systems

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Abstract

Although managers consider accurate, timely, and relevant information as critical to the quality of their decisions, evidence of large variations in data quality abounds. This research developed and tested a model of factors influencing the level of data quality within an organisation. The model was tested using data collected from a data quality survey and interviews with senior managers. The results indicated that management commitment to data quality and the presence of data quality champions strongly influence data quality in the organisation. Interview responses indicated the managers of the participating organisation are committed to achieving and maintaining high data quality. Interviews with the managers revealed that changing work processes and establishing a data quality awareness culture are required to motivate further improvements to data quality.

(Keywords: data quality, champions, management commitment)

1. INTRODUCTION

1.1 Background

Almost every activity in which organisations engage involves data. Data provide the foundation for operational, tactical, and strategic decisions. As data become increasingly important resources in supporting organisational activities, the quality of the data that managers use becomes critical (Paradice and Fuerst 1991). Poor-quality data, if not identified and corrected, can have disastrous economic and social impacts on the health of the organisation (Wang and Strong 1996; Ballou et al. 2004). Anecdotal and empirical evidence of widespread poor data quality abounds (Huang et al. 1999; Redman 1996; Klein et al. 1997). These impacts range from operational inconvenience to ill-informed decision-making, to disruption of business operations, and possibly even to organisational extinction.

Anecdotal evidence of widespread poor data quality abounds. For example, in 1997, Hudson Foods lost its largest customer, Burger King, due to E.Coli bacteria contamination that caused several illnesses. Poor data quality relating to knowledge about which batches were mixed caused the delivery of contaminated hamburgers to Burger King. The contamination resulted in 25 million pounds of meat being recalled–the largest recall in US history. Without their largest customer, Hudson Foods was not profitable and was acquired by Tyson Foods.[1] In another case, English (1999, pp. 8-9) reported that two 20-year-old calculation errors in Los Angeles County's pension systems resulted in US$1.2 billion in unforeseen liabilities. The County must spend an additional US$25 million each year for the next 50 years to make up for the shortfall.

Data quality researchers recommend that organisations treat data as strategic corporate resources for competitive advantage (Redman 1995; Wang 1998). Nonetheless, most organisations admit they do not manage data as well as they manage human and financial

[1] The New York Times, 24 August 1997.

resources (Levitin and Redman 1998). Empirical evidence also indicates that many information systems contain substantial errors. Redman (1996) reported that organisational databases with error rates up to 30 percent are typical in industry. Klein et al. (1997) indicated mission-critical databases generally contain errors ranging from one percent to 10 percent. Poor quality data is estimated to cost US businesses more than USD$600 billion a year.[2] Research evidence indicates organisations are aware that poor data quality is affecting their business. Nevertheless, few organisations appear to be actively engaged in systematic efforts to reduce data problems (see, e.g., Global Data Management Survey 2001; TDWI Report Series 2002).

A number of data quality frameworks have been developed to organise and structure data quality dimensions. Organisations can use data quality (DQ) frameworks to understand data quality dimensions, e.g., accuracy, timeliness, relevancy, completeness, and reliability (Huh et al. 1990; Ballou and Pazer 1995; Wang et al. 1995; Cappiello et al. 2004). They can also use these frameworks to assist them in developing procedures to measure data quality and investigate its relationship to organisational processes. These frameworks, however, do little to increase our understanding of how organisations identify and resolve data quality problems and, in particular, *what factors influence an organisation to improve the quality of its data?*

The goal of this research is to develop and test a model of factors influencing the data quality within an organisation. The model was tested using data collected from an in-depth case study at a government-funded services organisation. The research model benefits organisations in several ways. First, managers will be better able to identify critical factors for successfully implementing new data quality initiatives and for nurturing existing data quality activities. Second, managers will be better able to understand the relationships among these critical success factors. Third, they can use their improved understanding to develop or

[2] TDWI Report Series, March 2002, " Data Quality and The Bottom Line: Achieving Business Success through a Commitment to High Quality Data." See http://www.dw-institute.com/research/display.asp?id=6064.

improve their organisational data quality policies.

2. THEORETICAL FOUNDATIONS AND HYPOTHESIS DEVELOPMENT

2.1 Data Quality Dimensions and Definition

Numerous researchers have attempted to define data quality and to identify its dimensions (Wang and Kon 1993; Fox et al. 1994, Wang and Strong 1996; Kahn et al. 2002). Dimensions of data quality typically include accuracy, reliability, importance, consistency, precision, timeliness, fineness, understandability, conciseness, and usefulness. Unfortunately, a set of data may be completely satisfactory on most dimensions but inadequate on a critical few. Improving one data quality dimension can impair another dimension (Ballou et al. 1998). Moreover, different stakeholders in an organisation may have different data quality requirements and concerns (Giannoccaro et al. 1999; Lee and Strong, 2004).

This research focuses on the data quality dimensions of accuracy, relevance, and timeliness. Accuracy refers to the degree of correspondence of recorded values to the actual values of the associated real-world objects. Timeliness refers to the extent to which the data are up-to-date for the required task. Relevance refers to the extent to which the data are applicable or appropriate for the required task. These three dimensions were investigated because the participating organisation was most interested in them in relation to their organisational needs for data quality.

To develop the research model, several theories, models, and frameworks were reviewed to identify factors that potentially influence an organisation to improve the quality of its data. These include data quality models and frameworks, information systems implementation and data warehouse success models, total quality management concepts, and the resource-based view of the firm.

2.2 Theoretical Framework

2.2.1 Management Commitment to Data Quality

Tubbs (1993) defines commitment as strength of intention. Commitment affects the persistence of behaviour (Salancik 1977). In the context of this research, management commitment is defined as the strength of management[3] intentions to achieve high data quality. Prior research has shown that management commitment influences the extent to which total quality programs are successful (Saraph et al. 1989; Anderson et al.1995; Flynn et al. 1995; Black and Porter 1996). Hence,

> H1: Management commitment to data quality is positively associated with the level of data quality achieved.

2.2.2 DQ Champions

DQ Champions are managers who actively and vigorously promote their personal vision for using DQ-related technology innovations. They push projects over approval and implementation hurdles (Beath 1991). DQ Champions provide political support, keep participants informed, and allocate resources to DQ projects (Oz and Sosik 2000; Flynn et al. 1994). DQ Champions also exhibit transformational leadership behaviour when they strongly support a DQ project (Howell and Higgins 1990; Heng et al. 1999; Poon and Wagner 2001). They possess the skills (e.g., communication and project management) and clout (e.g., reputation and position in the organisation) needed to overcome resistance that may arise when change occurs within organisations (Guimaraes and Igbaria 1997; Jiang et al. 2000). Accordingly,

> H2: The presence of DQ champions is positively associated with management's commitment to data quality.

2.2.3 Extrinsic Rewards

The use of extrinsic rewards (financial and non-financial) as a means of controlling,

[3] Management here is not confined to top or senior management, but refers to all levels of management in the organisation.

managing, and enhancing performance has been well established in marketing, sales force development, and new product development (Ingram and Bellenger 1983; Sarin and Mahajan 2001). Data quality-related extrinsic rewards such as recognition for DQ improvement suggestions, increased budgets for DQ activities, positive feedback, and training (Nambisan et al. 1999) affect the successful implementation of data quality initiatives. The type and level of rewards that organisations provide for data quality initiatives reflect management's commitment to data quality. Thus,

H3: Extrinsic rewards are positively associated with management's commitment to data quality.

2.2.4 Perceived Usefulness of Data Quality as a Strategic Resource

An organisation's resources include all assets, capabilities, organisational processes, attributes, information, and knowledge that enable the organisation to conceive of and implement strategies that improve its efficiency and effectiveness (Barney 1991). Strategic resources are rare, difficult to imitate, and non-substitutable. Use of data quality for competitive advantage means organisations use high-quality data as strategic resources to earn long-run abnormal returns. If managers recognise that data quality can provide strategic advantages, they are more likely to commit to achieving high-quality data within their organisations. Therefore,

H4: The perceived usefulness of data quality as a strategic resource is positively associated with management's commitment to data quality.

