IMPROVING DATA QUALITY IN THE BANKING SUPERVISORY DATA OF SOUTHERN AFRICA CENTRAL BANKS

Refiloe Motjolopane
School of Information Technology
University of Pretoria
Pretoria
South Africa
rmotjolopane@centralbank.org.ls

Patricia E.N. Lutu[1]
Department of Computer Science
University of Pretoria
Pretoria
South Africa
Patricia.Lutu@up.ac.za

ABSTRACT
The importance of effective supervision of banking institutions in developing countries cannot be over-emphasised. Central banks are responsible for the supervision of the banking institutions of a country. In order to effectively perform the supervisory role of banking institutions, central banks need to collect and analyse data about the operations of the banking institutions they supervise. Data analysis is conducted in order to establish the health of these institutions. Central banks in the SADC region experience many problems with the quality of the data that they receive from the banking institutions they supervise. Needless to say, decisions made on the basis of poor quality data increase the risk of allowing unsound institutions to continue in operation. This creates the real risk of loss of money by the individuals and organisations that form the clientele of these institutions, and will adversely affect the economy of the country. Despite the commendable efforts made by the regional central banks to implement a banking supervision application to expedite the supervisory activities through instituting a one-stop-shop for all the banking supervisory information, and the introduction of an electronic platform for collecting and analysing periodic banking supervision returns, there are still many imperfections in the information. A survey was conducted to investigate data quality problems at three SADC central banks. Recommendations are provided in this paper on measures that can be taken to improve the quality of the banking supervisory data for the SADC central banks.

Keywords: data quality, information quality, SADC banking supervision, banking supervisory data.

1. INTRODUCTION

The importance of effective supervision of banking institutions in developing countries cannot be over-emphasised. Central banks are responsible for the supervision of the banking institutions of a country. In order to effectively perform the supervisory role of banking institutions, central banks need to collect and analyse data about the operations of the banking institutions they supervise. Data analysis is conducted in order to establish the health of these institutions. Central banks in the SADC region experience many problems with the quality of the data that they receive from the banking institutions they supervise. Needless to say, decisions made on the basis of poor quality data increase the risk of allowing unsound institutions to continue in operation. This creates the real risk of loss of money by the individuals and organisations that form the clientele of these institutions, and could adversely affect the economy of the country.

According to the Association of African Central Banks (2009), typical functions of central banks include the following:

[1] Corresponding author

(1) Promoting sound monetary policies within the framework of the economic objectives
(2) Managing the exchange rate policy and the official reserves
(3) Safeguarding the integrity and efficiency of the banking sector
(4) Advising government on monetary and fiscal policies
(5) Acting as banker to top government
(6) Conducting research in economic matters

With respect to safeguarding the integrity and efficiency of the banking sector, the central banks' objective is to achieve a sound, efficient banking system in the interest of the depositors of banks and the economy as a whole (South African Reserve Bank, 2009). In order to carry out this role, the central banks must be able to gather and analyze meaningful and timely information (de Krivoy, 2004). It is therefore imperative that the central banks need to ensure that the information used in this regard is of high quality to facilitate efficient and effective banking supervision. Given the recent developments in the global financial markets, and especially the credit-crunch in Europe and North America, there is added pressure on the central banks to be more vigilant in their regulation of the banking institutions, hence the need for even better quality data and information.

In 2003, Alawode (2003) reported the research he had conducted on African banking institutions and identified four major problems in banking supervision practices. The first problem was that the supervised banks were often not diligent in rendering returns on time. The second problem was that the supervised banks complained about the volumes of information required by the central banks and the cumbersome processes of rendering returns in hard copy format. The third problem identified by Alawode (2003) was that the central banks were often lenient in the application of the sanctions for the late submissions, a practice which undermined the credibility with the banking institutions. The fourth problem was that the African central banks had made efforts to introduce electronic submission of prudential returns. Unfortunately these efforts were generally plagued by technical problems such as lack of compatibility between the central bank computer systems and those of the supervised banking institutions, and were therefore not successful.

A literature search by the authors did not reveal any studies that focus on data quality issues in the SADC region central banks. However, as an employee of one of the SADC central banks, the first author of this paper has observed that the regional central banks have automated the submission and analysis of the returns. Unfortunately, these banks are battling with ways to improve the data collection, data analysis as well as the quality of information used to supervise the banking institutions. The foregoing observations motivated the second author to conduct an empirical study that focused on the data quality issues in the banking supervisory data for SADC region banks. The objectives of the research reported in this paper were to: (1) identify the factors that affect the quality of data collected by SADC central banks, (2) identify the problems that arise due to poor quality data, (3) raise awareness of the problems due to poor quality data, and (4) suggest corrective measures that central banks can take to improve the quality of the data they use for decision making. The main research question that was answered by this research was: *How can the problems that affect the quality of supervisory information in the SADC central banks be resolved?* Survey research was conducted at three SADC central banks to establish the existence and extent of data quality problems in supervisory data. Based on the research findings, recommendations are provided in this paper on measures that can be taken to improve the quality of the banking supervisory data for the SADC central banks.

The rest of this paper is organized as follows: Section 2 provides the background to banking supervision. Section 3 provides a discussion of data and information quality problems. Section 4 presents the research methods used for the reported study. The research

findings are presented in section 5. Sections 6 and 7 respectively provide a discussion of the research findings and conclusions.

2. BANKING SUPERVISION

Banking supervision is discussed in this section. Banking supervision functions, information requirements for banking supervision, and the information systems used by the banks in the SADC region are presented.

2.1 Banking Supervision in the SADC Region

The main purpose of banking supervision is to achieve a sound, efficient banking system in order to protect the interests of the depositors and the national economy (South African Reserve Bank, 2009). To achieve this objective, banking supervision involves controlling entrance and participation into the banking industry through the issuing of licenses for conducting banking business as well as controlling, supervising and regulating banking institutions in accordance with applicable banking legislation in the country of operation (South African Reserve Bank, 2009; Bank of Namibia, 2009). Within the SADC region, the task of supervising banks is predominantly undertaken by the central banks. The central banks in this region form part of the regional group of the Basel Committee on Banking Supervision known as the East and Southern African Banking Supervisors Group (ESAF), which was formed in 1997. The main objective of ESAF is 'to harmonise banking legislation and supervision practices and to share information on matters regarding banking supervision' (East and Southern Africa Banking Supervisors Group, 2003, 2009).

In harmonising banking supervision, ESAF covers several aspects of the legal framework, namely: internationally accepted minimum reporting, disclosures and prudential standards, common enforcement measures as well as common business, applications and technology architecture. These areas have been identified for harmonisation within the ESAF group (East and Southern Africa Banking Supervisors Group, 2003).

2.2 Information Requirements for Banking Supervision

At a high-level, the bank supervision function encompasses processes such as management of supervisory infrastructure, licensing of banks, on-site and off-site supervision and enforcement of action (East and Southern Africa Banking Supervisors Group, 2003). Detailed discussions of the individual processes and their information requirements are provided in this section. Figure 1 depicts the five components of the ESAF banking supervision function.The first component of the ESAF banking supervision function is the management of supervisory infrastructure. Generally, the laws governing the operations of the banks are formulated and maintained by governments through their legislative bodies, the parliaments. However, in performing this function, the governments need informed input from the central banks. In addition to this, the supervisory authorities need to formulate rules, regulations, policies and guidelines required for regulating the banking sector. This requires the supervisory authorities to be informed about current legislature and regulations, international trends in banking institutions and banking supervision, regional and local banking supervision standards. In this regard, the central banks need information to enable them to assess the adequacy of their supervisory frameworks to be able to ensure that the frameworks continue to be relevant to their environments over time.