2.2.5 IS/IT Capability

Organisational IS/IT capabilities refer to an organisation's ability to assemble, integrate, and deploy IS/IT-based resources, usually in combination with other resources (Grant 1991, 1995; Bharadwaj 2000). An organisation's capability to use data quality as a source of competitive advantage has two major components (Grant 1995). First, a *physical*

infrastructure comprised of computers, communication technologies, sharable technical platforms, and integrated databases is required. Second, appropriate *human resources* are required to support use of data quality as a competitive resource. These include training, experience, relationships, business skills, technical IT skills, and competencies in emerging technologies. They also include managerial skills and leadership skills (Copeland and McKenney 1988; Barney 1991; Grant 1995). Hence, organisations with strong IS/IT capabilities are better able to recognise and exploit data quality as a strategic resource. Hence,

H5: IS/IT Capabilities are positively associated with the perceived usefulness of data quality as a strategic resource.

2.2.6 Perceived Need For Data Quality to Support Products and Services

The value of the products and services organisations offer often depends on the quality of the data associated with these products and services. The quality of data about products and services influences customers' perceptions about the quality of products and services organisations offered (Wang and Strong 1996). Hence, the impact of data on the value of the products and services offered by an organisation is likely to increase management's perception of the need for data quality to support their products and services. Accordingly,

H6: The perceived need for data quality to support products and services is positively associated with management's commitment to data quality.

2.2.7 Regulatory Requirements

The level of data quality associated with the products and services organisations offer is often dictated by legal or regulatory constraints. Organisations must comply with the Privacy Act (Gibbs 2002)[4] and the Data Quality Act (Anderson 2002)[5] which prescribe how organisations should collect, use, secure, and disclose information. Regulatory requirements

[4] Australian Privacy Act 2000
[5] US Public Law 106-554 (The Data Quality Act) Information, see http://www.whitehouse.gov/omb/fedreg/reproducible.html

increase the organisations' perceived need for data quality in their products and services to avoid the costs of sanctions or to take advantage of opportunities that regulations provide to their organisations. Thus,

H7: The need to comply with regulatory requirements is positively associated with the perceived need for data quality to support products and services.

2.2.8 Contractual Requirements

Organisations often need high-quality data because of contractual obligations they have to their customers. Increasing the requirements for data quality to support contractual obligations is likely to increase management's commitment to attain high levels of data quality. Therefore,

H8: The need to comply with contractual requirements is positively associated with the perceived need for data quality to support products and services.

2.2.9 Competitive Pressures

Competitive pressures drive organisations to improve the quality of the products and services they provide to customers. Customers are likely to be dissatisfied if they are wrongly billed. Competitive pressures increase the need to improve the quality of data associated with an organisation's products and services. Hence,

H9: Competitive pressures are positively associated with the perceived need for data quality to support products and services.

The above hypotheses are represented in Figure 1 below:

INSERT FIGURE 1 HERE

3 RESEARCH METHOD

3.1 Research Setting and Design

This research used a single case study organisation (ZELDA[6]) with a combination of data collection methods. The study consisted of a DQ survey and interviews with senior managers. Zelda is a government-funded service organisation in Australia. Zelda employs just over 300 staff of which approximately 50% are qualified professionals. Zelda provides three types of specialised services: information, advisory (approximately 63,700 per year provided by Zelda's professional staff), and practical assistance (approximately 30,500 per year: 30% provided by Zelda's professional staff and 70% by external professional staff). These services are provided via a head office, a network of regional offices, a panel of several hundred professional service suppliers, and a Client Information Service accessible from anywhere in the state.

In 1994, Zelda adopted Total Quality Service as its business philosophy. By embracing the total quality service concept, Zelda is committed deliver high-quality, effective, and efficient services via technology and innovation. In 1998, the senior management of Zelda perceived a need for high-quality data to support their operations and client services. They designed and implemented Vision to improve operational efficiency and to further improve the quality of their services. Zelda uses a this mission-critical information system, to create, store, and maintain its clients' information, record services provided to the public, and report to stakeholders on its performance. After gaining an understanding of the business, business processes, and the software associated with these activities a data quality survey was administered.

3.2 Survey

The first technique used to gather data was a survey of general users and of senior managers. The survey responses were used to test the research model and as the basis to formulate questions for follow-up interviews. The following subsections describe the data

[6] Fictitious name.

quality survey. Section 3.2.1 discusses the development of the data quality survey questionnaires. Section 3.2.2 describes the administration of the questionnaires.

3.2.1 Questionnaire Development

Seven constructs were adapted from existing instruments. The remaining constructs were developed by the researchers and went through extensive pre-testing to ensure construct validity. Table 1 contains the constructs, descriptions and source for the questions making up the construct.

INSERT TABLE 1 HERE

All constructs except IS/IT capabilities were measured using multiple items. IS/IT capabilities were measured by the participants' self-reported IS/IT experience. To obtain continuous measures for each construct, participants were asked to mark their perceptions on a continuous scale of 0, Strongly Disagree to 1, Strongly Agree (see Figure 2)[7]. The participant's score on each question was the ratio of the marked distance (from 0 to x) to the total distance (from 0 to 1).

INSERT FIGURE 2 HERE

Only members of senior management were able to answer questions related to the perceived use of high-quality data as a strategic resource for competitive funding and the perceived need for high-quality data to support operations and client services. As a result, two sets of questionnaires were prepared: one set for general users and the other set for senior managers. The questionnaire for general users contained the first four constructs whereas the questionnaire for senior managers contained all constructs. A total of 67 surveys were distributed (Table 2 shows the total population, sample, and responses). Fourteen surveys were sent to members of senior management and fifty-three surveys were sent to general

[7] Throughout this research it has been assumed that respondents would have selected the mid point on the scale as the neutral point.

users. In total, 51 usable responses were received. Thirteen were from senior management, and 38 were from general users (76.1 percent response rate).

INSERT TABLE 2 HERE

3.3 Interviews with Senior Managers

After conducting the survey, seven interviews, ranging in length from 60 to 90 minutes, were conducted. The interviewees included the Chief Executive Officer, the managers of business units one and three, the second officer in charge of business unit two, the business analyst, the database administrator, and the senior administrative officer of business unit one. Prior to the interviews, the researcher reviewed the interviewees' demographic data collected during the data quality survey to obtain greater knowledge about the experience and skills of each interviewee. A set of open-ended questions were developed to assist in the interview. Interviewees were asked about issues ranging from data quality awareness to benefits of data quality programs. Follow-up questions were introduced to gain more insights about interesting issues. Probing questions were also introduced to elicit information to address relationships in the research model. Interview transcripts were analysed using the deductive analysis approach (Patton 2002). Deductive analysis uses an existing framework to categorise qualitative data. The research model, Figure 1, is the taxonomy used to categorise and interpret the responses from the senior managers. The analysis started with multiple readings of the interview transcripts.

4. RESULTS

4.1 Background

Of the 51 respondents 20 are data producers, and the remaining 31 are data consumers.[8] Approximately 59 percent of the general user respondents have worked in the organisation for more than five years. Responses also indicated that general users rarely attend IS/IT/DQ

[8] Data producers capture, enter, and process data. Data consumers use the data entered by the data producers.

conferences, seminars, workshops, or exhibitions. Approximately 50 percent of the senior manager respondents have worked in the organisation for more than ten years. Members of senior management attend approximately two IS/IT/DQ-related conferences, exhibitions, seminars, and workshops each year.

INSERT TABLE 3 HERE

For each questionnaire, the scores for all the questions related to each construct were averaged[9] to compute the value of the construct.[10] The questionnaires for general users and senior managements were analysed separately. Table 4 Panel A presents descriptive statistics for the constructs measured via the general users' questionnaires. Table 4 Panel B presents descriptive statistics for the constructs measured via the senior managers' questionnaires.

INSERT TABLE 4 HERE

These results show that general users perceive the DATA QUALITY and DQ COMMITMENT as moderately high and that Zelda has an effective DQ CHAMPION. The low result for DQ REWARDS is primarily attributable to the organisational setting, i.e., government-funded agencies can seldom provide direct performance-based payments to employees. The results show that senior managers rated all constructs except DQ REWARDS, REGULATORY REQUIREMENTS, and FUNDING AGREEMENT as moderately high (> 0.6). The mediocre ratings for REGULATORY REQUIREMENTS and FUNDING AGREEMENT suggest that senior management perceives that the benefits associated with complying with these requirements provide little motivation for Zelda to improve data quality. Similar to the results for general users, the results for senior management also indicated that DQ REWARDS provide few incentives for data quality improvements.

The participants were asked to indicate their perceptions of the relative importance of

[9] Because the number of responses was well below the desirable level, factor analysis was not performed.
[10] Detailed discussion in relation to the Cronbach alpha measurements is contained in Appendix A.

accuracy, relevance, and timeliness of the data they entered or used. Table 5 summarises the perceptions of the relative importance of each of the data quality dimensions. There was no significant difference between senior management and general users' perceptions of the relative importance of the three data quality dimensions. Both senior management and general users perceived accuracy as approximately twice as important as relevance or timeliness. When a similar analysis was undertaken from the perspective of data producers versus data consumers, significant differences existed between the relative importance of the three data quality dimensions. That is, data producers perceived accuracy, relevance, and timeliness as approximately equally important. Data consumers perceive accuracy as twice as important as relevance or timeliness. Data consumers also perceived accuracy as significantly more important than data producers. Data producers, however, perceived both relevance and timeliness as more important than data consumers. Data producers may consider timeliness, in particular, as more important than data consumers because the organisation constantly encourages data producers to enter their data on a timely basis. This emphasis on timeliness occurs because the organisation may not receive recognition from funding agencies for activities that occurred prior to the end of a reporting period but that were entered after the end of the reporting period.

INSERT TABLE 5 HERE

4.2 Empirical Testing of the Research Model

The research model was tested using Pearson correlations. A subset of the model was tested with data from general users. The full model was tested using data from senior management. Additional post hoc analyses are conducted using the categories of data consumers and data producers.

4.2.1 Factors Affecting Data Quality Levels

Figure 3a shows the partial model tested using survey data from general users. The figure

indicates the Pearson correlations between the constructs and the levels of significance. Figure 3b shows the full model that was tested using survey data from senior management. The figure also includes the Pearson correlations between the constructs and the levels of significance.

INSERT FIGURE 3 HERE

4.2.2 Associations between Management Commitment and Data Quality, Champions and Extrinsic Rewards (Hypotheses 1, 2, and 3)

Hypothesis 1 asserts that management commitment is positively associated with data quality. The correlation coefficient between the two measures is highly significant for both the general users' (correlation coefficient of 0.487, p=0.001) and senior management (correlation coefficient of 0.687, p=0.005) models. Thus, hypothesis 1 is supported.

Hypothesis 2 states that the presence of one or more data quality champions is positively associated with management commitment to data quality. The correlation coefficient between the two measures is highly significant for the general users' (correlation coefficient of 0.480, p=0.007) and significant for senior management (correlation coefficient of 0.581, p=0.019) models. Hence, hypothesis 2 is supported.

Hypothesis 3 maintains that the presence of extrinsic rewards is positively associated with management commitment to data quality. The correlation coefficient between the two measures for the general users' model was moderately significant (correlation coefficient of 0.251, p=0.073).[11] The correlation coefficient between the two measures in the senior management model was not significant (correlation coefficient of 0.328, p=0.137). Given the low number of senior management observations, the lack of results may simply be due to the small sample size. Thus, hypothesis 3 is partially supported.

[11] Although this result is not significant at □ ≤ 0.05, it can be considered moderately significant in light of the small sample size of 38.

4.2.3 Association between Management Commitment, IS/IT Capabilities and Perceived Usefulness of Data Quality as a Strategic Resource (Hypotheses 4 and 5)

Hypothesis 4 which, asserts that management's perceptions of the usefulness of data quality for competitive funding is positively associated with management commitment to data quality, was not supported (correlation coefficient of -0.078, p=0.400). One possible reason for the non-significant relationship was the low number of responses (13). Another possible reason is that Zelda is a government-funded agency that operates in a non-competitive environment.

Hypothesis 5, which asserts that the organisation's IS/IT capabilities are positively associated with management's perceptions about the usefulness of data quality for competitive funding, was also not supported (correlation coefficient of 0.255, p=0.200). Two possible explanations for the non-significant relationship are a weakness in the survey questions intended to measure the construct[12] and the limited number of observations available for analysis.

4.2.4 Association between Perceived Need to Support Operations and Clients Services and Management Commitment (Hypothesis 6)

Hypothesis 6 asserts that management's perception of the need for high-quality data to support the organisation's operations and clients services is positively associated with management commitment to data quality. The analysis supported this hypothesis (correlation coefficient of 0.516, p = 0.036).

4.2.5 Association between External Factors and the Perceived Need for Data Quality to Support Operations (Hypotheses 7, 8, and 9)

Hypothesis 7 asserts that regulatory requirements influence organisations' perceptions of the need for high-quality data to support their operations and client services. The analysis supported this hypothesis (correlation coefficient of 0.525, p = 0.033).

[12] IS/IT/DQ experience was used as proxy for IS/IT capabilities. This proxy construct may not have measured IS/IT capabilities effectively.

Hypothesis 8, which asserts that funding agreement requirements influence management's perception of the need for data quality to support operations and client services, was not supported (correlation coefficient of 0.261, p=0.195). One possible explanation for the lack of support was that Zelda currently has a four-year funding agreement with the funding agencies. Thus, senior management may not perceive an immediate need for high-quality data to support operations and client services and funding agreements.

Hypothesis 9 asserts that government priorities influence management's perception of the need for data quality to support products and services. The analysis supported this hypothesis (correlation coefficient of 0.630, p = 0.010.)

4.3 Interviews with Senior Managers

Recall that seven senior managers were interviewed. The senior managers included the chief executive officer, two divisional managers, the business analyst, and three key officers of Zelda. The interviews provided insights into factors that Zelda's senior management's commitment to improve the quality of their data. The interviews with senior managers provided insights about the nature and causes of the data quality issues experienced by Zelda. Most errors currently experienced by Zelda were caused by staff not following procedures correctly when processing applications. Zelda attempts to reduce these errors by conducting data quality awareness programs with all levels of staff in the organisation.

Responses from the interviewees are discussed here where the responses illustrate support for an hypothesis that was previously not statistically supported. Thus, the four areas discussed are (1) whether Extrinsic rewards are positively associated with management's commitment to data quality; (2) whether the perceived usefulness of data quality for competitive funding is positively associated with management's commitment to data quality; (3) whether IS/IT Capabilities are positively associated with the perceived usefulness of data quality for competitive funding; and (4) whether the need to comply with funding agreements

is positively associated with the perceived need for data quality support operations and client services.

4.3.1 Attention to Data Quality

After analysing the interview transcripts for relationships in the model, they were then re-examined to understand a) how Zelda recognised and became aware of data quality issues, b) how Zelda identified the sources of data quality issues, and c) the strategies and processes Zelda used to improve data quality.

Strong and Miller (1995) categorised errors into operation errors, design errors, and errors due to dynamic changes in the organisation. Operation errors are errors caused by mistakes in processing and mistakes in inputs to the processes. Design errors are errors caused by inaccurate implementation of systems. Errors due to dynamic changes in the organisation occur when a static process embedded in the system does not match the organisation's current decision rules. These errors impact the accuracy and timeliness dimensions of data quality. Both transaction input errors and processing errors experienced by Zelda fall within these three broad categories of errors.

The major source of error was staff failing to follow procedures when processing applications. Providing more on-the-job training and continuing to communicate the impacts of poor data quality is likely to reduce errors from this source.

4.3.2 DQ Rewards

Through the years, Zelda has received numerous awards and recognition for excellence in innovation and productivity and for quality of service. For example, Zelda was a finalist in the prestigious Australian Quality Awards for Business Excellence competition. It also received high commendations for innovation and productivity in the Premier's Awards for Excellence in Public Sector Management. The spirit of delivering quality service and fostering innovation is one of the most-cherished aspects of Zelda's culture.

The commitment to maintaining high-quality data is not as strong, however, as delivering high-quality service. Zelda's mission is to provide services and assistance to people, especially low-income and disadvantaged people. Zelda's staff perceive that providing this assistance is their primary professional goal. Hence, they place much higher priority on delivering customer-related activities than on keeping data entry up-to-date. Furthermore, because Zelda is a government-funded agency, it can seldom provide tangible performance-based rewards to employees for achieving high-quality data. The following statement by the CEO illustrates the aforementioned fact:

> *Like any public sector organisation, there are no incentives to record time spent on each job accurately because they [the professionals] receive wages each week. If they record data late, they are not reprimanded, transferred, or downgraded on their performance appraisal. (SM1[13])*

Zelda's management recognises the importance of high-quality data for monitoring their funding budget and for requesting future funding. Hence, in spite of the obstacles, Zelda continues to strive to improve the quality of their data. Unfortunately, there is insufficient evidence to support Hypothesis 3.