The second component of the ESAF banking supervision function is the licensing of banking institutions. In most countries, the initial licensing, renewal of licenses and the revocation of licenses are left to the supervisory regulators to perform in accordance to the established rules and regulations for performing these functions. To achieve this, the regulators need accurate and up-to-date information on the organisational structure,

shareholder details, management details, directorship, officers' details, auditors' details, shareholdings, affiliation to other institutions, products and services, financial track record, financial projections, proof of available funds, risk management policies, contact details, and the bank branches (East and Southern African Banking Supervisors Group, 2003).

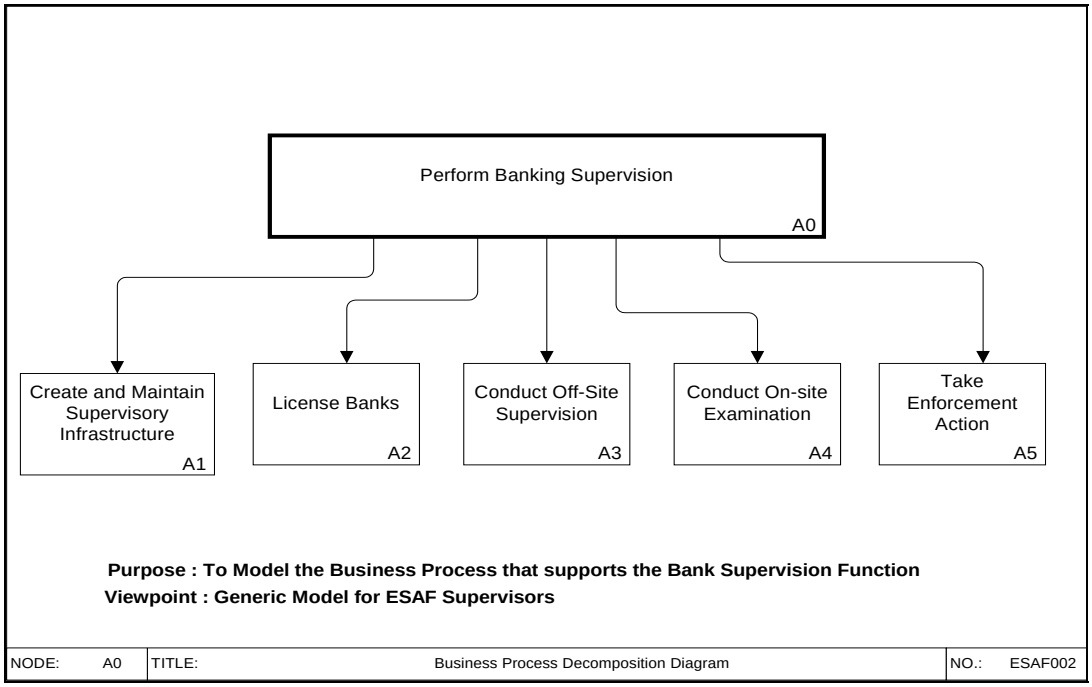


Figure 1: Business Processes Supporting Banking Supervision (Source: East and Southern Africa Banking Supervisors Group, 2003)

The third component of the ESAF banking supervision function is off-site surveillance. Off-site surveillance is one of the activities performed by the central banks to ensure soundness and safety of the banking system and the protection of the depositors' interests (Reserve Bank of Zimbabwe, 2004). To perform off-site surveillance the central banks need information that can help assess the current and future individual health of the banking institutions and the collective health of the banking system as a whole. Off-site surveillance involves setting up a reporting framework, collecting supervisory information from the banks and other relevant sources, performing financial and compliance reviews, as well as reporting about the financial performance and compliance of the institutions and the entire banking sector.

With regard to the setup of the reporting frameworks, it was observed from the documentation provided by the individual banking supervisory institutions (e.g. Bank of Namibia, 2009; Central Bank of Lesotho, 2009) that each of the central banks has its own set of prudential requirements that have to be complied with by the institutions they supervise, based on the rules and regulations governing the banking institutions in their countries. However, due to attempts to align with international standards such as the BASEL II capital accord as well as international best practices such as the CAMELS rating system, which is a trend in the regional central banks, there are significant similarities in the specific data items being monitored. In order to track compliance to BASEL II or the performance with the CAMELS rating systems, the central banks have also established their own set of key ratios and benchmarks to track for compliance and performance assessments. These ratios and benchmarks provide a degree of indication regarding compliance to a certain requirement.

With regard to data collection, each central bank collects any form of information that can help to determine the compliance to its own supervisory requirements. However, as discussed above, due to the attempts to align with international standards and best practices, there are significant convergences in relation to the data items being collected from one country to another. For instance, in order to use the CAMELS rating system, each central bank should have relevant information that can be used to determine capital adequacy, asset quality, management capabilities, earnings quality and level, liquidity adequacy, and sensitivity to market risk, all of which form a set of data requirements for the institution using the CAMELS rating system. In order to obtain this information, the central banks have devised return templates, which are provided to the supervised banking institutions for reporting purposes in order to facilitate regular reporting of relevant information.

With regard to the financial and performance reviews, the central banks use the information obtained from the banks and analyse it in different ways to determine the financial soundness of the banks individually and collectively for the industry and their compliance to the prudential requirements. The first type analysis performed involves the determination of the key performance ratios and comparing them with set benchmarks. The second type of analysis performed involves horizontal analysis of different data items where a single data item or a group of related items can be tracked over a certain period of analysis to determine a particular trend. Horizontal analysis could also be performed by comparing a single data item or a group of related items from one institution to another and to the industry as a whole. Another form of analysis involves vertical analysis of data where data items from the same period are compared. This form of analysis can also be done on an individual institution basis, comparing one institution to one or more peer group institutions, and to the industry as a whole. For financial and performance reporting, the analysts usually prepare reports based on the different types of analysis as discussed above. Following from these reports, recommendations can be made to rectify any worrying situation. Supervisory decision making bodies within the central banks can decide what to do regarding the suggested recommendations given the worrying situation.

The fourth component of the ESAF banking supervision function is on-site examination. On-site examinations are conducted as part of banking supervision to ensure soundness and safety of the banking system and the protection of the interests of the depositors (Reserve Bank of Zimbabwe, 2004). Through on-site supervision the central banks attempt to reconcile the information received through off-site surveillance and to collect any further information that may be necessary to satisfy the supervisors that the banking institutions are financially sound and are conducting their operations in a sound, safe, legal and prudent manner. Through on-site surveillance, the supervising institutions are also able to establish whether the supervised institutions comply with the rules and regulations governing their operations. Typical information needs for on-site examinations include the source documents that can serve as proof of what is reported in off-site surveillance, records of previous examinations with source documents, key findings, feedback provided and recommendations, history of corrective actions taken against the institution, information pertaining to unsafe and unsound banking practices by the institution, operational policies, and information pertaining to risk exposure.

The fifth component of the ESAF banking supervision function is to take enforcement action. Based on what the supervisors obtain through on-site and off-site supervision, the supervisory bodies may need to take supervisory action against defaulting institutions. The information requirements in this regard comprise mainly of corrective actions taken against a particular institution as well as information regarding the efforts made by the institution to comply with directives given.