4.3.3 Perceived Usefulness of High-Quality Data for Competitive Funding

Zelda's management perceives that high-quality data enhance Zelda's reputation and improve its relationships with its funding agencies. They perceive that high-quality data help Zelda to negotiate better future funding arrangements. The following statement by the CEO provides qualitative support for Hypothesis 4:

> *Both Commonwealth and the State Government officials have high regard for the quality of the information they are getting from Zelda. Having a reputation for accurate data has positive effects and helps Zelda obtain more of the funding we request. (SM1)*

[13] For anonymity the seven Senior Managers are identified as SM1 through SM7.

4.3.4 IS/IT Capabilities

Zelda's ability to recognise the potential benefits of high-quality data helped motivate improvements in the organisation's IS/IT capabilities. The increased use of technology innovations allowed Zelda to implement online electronic lodgement of applications. Improvements in technology have facilitated the implementation of a sophisticated accounting system that more accurately tracks Zelda's budget. The new accounting system enables the staff to conduct more sophisticated data analyses. One senior manager asserted that better IS/IT capabilities help link business and data together:

> *Information technology enables the organisation to allow people to play with the data and to understand it. They begin to realise that it is not just a piece of paper with graph on it, but something that when you look at it, you can feel what is right and what is wrong. More importantly, people now know how to use it and benefit from it. (SM2)*

This response provides qualitative support for hypothesis 5.

4.3.5 Funding Agreement

The overwhelming majority of Zelda's operating funds come from the Commonwealth and State Governments. These funds are provided to Zelda through funding agreements that normally last three to four years. The funding agreements require Zelda to provide accurate data on the services it provides and the clients it serves. The frequency of submissions and the types of data Zelda needs to provide are specified in the agreement. As the database administrator recalled:

> *We (Zelda) developed Vision to satisfy the requirements agreed upon between Zelda and the Commonwealth. The agreement specifies what data Zelda (and other similar service providers) should collect and submit. (SM6)*

These statements provide qualitative support for hypothesis 8.

4.4 Results Summary from Questionnaire and Interviews

Table 6 summarises the results relative to each of the nine hypotheses. It indicates that Hypotheses 1 and 2 were supported by both data collection methods. Hypothesis 3 was supported by the survey results, but not by the interviews. Hypotheses 4 and 8 were supported only by the interviews. Hypotheses 6 and 9 were supported by both data collection methods. Hypothesis 7 was supported only by the survey results.

4.5 Ex Post Analyses

Further analyses were conducted to examine relationships outside the research model. Results indicated a moderate correlation between DQ rewards and DQ (correlation coefficient of 0.522, $p = 0.034$). This relationship suggested that senior management perceived DQ rewards to directly influence data quality.

Results also show moderate correlations between Operations and Client Services and DQ (correlation coefficient of 0.507, $p=0.039$). Zelda is committed deliver high-quality, effective, and efficient services via technology and innovation. More recently, the senior management perceived a need for high-quality data to support their operations and client services. This relationship suggested a link between operations and client services and data quality.

Ex post analysis was also conducted to examine the relationships within the research model from the perspectives of data consumers versus data producers. The majority of senior managers were, as expected, data consumers (17 out of 20). Approximately half the general users were data consumers (17 out of 38 – 45%). Table 7 Panel A presents descriptive statistics for the constructs measured for data producers. Table 7 Panel B presents descriptive statistics for the constructs measured for data consumers. There were no significant differences between the means for each of the constructs.

Further analyses were conducted to examine relationships within the partial model for data producers and data consumers (Figures 4a and 4b). Results indicate that extrinsic rewards are associated with management's commitment to data quality for data consumers, however not data producers. When compared with the results for both senior managers and general users this result indicates that the relationship between extrinsic rewards and management's commitment to data quality for data consumers is most important for general users who are data consumers.

INSERT TABLE 7 HERE

INSERT FIGURE 4 HERE

5. CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH

This research was motivated by empirical and anecdotal evidence about the impacts of poor data quality on organisations' information systems. Data quality researchers have developed data quality frameworks to organise and structure data quality dimensions. Organisations can use these frameworks to understand data quality. Nevertheless, organisations continue to experience problems with data quality. The purpose of this research was to develop and test a model of factors influencing the level of data quality within an organisation. The model was tested using data collected from a data quality survey and interviews with senior managers.

This research validated the assertions that management responsibilities, including commitment to continuously improving data quality, effective communication among stakeholders, and data quality awareness, are important organisational elements that influence data quality. Data management researchers can use this research to refine existing data quality theory and models. They also can use the results of this research to refine existing data management policies or to develop new policies.

The research model benefits organisations in several ways. First, managers will be better able to identify critical factors for successfully implementing new data quality initiatives and for nurturing existing data quality activities. Second, managers will be better able to understand the relationships among these critical success factors. Third, they can use their improved understanding to develop or enhance their organisational data quality policies and initiatives.

The usual caveats associated with surveys and interview based research apply here. Within these caveats the most significant limitation is the small sample size upon which to base the statistical conclusions. The small sample did not allow more advanced techniques such as factor analysis or structural equation modelling to be used. With data being collected from only one case study firm, the additional limitation of generalisability of results also applies. Furthermore, the researchers relied upon the business analyst within the case study firm to help with the identification of the groups for receiving the questionnaire and also for the interviews. Finally, the possibility of measurement issues needs to be raised. With the constructs being modified from a number of existing instruments and the measurement scale being continuous rather than ordinal their applicability to a new setting needs to be noted.

The results of this study suggest several areas for future research. First, this study should be replicated with organisations from different industry sectors and with organisations that face different levels of competitiveness. This replication would allow for firm specific attributes to be incorporated into the research. Furthermore, with an expanded data set the model may be examined using additional statistical techniques such as structural equation modelling. Second, future studies could examine the impact of product types (information products versus traditional products) and business environments (e-Commerce versus traditional commerce) to further develop the framework and to obtain a deeper understanding of the need for high-quality data. Third, future research can be undertaken to refine the

researcher developed constructs and to improve the theoretical basis for examining the association between these constructs and the usefulness of data quality for competitive advantage. This research could also take into consideration the issues in relation to the actual level of data quality, ideal levels of data quality, and acceptable levels of data quality.

Appendix A – Reliability of Constructs

Table A.1 presents Cronbach's alpha for each construct. The generally agreed-upon lower limit for Cronbach's alpha is 0.70 (Nunnally 1978; Straub 1989) but may be decreased to 0.60 in exploratory research (Hair et al. 1998). For the first four constructs, the results show that constructs met or exceeded the guideline. Measurements for two of the five remaining constructs were below the desired level of 0.60. One possible explanation for these lower-than-desired scores was the limited number of observations (13) available for analysis. Furthermore, one of the constructs was measured by a new instrument developed by the researcher. Nunnally (1978, p. 230) states that Cronbach's alpha scores generally increase as the number of observations increases. Overall, the constructs appear reasonable.

INSERT TABLE A.1 HERE

Appendix B - Data Quality Survey Questionnaire: General Users

Dear Participant,

The attached questionnaires request information about your background and about your experience and opinions regarding data issues at YOUR ORGANSATION. The package has been pilot tested and should take less than 15 minutes to complete. While you are under no obligation to participate in this research, your participation is likely to benefit YOUR ORGANISATION as well as society overall.

Participant Background

1. Name: _____
2. Division/Department: _____ Phone: _____
3. Your job title: _____
4. Years with YOUR ORGANISATION: _____
5. Years of managerial experience: _____
6 Years in current position: _____
7. Application systems used include general applications like Word, Excel etc., and applications you use at YOUR ORGANISATION.

Application Systems Used

_____

_____

_____

Data Quality

Definition:

Data quality relates to the fitness of data for a task or set of tasks. This research focuses on the data-quality dimensions of **accuracy, relevance, and timeliness**. *Accuracy* refers to the degree of correspondence of recorded values to the actual values of the associated real-world objects. *Relevance* refers to the extent to which the data is applicable or appropriate for the required task. *Timeliness* refers to the extent to which the data are up-to-date for the required task.

The following set of questions asks you to indicate your perceptions of data quality in the Vision database. Please indicate by marking **X** on the line how strongly you agree with each of the following statements:

1. The data I enter/use are accurate.

Strongly Disagree **Strongly Agree**

0 1

2. The data I enter/use are relevant.

Strongly Disagree **Strongly Agree**

0 1

3. The data I enter/use are timely.

Strongly Disagree **Strongly Agree**

0 1

4. Please indicate the relative importance of the three data quality dimensions above in relation to the tasks you perform at YOUR ORGANISATION.