2.3 The ESAF/SADC Bank Supervision Information System

The ESAF banking supervisors group has developed regional specifications for common business, applications and technology architecture from 1999 and 2000 (Eastern and Southern Africa Banking Supervisors Group, 2003). Subsequently, the first version of the computerized application for banking supervision, the ESAF/SADC Banking Supervision Application (BSA), was developed between 2001 and 2003. The system was deployed to the participating central banks. The second version of the application, version 2.1 was developed between 2007 and 2008, and rolled out to the participating banks beginning late 2008.

As stated in section 2.2, the central banks continuously need various forms of information to guide the formulation of sound supervisory frameworks, to assess the soundness of licensing applications, and to assess the financial soundness of licensed institutions on an ongoing basis. However, despite the commendable efforts made by the regional central banks to implement a banking supervision application to expedite the supervisory activities through instituting a one-stop-shop for all the banking supervisory information, there are still many imperfections in the information. These imperfections call for further enhancement of data quality by identifying specific flaws in the data, analyzing the root causes of the data quality problems, identifying solutions to the specific problems, and instituting a data quality management framework for the supervisory data.

3. DATA AND INFORMATION QUALITY

A discussion of research on data quality, data quality dimensions, and data quality frameworks is provided in this section.

3.1 Research on Data Quality

Many studies have been conducted on information and data quality as observed in literature. According to Parssian et al. (1999), most of these studies have focused on the identification of quality characteristics, the measurements of quality characteristics and their representations, management of data quality, and analyzing the impact of data quality on business processes. Several studies have been conducted on data quality problems for specific domains (e.g. Galway & Hanks, 1996; Gendron & D'Onofrio, 2001; Kerr, 2007; Xu et al., 2002). Galway and Hanks (1996) have studied the data quality problems in the Army Logistics and classified them into three categories namely, the operational problems, conceptual problems and organisational problems. The study by Galway and Hanks (1996) has provided examples of operational problems, conceptual problems and organisational problems and further suggested possible fixes to address them in the army logistics context.

Gendron and D'Onofrio (2001) and Kerr (2007) have studied data quality problems in the healthcare sector. Gendron and D'Onofrio (2001) have established key dimensions applicable to the healthcare sector and concluded that data quality is indeed domain specific and that specific industries needed to be explored with the goal of formulating data quality frameworks that are industry specific. Although Galway and Hanks (1996), Gendron and D'Onofrio (2001), and Kerr (2000) have proposed data quality frameworks to assess data quality, the data quality frameworks they have proposed are not directly applicable to banking supervision given the vast difference in the environments. In fact, Kerr (2007) has suggested that much research is still required to understand the data quality and information needs of data users in different organisations and domains. Kerr (2007) has further recommended that the research needs to take place within the organisational environment to understand fully the operational issues specific to that environment.

Several studies have also been conducted on data quality problems for specific applications (e.g. Xu et al., 2002; Reid & Catteral, 2005; Beall, 2006; Su et al., 2007; Lin et al., 2007). Xu et al. (2002) have explored data quality and the critical success factors that

impact data quality in SAP™ Enterprise Resource Planning (ERP) systems. Xu et al. (2002) have developed a framework for understanding data quality problems in ERP implementations, and have applied the framework to two large Australian organisations. Beall (2006) studied data quality issues in digital libraries and have provided suggestions for digital library data quality. Reid and Catteral (2005) have explored data quality problems in Customer Relationships Management (CRM) implementations and have provided examples of problems encountered in CRM implementations. Su et al. (2007) have explored data quality issues for Geographical Information Systems (GIS) databases and provided a methodology to assess spatial data quality based on the quality of source data and associated processes. Lin et al. (2007) have conducted a large-scale nation-wide survey of Australian engineering organizations to study data quality problems in asset management systems and have proposed a data quality framework for asset management data. The studies on specific systems have uncovered typical issues for specific systems and environments and are not directly applicable to the banking supervisory environment.

3.2 Data and Information Quality Dimensions

There are multiple views regarding the definitions of information and data in literature. Several authors (e.g. Stvilia et al., 2007; Lee, 2003; English, 1999; Galway & Hanks, 1996; Atzeni et al., 1999) have differentiated the two concepts considering data as a raw material to be processed for purposes of obtaining information. Other authors (e.g. Bovee et al., 2003; Wang et al., 2001) have ignored this distinction and have used the terms data and information synonymously. The term *data quality* is generally defined in literature as 'fitness for use' (Stvilia et al., 2007; Shankaranarayanan & Cai, 2006; Scannapieco et al., 2005; Bovee et al., 2003; Lee, 2003; Tayi & Ballou, 1998; Strong et al., 1997; Wang & Strong, 1996). This definition of data quality has been extended by Wang and Strong (1996) to suggest that quality data is the data that is 'fit for use by data consumers', and the definition has been widely adopted by many researchers (e.g. Strong et al., 1997; Lin et al., 2007). The definition of quality data as data that is 'fit for use by data consumers' was adopted for the research reported in this paper.

Many researchers have observed that fitness for use by data consumers cannot be viewed from only one dimension but in several dimensions (Lin et al., 2007; Shankanarayanan & Cai, 2006; Scannapieco et al., 2005; Wang & Strong, 1996). Wang & Strong (1996) have defined a data quality dimension as a set of data quality attributes that represent a single aspect or construct of data quality (Wang & Strong, 1996). Based on the literature considered in this study (e.g. Michnik & Lo, 2007; Knight & Burn, 2005), it was observed that the definition and classification of data quality dimensions proposed by Wang and Strong (1996) is by far the most referenced and widely accepted classification than other competing classifications. The Michnik and Lo (2007) classification was derived from the original Wang and Strong (1996) but was slightly modified to incorporate expert opinion on the original model. The classification suggested by Michnik and Lo (2007) was adopted for the research reported in this paper. This classification is depicted in figure 2.

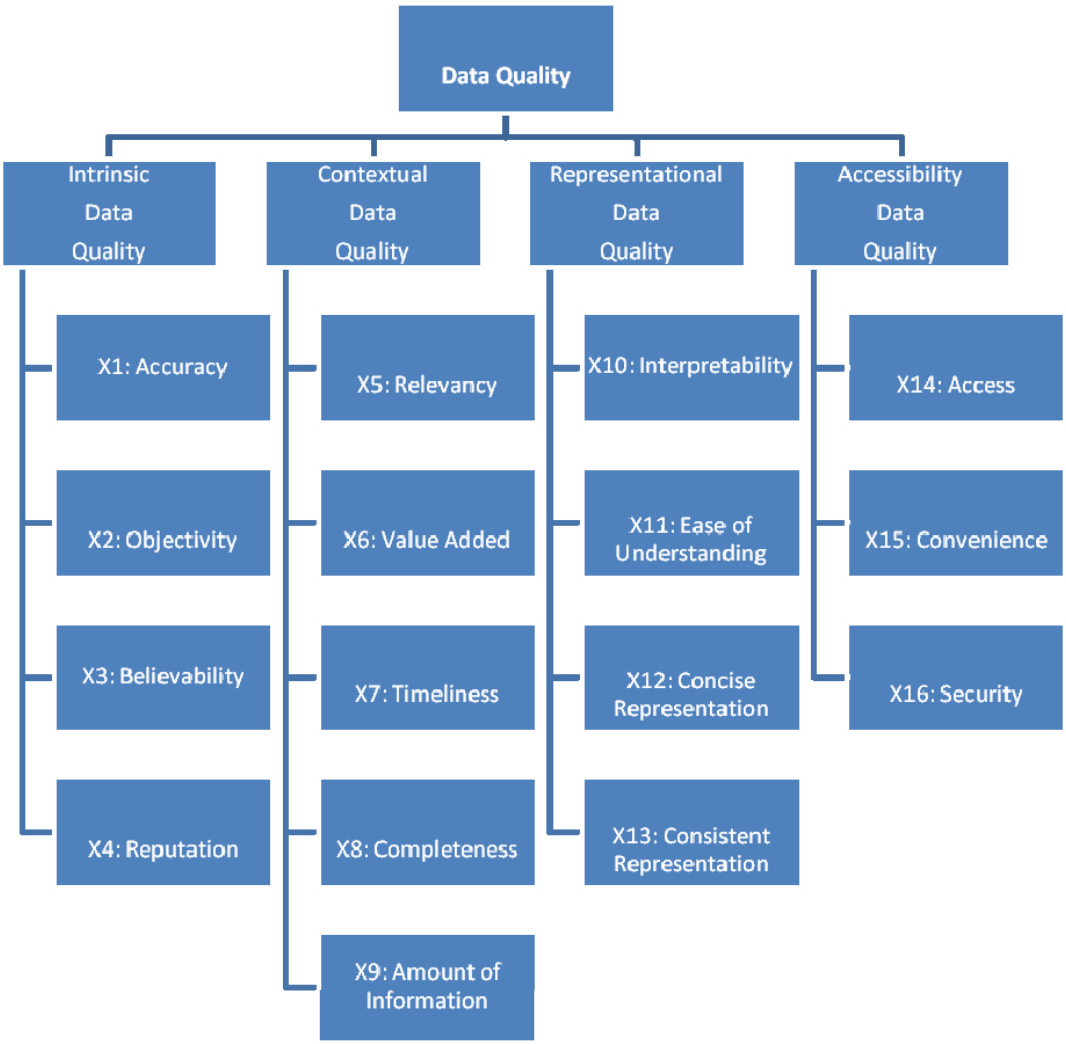


Figure 2: The adopted classification of data quality dimensions (Michnik and Lo, 2007)

The intrinsic data quality dimension refers to degree to which data values are in conformance with the actual or true values (Wang and Strong, 1996). Intrinsic data quality denotes features which belong to internal characteristic of data namely: accuracy, objectivity, believability and credibility (Michnik and Lo, 2007).

The contextual data quality dimension refers to the degree to which the data is applicable to, or pertains to the task of a data user (Wang & Strong, 1996). This dimension highlights the requirement that data quality must be considered within the context of the task at hand, that is, information must be relevant, timely, complete, and appropriate so as to add value (Michnik & Lo, 2007). Michnik and Lo (2007) view this category as consisting of four sub-dimensions namely: relevance, value added, timeliness, completeness and amount of information. The representational data quality dimension refers to degree to which the data is represented in a clear and intelligible manner (Wang & Strong, 1996). This dimension represents the need for information systems to present information in a way that is interpretable, easy to understand, concise and consistently presented to the users (Michnik & Lo, 2007). Michnik and Lo (2007) have proposed four sub-dimensions namely: interpretability, ease of understanding, concise representation, and consistent representation. The accessibility dimension of data quality refers to the degree to which the data is available and obtainable (Wang & Strong, 1996). It represents the need for information systems to be

accessible but secure (Michnik & Lo, 2007). Michnik and Lo (2007) view this category as comprising of three sub-dimensions namely: access, convenience and security.

3.3 Data Quality Frameworks

The term data quality framework could be very subjective and mean different things to different people as observed in data quality literature. Wang and Strong (1996) have suggested that at its most basic level, a data quality framework is a tool for the assessment of data quality within an organisation. Kerr (2000) have extended this definition by suggesting that frameworks can go beyond the individual elements of data quality assessment, becoming integrated within the processes of the organisation. Willshire and Meyen (1997) have defined the data quality framework as 'a vehicle that an organisation can use to define a model of its data environment, identify relevant data quality attributes, analyse data quality attributes in their current or future context, and provide guidance for data quality improvement'. Given the synergy between this definition and what this study intended to achieve, DQ frameworks will be used in this study to refer Willshire and Meyen (1997)'s view of data quality frameworks.

According to Kerr (2000) there have been several seminal works in the quality area, which have defined various extensive frameworks to review systems within organizations. Examples of these works include: Willshire and Meyen (1997), Redman (1995), English (1999), Wang et al. (2001), Batini and Scannapieco (2006), Vannan (2001), Pipino et al. (2002), Olson (2003), Kerr (2000), and Batini and Scannapieco (2006).

4. RESEARCH METHODS

A survey of banking institutions in the SADC region was conducted for this research. Quantitative and qualitative methods were used for this research. The quantitative methods involved data collection using questionnaires and analysis of the questionnaire responses using simple descriptive statistics. The questionnaires were distributed to various data quality stakeholders in order to obtain their subjective assessment of the quality of the banking supervision data and information. The qualitative study was conducted through interviews of selected participants representing the different types of stakeholders of the banking supervisory information.

During case selection, the first bank was chosen to represent a typical small central bank which uses version 1 of the Bank Supervision Application. The second bank was chosen to represent a smaller central bank which uses version 2 of the application. The third bank was chosen to represent a bigger central bank which uses version 2 of the application. Prior to data collection, the stakeholders of the data were identified using Wang's (1998) four role classification of information production roles, which classifies stakeholders in an information manufacturing system as *information suppliers*, '*information manufactures*, *information consumers*, and *information managers*. The stakeholders in the production of the banking supervisory data were identified as follows:

(1) *Information suppliers* or *information collectors* are the reporting personnel from banks who collect the supervisory information and report it to the central banks.
(2) *Information manufacturers* or *data custodians* are the IT professionals who manage and operate banking supervision systems in the central banks.
(3) *Information consumers* are the bank supervision analysts and examiners who analyse the information obtained from the banks and report on it to banking supervision management. Banking supervision managers who make supervisory decisions based on the information also form another category of information consumers.

(4) *Information managers* or *information owners* are the banking supervision managers who are responsible for managing the entire banking supervisory information.

5. RESEARCH FINDINGS

The results of the survey of banking institutions are presented in this section. The analysis of the questionnaire responses and interview responses is presented.

5.1 Questionnaire Response Rates

Twenty-four questionnaires were distributed and thirteen responses were obtained, which makes the survey's response rate to be 54%. Figure 3, below illustrates the distribution and response for the study.