Data Quality Dimension	Relative Importance
Accuracy	
Relevance	
Timeliness	

Total 100

Management Commitment to Data Quality

Considering the data quality definition from the previous page, please indicate by marking **X** on the line how strongly you agree with each of the following statements:

1. Senior management at YOUR ORGANISATION assumes responsibility for data quality improvement.

Strongly Disagree **Strongly Agree**

0 1

2. Senior management at YOUR ORGANISATION supports long-term data quality improvement initiatives.

Strongly Disagree **Strongly Agree**

0 1

3. Divisional heads at YOUR ORGANISATION accept responsibility for data quality improvement.

Strongly Disagree **Strongly Agree**

0 1

4. Divisional heads at YOUR ORGANISATION support long-term data quality improvement initiatives.

Strongly Disagree **Strongly Agree**

0 1

5. The goal-setting process among senior management at YOUR ORGANISATION for data quality improvement is comprehensive.

Strongly Disagree **Strongly Agree**

0 1

Champion

Considering the data quality definition on page 2, please indicate by marking **X** on the line how strongly you agree with each of the following statements:

1. Currently, one or more people within YOUR ORGANISATION are actively supporting and promoting the use of high-quality data.

Strongly Disagree **Strongly Agree**

0 1

2. Currently, one or more people within YOUR ORGANISATION are responsible for data quality improvement.

Strongly Disagree **Strongly Agree**

0 1

3. People currently responsible for data quality improvements come from a functional area.

Strongly Disagree **Strongly Agree**

0 1

Extrinsic Rewards

Considering data quality definition on page 2, please indicate by marking **X** on the line how strongly you agree with each of the following statements:

1. Employees are recognised and rewarded for data quality improvement suggestions and ideas.

Strongly Disagree **Strongly Agree**

0 1

2. Bonuses, promotions, or increases in budget are given for data quality efforts that lead to improved productivity and performance.

Strongly Disagree **Strongly Agree**

0 1

3. Resources are available for attending data quality-related training, seminars, conferences, and workshops.

Strongly Disagree **Strongly Agree**

0 1

IS/IT and Data Quality Experience

The following set of questions request information about your exposure to information system (IS) or information technology and awareness regarding data quality.

1a. How frequently do you attend IS/IT-related conferences, seminars, exhibitions, or workshops?
Average number per Year: _____

1b. For the last two years, which IS/IT-related conferences, seminars, exhibitions, or workshops have you attended?

Which ones did you find most useful? Please evaluate them in terms of their usefulness. (0-100 with 0 = worthless and 100 = extremely useful)

Conferences/Seminars/Exhibitions/Workshops Attended	*Usefulness (0-100)*

1c. What IS/IT-related publications (books, journals, magazines, etc.) do you read?

Which ones did you find most useful? Please evaluate them in terms of their usefulness. (0-100 with 0 = worthless and 100 = extremely useful)

Books/Journals/Magazines Read	*Usefulness (0-100)*

2a. How frequently do you attend data quality (DQ)-related conferences, seminars, exhibitions, or workshops?
Average number per Year: _____

2b. For the last two years, which data quality (DQ)-related conferences, seminar exhibitions, or workshops have you attended?

Which ones did you find most useful? Please evaluate them in terms of their usefulness. (0-100 with 0 = worthless and 100 = extremely useful)

Conferences/Seminars/Exhibitions/Workshops Attended	*Usefulness (0-100)*

2c. What data quality-related publications (books, journals, magazines, etc.) do you read?

Which ones did you find most useful? Please evaluate them in terms of their usefulness. (0-100 with 0 = worthless and 100 = extremely useful)

Books/Journals/Magazines Read	*Usefulness (0-100)*

Appendix C - Data Quality Survey Questionnaire: Senior Management

Dear Participant,

The attached questionnaires request information about your background and about your experience and opinions regarding data issues at YOUR ORGANISATION. The package has been pilot tested and should take less than 15 minutes to complete. While you are under no obligation to participate in this research, your participation is likely to benefit YOUR ORGANISATION as well as society overall.

Participant Background, Applications Systems Used, Data Quality, Management Commitment to Data Quality, Champion and Extrinsic Rewards - Same as for the Relevant Section on General User Questionnaire – Appendix B

Perceived Usefulness of Data Quality For Competitive Funding

The following set of questions is included to ascertain the perceived usefulness of high-quality data for competitive funding submissions. Please indicate by marking **X** on the line how strongly you agree with each of the following statements:

1. Use of high-quality data will allow us to be more competitive in the funding submissions we put forward.

Strongly Disagree	**Strongly Agree**
0	1

2. Use of high-quality data will increase our ability to compete for scarce funding.

Strongly Disagree	**Strongly Agree**
0	1

3. Use of high-quality data enables us to maintain/increase the number of services to financially disadvantaged public.

Strongly Disagree	**Strongly Agree**
0	1

4. Use of high-quality data will result in increases in the amounts of individual assistance to financially disadvantaged public.

Strongly Disagree	**Strongly Agree**
0	1

Perceived Need for Data Quality to Support Operations and Client Services

The following set of questions is included to ascertain the perceived need for data quality to support operations and client services. Please indicate by marking **X** on the line how strongly you agree with each of the following statements:

1. High-quality data are important for our stakeholder's/client's satisfaction.

Strongly Disagree	**Strongly Agree**
0	1

2. High-quality data are essential for YOUR ORGANISATION's reputation and trust.

Strongly Disagree **Strongly Agree**

0 1

3. Use of high-quality data increases our ability to effectively use our resources for our stakeholders/clients.

Strongly Disagree **Strongly Agree**

0 1

4. Use of high-quality data results in fewer stakeholder/client complaints.

Strongly Disagree **Strongly Agree**

0 1

5. Use of high-quality data enable us to give our stakeholders/clients more personal attention and quicker responses.

Strongly Disagree **Strongly Agree**

0 1

Regulatory Requirements

The following set of questions is included to ascertain regulatory requirements. Please indicate by marking **X** on the line how strongly you agree with each of the following statements:

1. Regulatory requirements mandate maintaining high-quality data in Vision.

Strongly Disagree **Strongly Agree**

0 1

2. Regulatory requirements impose strong penalties for failing to maintain high-quality data.

Strongly Disagree **Strongly Agree**

0 1

3. Compliance with regulatory requirements to maintain high-quality data is important to maintain or increase funding to YOUR ORGANISATION.

Strongly Disagree **Strongly Agree**

0 1

Funding Agreements

The following set of questions is included to ascertain the nature of funding agreements. Please indicate by marking **X** on the line how strongly you agree with each of the following statements:

1. Data quality requirements are included in all funding agreements.

Strongly Disagree **Strongly Agree**

0 1

2. Procedures are in place to measure data quality to ensure it meets funding agreements.

Strongly Disagree **Strongly Agree**

0 1

3. There are provisions for penalties for non-adherence to data quality requirements in the funding agreements.

Strongly Disagree **Strongly Agree**

0 1

4. There are incentives for achieving high-quality data (meeting or exceeding the data quality requirements in funding agreements).

Strongly Disagree **Strongly Agree**

0 1

Government Priorities

The following set of questions is included to ascertain competitive pressure and government priorities. Please indicate by marking **X** on the line how strongly you agree with each of the following statements:

1. Use of high-quality data increases our ability to produce the outputs required to support government priorities.

Strongly Disagree **Strongly Agree**

0 1

2. Use of high-quality data enables us to meet reporting requirements required to support government priorities.

Strongly Disagree **Strongly Agree**

0 1

3. Use of high-quality data enables us to help government to better identify future needs and gaps in the professional services currently provided.

Strongly Disagree **Strongly Agree**

0 1

IS/IT and Data Quality Experience

Same as for the IS/IT and Data Quality Experience Section on General User Questionnaire – Appendix B

References

Anderson, J.C., M. Rungtusanthanam, R. Schroeder, and S. Devaraj, 1995, A path analytic model of a theory of quality management underlying the Deming management method: preliminary empirical findings. *Decision Sciences* (19:3), 473-509.

Anderson, F.R. 2002, Data Quality Act, *National Law Journal* (25:8), B9.

Barney, J.B. 1991, Firm resource and sustained competitive advantage. *Journal of Management* (17:1) 99-120.