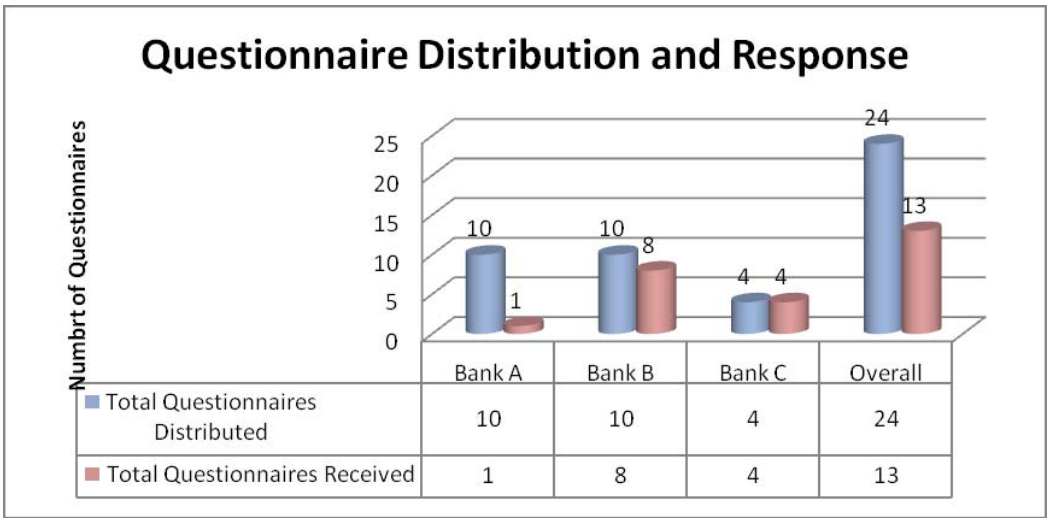


Figure 3: Questionnaire distribution and response rate

5.2 Interviews Conducted

The initial plan for collecting the qualitative data for this study was to interview key representatives of the four information stakeholder categories in the three Banks considered in the study. In the case of information suppliers, only the reporting personnel from Bank B were interviewed. All planned interviews in Bank B were conducted while the rest of the interviews could not be undertaken due to the lack of access to this category of stakeholders in the two other banks. In the case of information consumers and information owners, two examiners / analysts were interviewed from Bank B and Bank C while only one was conducted with Bank A. In the information custodians' category, ICT professionals from all the three central banks were interviewed. With respect to information owners, managers in banking supervision were interviewed. Figure 3 illustrates the planned interviews against the conducted interviews.

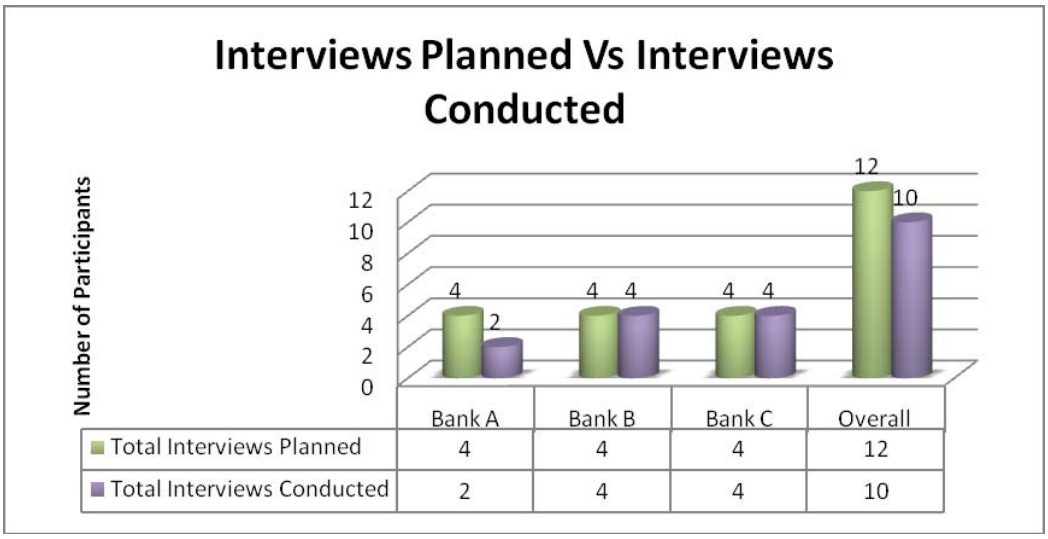


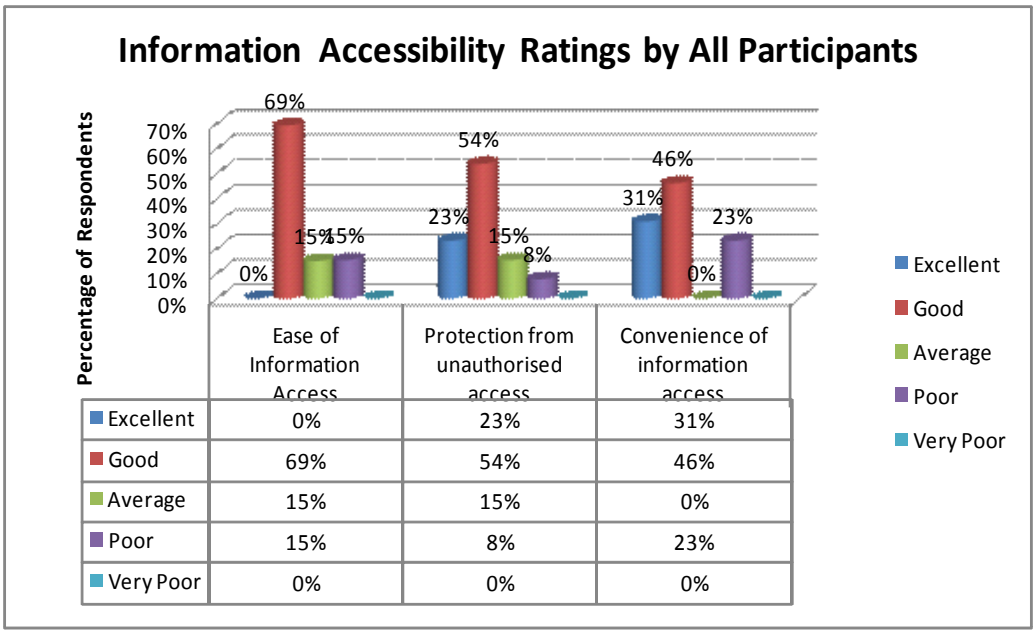
Figure 3: Interviews planned vs interviews conducted

5.3 Information Quality Management Assessment Results

In order to address the problem on the key concerns regarding information accessibility, the participants were asked three questions to provide their views regarding how they found the information to be easily and conveniently accessible, and how well protected the information was from un-authorised access. The questionnaire responses on information accessibility are summarized in Figure 4.

With respect to ease of access, the information was declared to be generally easy to access. The majority of respondents (69%) considered the information to be easily accessible while 15% considered information access to be difficult to access. The remaining 15% gave a neutral rating on this aspect. The comments provided regarding why ease of access is unsatisfactory mainly revolved around the performance of the information retrieval system. The specific comments provided included (i) The system is too slow to respond, (ii) it takes time to appear on the screen after it has been retrieved, (iii) Access to information is difficult, in that it takes too long for the system to produce requested information, especially when one requires bulk information, and (iv) Some information is not available due to some system faults.

On the issue of protection from unauthorised access, the respondents' ratings ranged from 'very well protected' to 'insufficiently protected', with the majority of respondents (54%) considering the information to be fairly well protected. Another 23% of the respondents considered the information to be 'extremely well protected'. From the remaining participants, 15% found the information to be 'insufficiently protected' while 8% rated the security of information to be average. The comments provided regarding why the protection of information is considered to be inadequate included a comment that that users can have access to reports they are not authorised to, and that due to the need to export the data to other analysis tools, the security of the information may be compromised.



	Ease of Information Access	Protection from unauthorised access	Convenience of information access
Excellent	0%	23%	31%
Good	69%	54%	46%
Average	15%	15%	0%
Poor	15%	8%	23%
Very Poor	0%	0%	0%

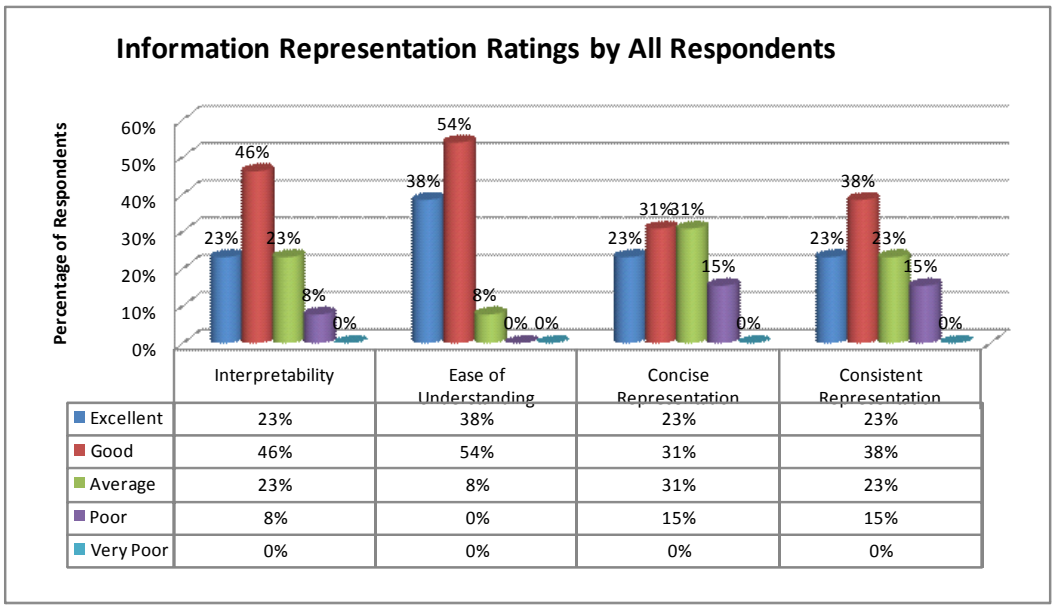
Figure 4: Information Accessibility Ratings by All Participants

Access convenience was largely regarded to be within acceptable limits. Most respondents (46%) considered convenience of information access to be 'fairly convenient', 31% of the respondents considered it to be 'very convenient', while the remaining 23% considered it to be 'slightly inconvenient'. The comments provided regarding why convenience of information access is not optimal included (i) inconvenience due to the need to extract the information for further analysis on other analysis tools in order to get required outputs, and (ii) delays in obtaining data in reports owing to the time between information receipt and the time at which the information has been processed by the system and is ready for usage and to the performance of the information system in opening the required reports.

Overall, information accessibility was rated positively, with protection from un-authorised access receiving the most credit having only 8% considering it to be below average. On the other hand, the convenience and ease of information access seemed relatively more unpopular with 15% and 23% of respondents rating the aspects to be below average, respectively, which suggest that the ease and convenience of access need more attention in order to ensure that the users' expectations regarding information access are met.

5.4 Representational Data Quality Assessment Results

In order to address the key concerns regarding information representation, the participants were asked four questions to provide their views regarding how they found the information to be easy to understand, easy to interpret, consistently represented and concisely represented. Figure 5 gives a summary of the questionnaire responses.



	Interpretability	Ease of Understanding	Concise Representation	Consistent Representation
Excellent	23%	38%	23%	23%
Good	46%	54%	31%	38%
Average	23%	8%	31%	23%
Poor	8%	0%	15%	15%
Very Poor	0%	0%	0%	0%

Figure 5 Information Representation Ratings by All Participants

The Interpretability of information was generally declared to be acceptable. Approximately 46% considered the information to be easy to interpret. A further 23% of the respondents also considered the information to be easy to interpret but more emphatically. Out of the remaining participants, 23% gave information interpretability an average rating, while 8% considered the information to be difficult to interpret. The comments provided on the interpretability of information included a comment that without adequate training information could be very confusing. Another comment provided was that in some cases the same information item can be referred to in different ways.

Regarding the ease of understanding, the responses obtained indicated that understandability was considered to be acceptable. Approximately 54% of respondents considered the information to be easy to interpret while a further 38% of the respondents indicated that it was extremely easy to understand the information. Only 8% of the respondents were of the view that the information was difficult to understand. The same comment regarding the occurrence of cases where the same information item can be referred to in different ways was provided as one of the reasons why understandability was unsatisfactory.

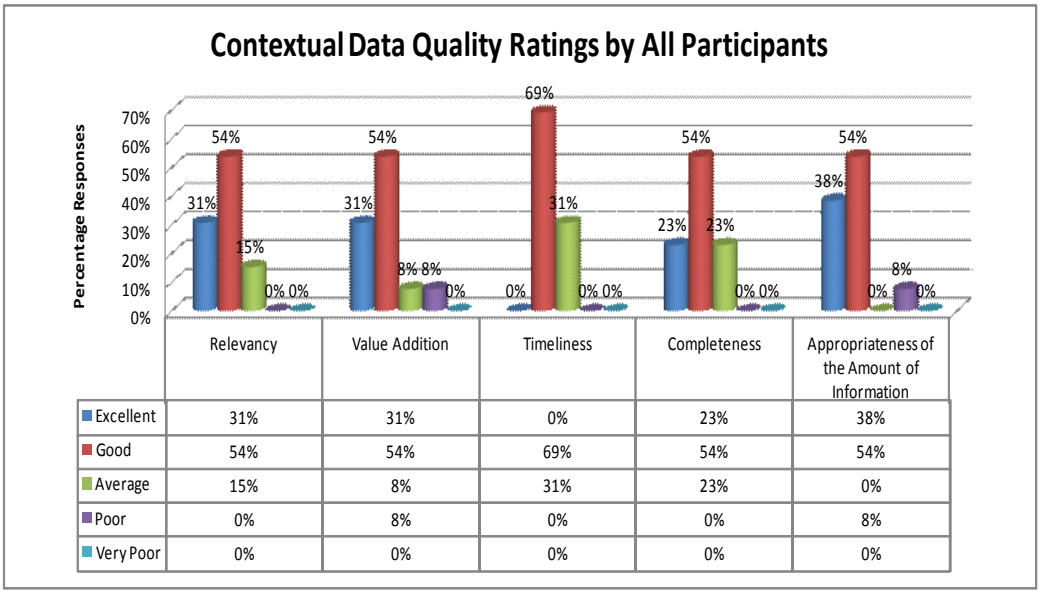
With respect to the consistence of information representation, the respondents find the consistency of the representation of information to be acceptable; with 23% of the respondents rating the representation is extremely consistent while a further 38% considered it to be consistent. The remaining 23% and 15% of the respondents rated the consistence of representation to be average and inconsistent, respectively. On the consistence of information representation, the same comment regarding the occurrence of cases where the same information item can be referred to in different ways was provided. Another comment provided indicated that the representation is consistent in as far as the submission by the reporting banks is correct.

The respondents generally considered information representation to be reasonably concise. A proportion of 7.7% of the respondents rated the representation to be very concise, while 31% considered the representation to be good and another 31% gave an average rating for information conciseness. The remaining 15% considered the representation to be long-winded. The participants generally rated information representation positively, with ease of

understanding and interpretability receiving most credit. On the other hand, conciseness and consistency representation received more criticism with each being rated below average by 15% of the respondents, which suggests that this areas need more attention in order ensure that the information is clear and intelligible enough to its users.

5.5 Contextual Data Quality Assessment Results

In order to address the question of what are the key concerns regarding information context, the participants were asked five questions to provide their views regarding how they found the information to be applicable for their intended tasks. The questionnaire responses on contextual data quality aspects are provided in Figure 6. The respondents generally rated relevancy of information positively, with 31% of the responses considering the information to be very good and a further 54% finding it to be good. The remaining 15% rated relevancy to be average. In terms of relevancy, the comments provided regarding the reasons why relevancy was not optimal included a comment that the data collection returns may in some cases have not been updated to cater for the current information requirements. Another comment provided was that due to the inability to obtain the required information, which requires the information consumers use the information in a manner in which it was received from the reporting institutions.