Ballou, D.P., and H. L. Pazer, 1995, Designing information systems to optimize the accuracy-timeliness tradeoff. *Information Systems Research* (6:1) 51-72.

Ballou, D.P., S. Madnick, and R. Wang, 2004, Assuring information quality. *Journal of Management Information Systems* (20:3) 9-11.

Ballou, D.P., R. Y. Wang, H. Pazer, and G. K. Tayi, 1998, Modelling information manufacturing systems to determine information product quality. *Management Science* (44:4) 463-485.

Beath, C.M. 1991, Supporting the information technology champion. *MIS Quarterly* (15:3) 355-371.

Bharadwaj, A. 2000, A resource-based perspective on information technology capability and firm performance: an empirical investigation. *MIS Quarterly* (24:1) 169-196.

Black, S.A., and L. J. Porter, 1996, Identification of critical success factors of TQM. *Decision Sciences* (27:1) 1-21.

Cappiello, C., C. Francalanci, and B. Pernici, 2004, Time-related factors of data quality in multichannel information systems. *Journal of Management Information Systems* (20:3) 71-92.

Copeland, D.G., and J. L. McKenney, 1988, Airline reservation systems: lessons from history. *MIS Quarterly* (12:3) 353-370.

Douglas, T.J., and W. Q. Judge, 2001, Total quality management implementation and competitive advantage: the role of structural control and exploration. *Academy of Management Journal* (44:1) 158-170.

English, L. P. 1999, *Improving Data Warehouse and Business Information Quality: Methods For Reducing Costs and Increasing Profits*. (Wiley, New York).

Flynn, B.B., R. G. Schroeder, and S. Sakakibara, 1995, The impact of quality management practices on performance and competitive advantage. *Decision Sciences* (26:2) 659-692.

Fox, C., A. V. Levitin, and T. C. Redman, 1994, The notion of data and its quality dimensions. *Information Processing & Management* (30:1) 9-19.

Giannoccaro, A., G. Shanks, and P. Darke, 1999, Stakeholder perceptions of data quality in a data warehouse environment. *Australian Computer Journal* (31:4) 110-117.

Gibbs, M.R., G. Shanks, R. Lederman, and R. De Silva, 2002, Privacy and customer data quality: Exploring the issues 1*3th Australasian Conference on Information Systems*, 4th – 6th December, Melbourne, Australia.

Grant, R.M. 1991, The resource-based theory of competitive advantage. *California Management Review* (33:3) 114-135.

Grant, R.M, 1995, *Contemporary Strategy Analysis*, (Blackwell Publishers Inc, Oxford).

Guimaraes, T., and M. Igbaria, 1997, Client/server system success: Exploring the human side. *Decision Sciences* (28:4) 851-876.

Hair, J.F., R. E. Anderson, R. L. Tatham, and W. C Black, 1998, *Multivariate Data Analysis*, (Prentice-Hall International, Inc, Upper Saddle River, New Jersey).

Howell, J.M., and C. A. Higgins, 1990, Champions of technological innovations. *Administrative Science Quarterly* (35:2) 317-341.

Heng, M.S., E. M. Trauth, and S. J. Fisher, 1999, Organisational champions of IT innovation.

Accounting Management and Information Technology (9:3) 193-222.

Huang, K.T., T. W. Lee, and R.Y. Wang, 1999, *Quality Information and Knowledge*. Prentice Hall, Upper Saddle River, New Jersey.

Huh, Y. U., F. R. Keller, T. C. Redman, and A. R. Watkins, 1990, Data quality. *Information & Software Technology* (32:8) 559-565.

Ingram, T.N., and D. N. Bellenger, 1983, Personal and organizational variables: their relative effects on reward valences of industrial salespeople. *Journal of Marketing Research* (20:2) 198-205.

Jiang, J.J., W. A. Muhanna, and G. Klein, 2000, User resistance and strategies for promoting acceptance across system types. *Information & Management* (37:1) 25-36.

Kahn, B.K., D. M. Strong, and R. Y. Wang, 2002, Information quality benchmarks: product and services performance. *Communications of the ACM* (45:4) 184-192.

Klein, B.D., D. L. Goodhue, and G. B. Davis, 1997, Can humans detect errors in data? Impact of base rates, incentives, and goals. *MIS Quarterly* (21:2) 169-195.

Lee, Y. W. and D. M. Strong, 2004, Knowing-why about data processes and data quality. *Journal of Management Information Systems* (20:3) 13-40.

Levitin, A. V., and T. C. Redman, 1998, Data as a resources: properties, implications, and prescription. *Sloan Management Review* (40:1) 89-101.

Nambisan, S., R. Agarwal, and M. Tanniru, 1999, Organizational mechanisms for enhancing user innovation in information technology. *MIS Quarterly* (23:3) 365-395.

Nunnally, J.C., 1978, *Psychometric Theory*, (McGraw-Hill, New York).

Oz, E., and J.J. Sosik, 2000, Why information systems projects are abandoned: A leadership and communication theory and exploratory study. *Journal of Computer Information Systems* (41:1), 66-78.

Paradice, D.B., and W.L. Fuerst, 1991, An MIS data quality methodology based on optimal

error detection. The Journal of Information Systems (5:1) 48-66.

Parasuraman, A., L. L. Berry, and V. A. Zeithaml, 1988, SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing* (64:1) 12-40.

Parasuraman, A., L. L. Berry, and V. A. Zeithaml, 1991, Refinement and reassessment of the SERVQUAL scale. *Journal of Retailing* (67:4) 420-450.

Poon, P., and C. Wagner, 2001, Critical success factors revisited: success and failure cases of information systems for senior executives. *Decision Support Systems* (30:4) 393-418.

Powell, T., 1995, Total quality management as competitive advantage: A review and empirical study. *Strategic Management Journal* (16) 15-37.

Redman, T.C., 1995, Improve data quality for competitive advantage. *Sloan Management Review* (36:2) 99-107.

Redman, T.C., 1996, *Data Quality for the Information Age.* (Artech House, Inc., MA).

Reich, B.H., and I. Benbasat, 2000, Factors that influence the social dimension of alignment between business and information technology objectives. *MIS Quarterly* (24:1) 81-113.

Salancik, G.R., 1997, Commitment and control of organizational behavior and belief. In *New Directions in Organizational Behavior*, Staw, B., and Salancik, G.R., (eds) St Clair Press, Chicago, IL. 1-54.

Saraph, J. V., P. G. Bensen, and R. G. Schroeder, 1989, An instrument for measuring the critical factors of quality management. *Decision Sciences* (20:4) 810-829.

Sarin, S., and V. Mahajan, 2000, The effects of reward structures on the performance of cross-functional products development team. *Journal of Marketing* (65) April 35-53.

Straub, D.W. 1989, Validating Instruments in MIS Research, *MIS Quarterly* (13:2), 147-169.

Tubbs, M.E., 1993, Commitment as a moderator of the goal-performance relation: a case for

clearer construct definition. *Journal of Applied Psychology* (78:1) 86-97.

Wang, R.Y. and H. B. Kon, 1993, Toward total data quality management (TDQM). In *Information Technology in Action: Trends and Perspectives.* Wang, R.Y. (Ed), Prentice Hall, Englewood Cliffs, NJ.

Wang, R. Y., 1998, A product perspective on total data quality management. *Communications of the ACM* (40:2) 58-65.

Wang, R.Y., V. C. Storey, and C. P. Firth, 1995, A framework for analysis of quality research. *IEEE Transactions On Knowledge and Data Engineering* (7:4) 623-640.

Wang, R.Y., and D. M. Strong, 1996, Beyond accuracy: what data quality means to data consumers. *Journal of Management Information Systems* (12:4) 5-33.

Wixom, B.H., and H. J. Watson, 2001, An empirical investigation of the factors affecting data warehousing success. *MIS Quarterly* (25:1) 16-41.