	Relevancy	Value Addition	Timeliness	Completeness	Appropriateness of the Amount of Information
Excellent	31%	31%	0%	23%	38%
Good	54%	54%	69%	54%	54%
Average	15%	8%	31%	23%	0%
Poor	0%	8%	0%	0%	8%
Very Poor	0%	0%	0%	0%	0%

Figure 6: Contextual Data Quality Ratings by All Participants

The majority of respondents (54%) considered value addition to be good and a further 31% rating value addition to be very good. In contrast to these, 8% of the respondents found the value added to be low while another 8% rated value addition to be average. To comments provided regarding value addition suggested that the value added by the information was negatively impacted by inability to provide information regarding stress testing, what if analysis and industry analysis. The majority (61%) of the participants considered the information to be reasonably on time (timeliness), while 31% of respondents found the timeliness to be average. The comments provided regarding information timeliness mainly indicated that timeliness is affected by late submissions by the reporting institutions, which could be due to system failure during report submission, system delays in processing submissions or simply due delays in reporting by the institutions.

Only 23% of the respondents rated completeness to be average, while 54% of the respondents rated completeness to be good and a further 23% considered the information to

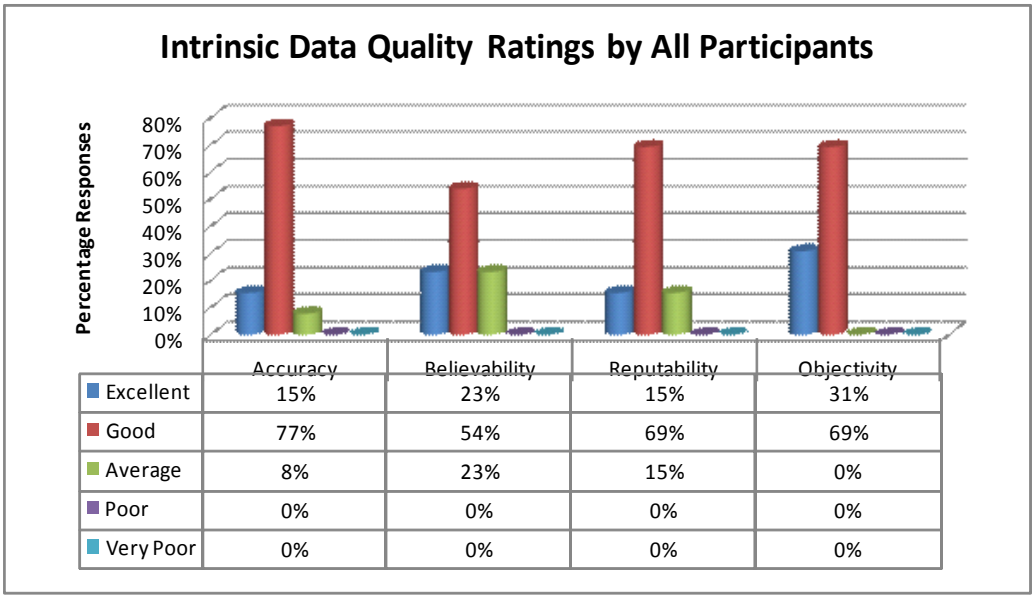
be highly complete. None of the participants rated completeness to be below average. The comments provided regarding why information completeness was unsatisfactory included a comment that the information is sometimes incomplete on account of incomplete submissions by the banks. Another reason provided suggested that the incompleteness of the information could be due to weaknesses in the data collections tools by not catering for the collection of all the necessary information. In some cases it was indicated that not all the Banks report through the Banking Supervision Application, which renders the information available in the system to be incomplete. The inability to cater for other forms of analysis such as stress testing and what-if analysis was also reported to another contributing factor towards having incomplete information.

The majority of the participants (54%) rated the appropriateness of the volumes to be good while a further 38% considered the appropriateness of the volumes to be very good. On the other hand, only 8% of the respondents reckon the volumes of information are inappropriate. Like in the case of completeness, the respondents indicate that information volumes appropriateness is affected by the inability to obtain information regarding stress testing, what if analysis and industry analysis. Overall, the participants rated information context positively, with the appropriateness of the amount of information receiving the most credit followed by relevancy. In contrast, value addition, completeness and timeliness received lesser credit. Similarly these are the areas that require more attention in order to ensure that the information becomes more applicable for the users intended tasks.

5.6 Intrinsic Data Quality Assessment Results

In order to address the key concerns regarding intrinsic data quality aspects, the participants were asked four questions to provide their views regarding how they found the information to be accurate, credible, reputable and objective. In response to the questions on information representation, the outcome provided in Figure 7 was obtained. The majority of respondents (77%) considered the information to be accurate while a further 15% of responses declared the information to be very accurate. The remaining 8% considered accuracy to be average. Regarding accuracy, the participants indicated that the main limiting factor towards having optimal accuracy would be a few errors that may be picked up from the submission by the banks. The majority of respondents (54%) considered the information to be credible. A further 23% considered it to be very credible, while the remaining 23% considered it to be average. According to the comments provided on credibility of the information is also negatively affected by the odd occurrences where errors are sometimes picked up, otherwise it is deemed to be acceptable. These errors were reported to be picked up either during the analysis of the information or during onsite examinations

Approximately 69% of the respondents considered the information to be reputable while a further 15% rated it to be highly reputable. The remaining 15% considered the reputability to be average. Like in the case of information accuracy and believability, the issue of odd occurrences of inaccurate submissions from the banks was reported to be the main reason why reputability was considered to be unsatisfactory. The majority of the participants (69%) found the information to be objective while the remaining 31% considered the information to be very objective. Overall, the intrinsic qualities of information were rated very highly with all the intrinsic aspects being rated either average or above average by all participants. This therefore indicates that the participant in this study were not very concerned about the intrinsic aspects of information.



	Accuracy	Believability	Reputability	Objectivity
Excellent	15%	23%	15%	31%
Good	77%	54%	69%	69%
Average	8%	23%	15%	0%
Poor	0%	0%	0%	0%
Very Poor	0%	0%	0%	0%

Figure 7: Intrinsic data quality ratings by all participants

5.7 Interview Responses

In order to address the research question regarding how the central banks ensured high quality of their supervisory data, the participants in all the four Wang (1998)'s classifications, were asked three general questions to establish the considerations they made to ensure information quality. In addition to these questions, interviews were conducted with the representatives of each of the groups to gain further understanding of the measures undertaken in each of the roles to ensure information quality. The discussion of this section provides the results on the measures undertaken by the participant's in order to ensure better quality of the information.

With respect to the actions undertaken by the different information stakeholders to ensure information quality in their areas, the following responses were obtained: In the case of the information consumers, most banking supervision analysts, who in this study were classified *information consumers*, indicated that they mainly corresponded with the reporting institutions to verify their submissions and if necessary request them to correct and resubmit their submissions. The analysts also indicated that at times they levied penalties to the reporting institutions when they submit incorrect or late submissions. The information consumers further indicated that if they consider the problems to be a technical system related problem, they contact their local system administrators or the regional support office.