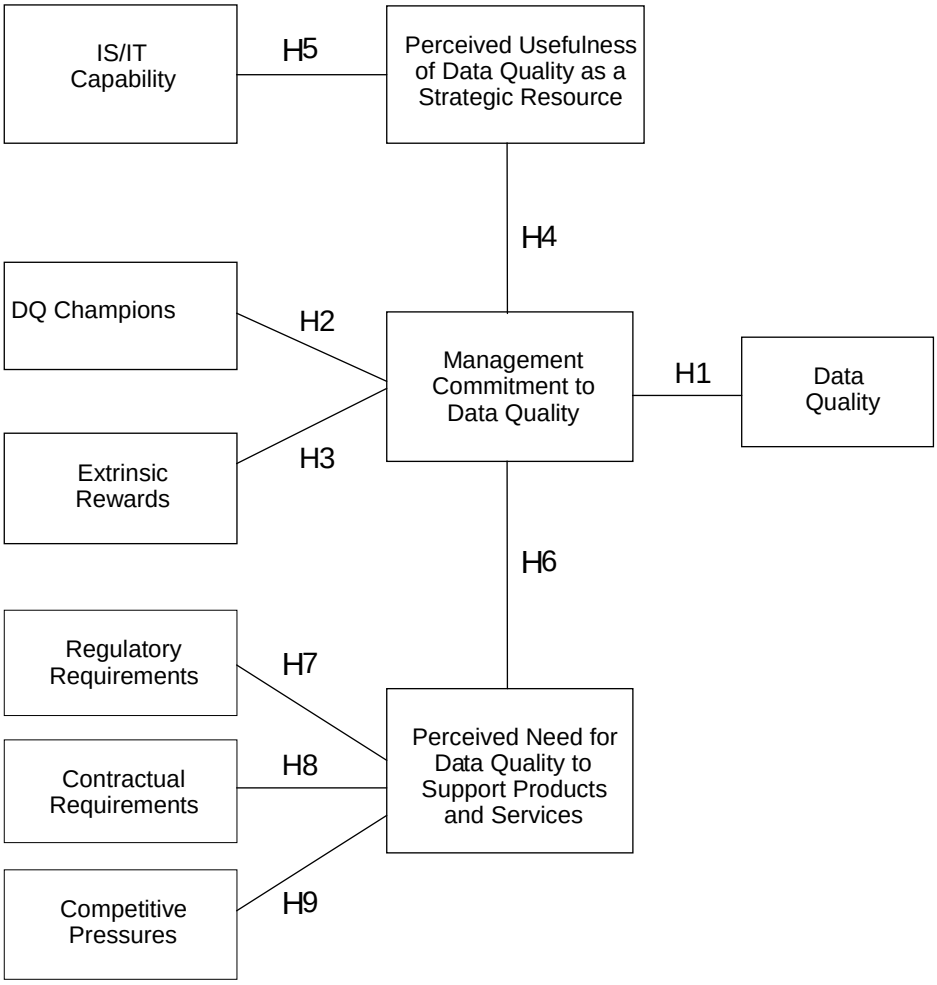
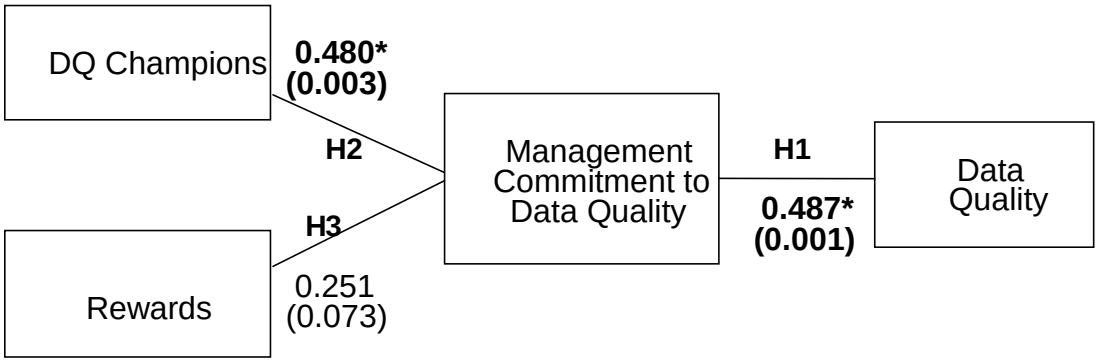


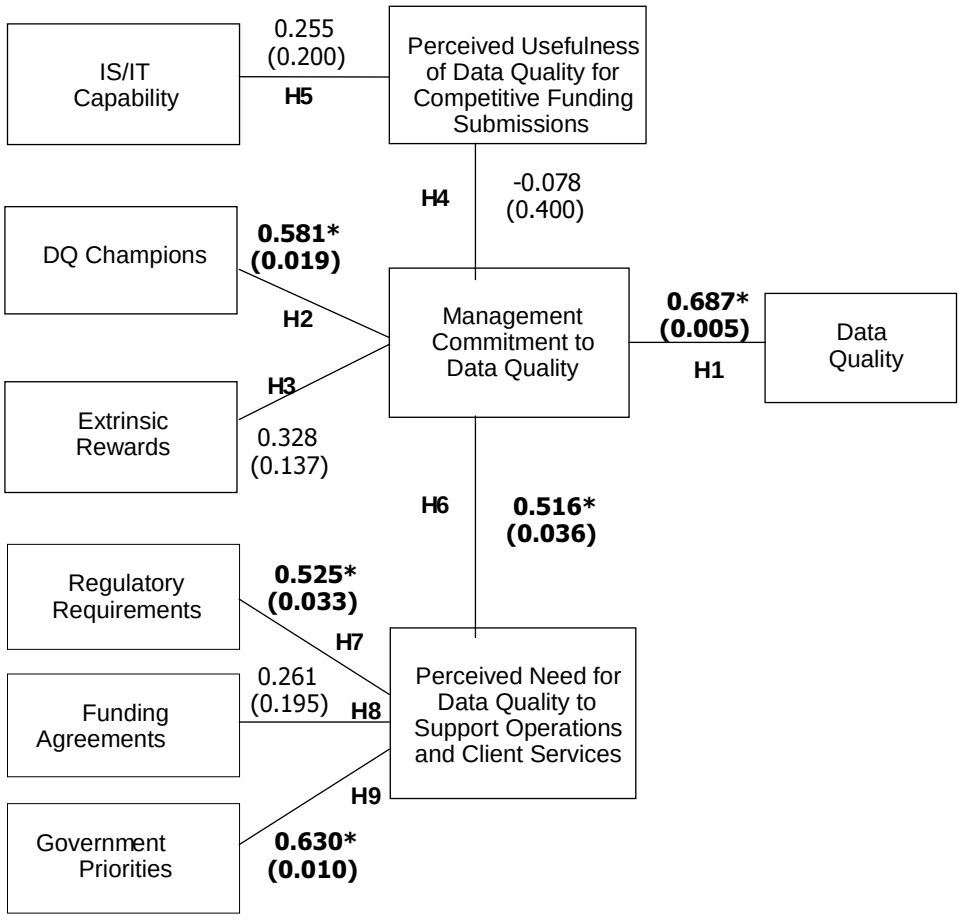
Figure 1: Research Model

Figure 2: Example of a Participant's Response



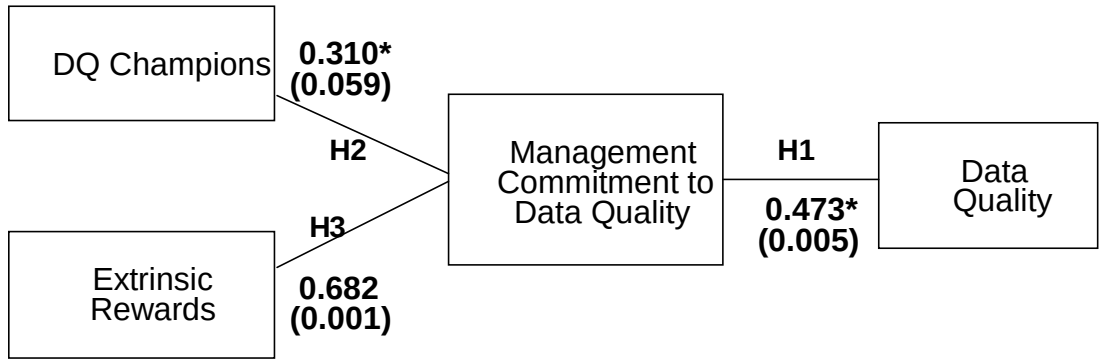
* Indicates statistically significant relationship.

Figure 3a: Factors Affecting Data Quality – General User Partial Model



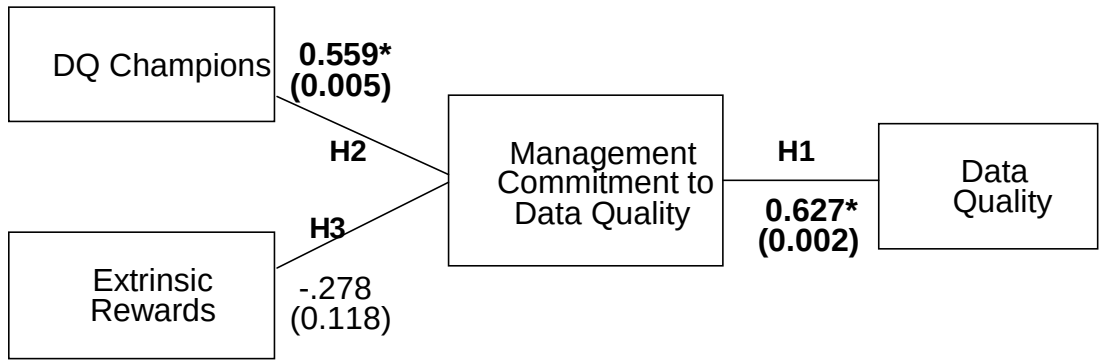
* Indicates statistically significant relationship.

Figure 3b: Factors Affecting Data Quality – Senior Management Model



* Indicates statistically significant relationship.

Figure 4a: Factors Affecting Data Quality – Data Consumers Model



* Indicates statistically significant relationship.

Figure 4b: Factors Affecting Data Quality – Data Producers Model

Table 1: Instrument Development

DESCRIPTION IN MODEL	SOURCE OF QUESTIONS	CONSTRUCT NAME
Data Quality	Wang et al. (1996), Kahn et al. 2002, as modified by researchers	DATA QUALITY
Management Commitment to Data Quality	Saraph et al. (1989), Flynn et al. (1994), Wixom et al. (2001), as modified by researchers	DQ COMMITTMENT
Data Quality Champions (DQ Champions)	Wixom et al. (2001), Beath (1991), Reich and Benbasat (1990), as modified by researchers	DQ CHAMPIONS
Data Quality-related Extrinsic Rewards (Extrinsic Rewards)	Saraph et al. (1989), Flynn et al. (1995), as modified by researchers	DQ REWARDS
Perceived Usefulness of Data Quality as a Strategic Resource (Perceived Usefulness of Data Quality for Competitive Funding Submissions)	Powell (1995), Douglas and Judge (2001), as modified by researchers	COMPETITVE FUNDING
IS/IT Capabilities	Bharadwaj (2000), Reich and Benbasat (2000), as modified by researchers	IS/IT CAPABILITY
Perceived Need for Data Quality to Support Products and Services (Perceived Need for Data Quality to Support Operations and Client Services)	SERVQUAL (Parasuraman et al. 1988 1991), as modified by researchers to take into account just the perceived need.	OPERATIONS AND CLIENT SERVICES
Regulatory Requirements	Developed by researchers	REGULATORY REQUREMENTS
Contractual Requirements (Funding Agreements)	Developed by researchers	FUNDING AGREEMENT
Competitive Pressures (Government Priorities)	Developed by researchers	GOVERNMENT PRIORITIES

Table 2: Population, Sample, and Responses

		General Users		
	Senior Managers	**Support Staff**	**Professionals**	**Total**
Head Office	15	90	150	255
Regional Offices	0	44	38	82
Total Population	**15**	**134**	**188**	**337**
Sample	14	41	12	67
Responses	13	33	5	51

Table 3: Respondents' IS/IT/DQ Experience (IS/IT CAPABILITY)

	General Users (N=36)*		Senior Management (N=13)	
	Mean	StdDev	Mean	StdDev
Frequency of attending IS/IT and DQ related conferences, exhibitions, seminars, and workshops	0.3056	0.6242	1.7692	2.1273

* Two general users did not indicate their IS/IT/DQ experience.

Table 4: Construct Descriptive Statistics
Panel A – Descriptive Statistics General Users

Constructs (N = 38)	Min	Max	Mean*	StdDev
DATA QUALITY	0.3918	0.9931	0.6828	0.1349
DQ COMMITMENT	0.2742	0.9794	0.6107	0.1634
DQ CHAMPIONS	0.4794	0.9639	0.7188	0.1307
DQ REWARDS	0.0241	0.8179	0.3386	0.1833

Panel B – Descriptive Statistics Senior Managers

Constructs (N = 13)	Min	Max	Mean*	StdDev
DATA QUALITY	0.4089	0.9519	0.6964	0.1691
DQ COMMITMENT	0.2948	0.9526	0.7156	0.2119
DQ CHAMPIONS	0.5200	0.9725	0.7354	0.1517
DQ REWARDS	0.1924	0.6900	0.3984	0.1251
COMPETITIVE FUNDING	0.4900	0.9948	0.7078	0.1452
OPERATIONS AND CLIENT SERVICES	0.3979	0.8680	0.6948	0.1380
REGULATORY REQUIREMENTS	0.2749	0.7835	0.5507	0.1554
FUNDING AGREEMENT	0.0900	0.6500	0.4493	0.1741
GOVERNMENT PRIORITIES	0.4467	1.0000	0.7105	0.1889

** On 0 – 1 point scale*

Table 5: Perceptions of Relative Importance of Data Quality Dimension (100 points in total)

Data Quality Dimension	By Staff Level			By Data User Type		
	Mean		P value	Mean		P value
	SM (N=13)	GU (N=38)	SM vs GU	DP (N=20)	DC (N=31)	DP vs DC
Accuracy	49.85	43.53	0.242	36.89	49.41	0.011
Relevance	24.45	29.90	0.115	32.52	26.38	0.058
Timeliness	25.68	26.53	0.805	30.58	24.16	0.042

Note: SM - Senior Management, GU - General User, DP - Data Producer, and DC - Data Consumer

Table 6: Summary Results of the Testing of Hypotheses in the Model

Hypothesis	Description	Statistical Test Results	Interview Responses
H1	Management commitment to data quality is positively associated with the level of data quality achieved.	**Supported**	**Supported**
H2	The presence of a champion is positively associated with management's commitment to data quality.	**Supported**	**Supported**
H3	Extrinsic rewards are positively associated with management's commitment to data quality.	**Partially Supported**	Insufficient Evidence
H4	The perceived usefulness of data quality for competitive funding is positively associated with management's commitment to data quality.	Not Supported	**Supported**
H5	IS/IT Capabilities are positively associated with the perceived usefulness of data quality for competitive funding.	Not Supported	**Supported**
H6	The perceived need for data quality to support operations and client services is positively associated with management's commitment to data quality.	**Supported**	**Supported**
H7	The need to comply with regulatory requirements is positively associated with the perceived need for data quality support operations and client services	**Supported**	Insufficient Evidence
H8	The need to comply with funding agreements is positively associated with the perceived need for data quality support operations and client services	Not Supported	**Supported**
H9	Meeting government priorities is positively associated with the perceived need for data quality to support operations and client services	**Supported**	**Supported**

Table 7: Construct Descriptive Statistics

Panel A – Descriptive Statistics Data Producers (3 Senior Managers)

Constructs (N = 20)	Min	Max	Mean*	StdDev
DATA QUALITY	0.3918	0.9931	0.6672	0.1498
DQ COMMITMENT	0.2742	0.9794	0.5945	0.1893
DQ CHAMPIONS	0.5326	0.9725	0.7393	0.1278
DQ REWARDS	0.0241	0.6495	0.3175	0.1741

Panel B – Descriptive Statistics Data Consumers (17 Senior Managers)

Constructs (N = 31)	Min	Max	Mean*	StdDev
DATA QUALITY	0.4000	0.9519	0.6987	0.1391
DQ COMMITMENT	0.2948	0.9113	0.6671	0.1726
DQ CHAMPIONS	0.4794	0.9639	0.7124	0.1296
DQ REWARDS	0.1000	0.8179	0.3800	0.1758

** On 0 – 1 point scale*

Table A.1: Summary of Reliability Tests of Constructs

No	Construct	Cronbach Alpha Value	
		General Users (N=38)	Senior Managers (N=13)
1	DATA QUALITY	0.7246	0.8286
2	DQ COMMITMENT	0.8842	0.9663
3	DQ CHAMPIONS	0.7528	0.7590
4	DQ REWARDS	0.8031	0.7590
5	COMPETITIVE FUNDING		0.6940
6	OPERATIONS AND CLIENT SERVICES		0.5246
7	REGULATORY REQUIREMENTS		0.7566
8	FUNDING AGREEMENT		0.5885
9	GOVERNMENT PRIORITIES		0.6595