The bank supervision managers, who in this study were classified as the *information managers*, indicated that they consulted the banking supervision analysts to confirm any details that appear to be suspicious in the reports and in the case where the details are indeed incorrect, they would request the analysts to undertake corrective measures. The managers also indicated that at times they consulted the regional support office to assist resolve any technical system related issues which they cannot resolve within the organisation. The system administrators, who in this study were classified as *information manufacturers* or *data custodians*, reported that in the case of technical problems, they addressed the problems as they arise but in the case of pure data problems they referred to the bank supervision analysts to address the problems with the reporting institutions.

In terms of the efforts made by the participants to ensure quality data, the following responses were obtained: The officials from the reporting institutions, who in this study were classified as *information suppliers*, indicated that they mainly used reviews within their banks

to ensure that a return prepared by each reporting official is reviewed by senior officials in that area of operations prior to being submitted to the central banks. In addition, the officials indicated that they also endeavoured to eliminate manual capturing of the reporting information by extracting these details automatically from their information systems, wherever possible. The *information consumers* reported that they mainly conducted discussions with other stakeholders such as the information custodians, the information managers and other senior officials in the organizations as well as with the information suppliers to discuss measures that can be undertaken to improve information quality. They also reported that they reviewed their reporting tools continuously. They further indicated that they provided training and assistance to the reporting institutions.

The *information managers* indicated that they manually checked the reports and they encouraged the reporting institutions to ensure the accuracy and completeness of their submissions and to validate their returns on an ongoing basis. The *information custodians* reported that they mainly applied data validations to ensure that incorrect submissions get rejected by the system. In addition, the custodians indicated that they also undertook rigorous testing of the collection and reporting tools upon changing these tools in order to avoid undue errors resulting from wrongly designed collection and reporting tools.With regard to whether the participants had any data quality checks on their data and how frequently the checks were conducted, the responses obtained were as follows: Most *information consumers* (57%) indicated that they did not have any information quality checks to assess the quality of their information. However, judging from the responses obtained in the subsequent section regarding the frequency of the checks, it appeared that where quality checks were reported to be undertaken, these checks were only limited to the checks made by the reviewers of the information to pick up obvious errors in the submissions.

The *information managers* indicated that they instituted some checks on their information. These were also observed to be limited to onsite examinations undertaken by banking supervision to satisfy them about the accuracy of the information provided by the banks in their reporting. These examinations were reported to be undertaken on each institution based on risk ratings but at least once in eighteen months. The *information custodians* had differing views regarding the information quality checks. One indicated that they had quality checks while the other indicated they had none. Also in the case of information consumers, it was observed that where the checks were reported to be undertaken, the checks seemed to be limited to the onsite inspections that were undertaken by banking supervision.

In order to address the research question regarding the considerations to be made to improve information quality, the participants in all the four Wang (1998)'s classifications, were asked a single question to suggest the measures that they consider to be essential towards securing improvement in the quality of the information. The question is provided in the appendix as question 30 of the questionnaire. In addition to this, interviews were conducted with the representatives of each of the groups to gain further understanding on these considerations. With regard to the considerations that can be undertaken to ensure information quality, the responses obtained were as follows: The *information suppliers* indicated that in their case better information quality could be attained if straight-through-processing could be achieved between their information systems in the banks and the central bank's banking supervision. The information suppliers also indicated that having validation tools on their end prior to submitting their supervisory information would also be essential in ensuring that if there are submission errors, these errors are picked up and corrected in a timely manner. This suggestion was made as counter proposal to the current practice whereby the information suppliers submit their returns and wait for the central banks returns

processing engine to validate the return and provide confirmation of success or a request to re-submit.

The *information consumers* emphasized the need to address the technical information system challenges in generating the required reports as a key consideration to improve information quality in their area. The information consumers also suggested continuous review of the collection and analysis tools. The third suggestion made by the information consumers was to undertake frequent training for the information suppliers. Another proposal made was to consider enforcing the submission rules and regulations against incorrect and untimely submissions of information. The *information managers* recommended improving data validation through the introduction of cross-form-validation. This validation method was described as matching the information contained in other submitted returns against a new submission so that the new submission can be rejected if a single or more values in that return does not match the corresponding value or values in the other return or returns.

6. DISCUSSION

A discussion of the research findings and the limitations of the research are discussed in this section.

6.1 Summary of Research Findings

The study identified the following information quality problems: (1) poor accessibility of information, (2) inadequate protection of information, (3) limited clarity of information, (4) lack of information relevance to intended tasks, and (5) lack of information credibility. The following contributory factors to information accessibility were identified: (1) inadequate computing resources (2) the inappropriate design of the information systems to facilitate speedy retrieval of information (3) the high volumes of information accumulated make information retrieval slower. The study identified the limitations in the capacity of the information systems to generate required reporting as the main contributor to the access security weaknesses. The study also found that unsuitable information specifications are the contributor towards limitations in information clarity. The study identified factors such as inability to generate required reporting, late submission of information by producers, large amounts of accumulated information, incomplete submissions by information producers and changing information needs as the main problems that affect information relevance.

The study revealed that information credibility is affected by the following factors: (1) technical challenges with validation, (2) unclear information definitions, (3) wrongly captured submissions by the banks, and (4) disparities with the reported information. The study identified three corrective measures for addressing the identified shortcomings as follows: (1) upgrading the information processing infrastructure, (2) redesigning the information systems to facilitate speedy processing and retrieval of information, (3) maintaining only the currently required information and archiving older information. System oriented approaches such as redesigning the information systems to ensure enough flexibility to provide all the required perspectives of information and the operational measures such as constant maintenance of the information, the information collection tools and the information systems have been recommended as the measures the contextual issues affecting access security.

Regarding information clarity limitations, the measures such as reviewing the specifications to ensure that information items are consistently represented have been recommended. In order to address information relevance limitations, system oriented approaches such as redesigning the information systems to ensure enough flexibility to provide all the required perspectives of information and the operational measures such as constant maintenance of the information, the information collection tools and the information

systems have been recommended. With respect to information credibility limitations, the measures such as correcting the validation challenges, ensuring availability of complete and up-to-date reporting guidelines as well as endeavouring to eliminate redundant data entry and automating data capture wherever possible have been recommended.

6.2 Limitations of the Study

Two main limitations were encountered during the study. Firstly, the level of participation was low. Secondly, there was a limitation regarding the access to the data in order to perform objective assessments of data quality. Twenty-four questionnaires were distributed and only thirteen responses were obtained, which makes the survey's response rate to be 54%. In addition, only one response was obtained from Bank A. The interviews with the information providers at the reporting banking institutions could only be done for one of the central banks. Carrying out effective data quality assessments in practice requires conducting both subjective assessment surveys and objective assessments studying the data and combining the two sets of results to determine the data quality issues to be addressed (Pipino et al., 2002). In carrying out this study, it was not possible to gain access to the data in order to perform the objective assessment. As a result the study depended on the subjective assessment as the only source of information regarding the quality of the supervisory information.

7. CONCLUSIONS

It has been acknowledged in the research literature on data quality that poor information quality is universal and cuts across all organisations and enterprises. It has also been argued by several researchers that information quality issues differ in different organisational environments and domains. In the case of the selected SADC central banks, the empirical study undertaken to assess information quality in the banking supervisory information of these banks identified several limitations and the causes of these limitations. The study also identified some corrective measures to apply in addressing the identified limitations. The authors are of the opinion that the study provides a foundation for understanding information quality issues in banking supervisory information in the selected central banks. This should help achieve the objective of raising awareness in the central banks about information quality issues in their banking supervisory information. Since this study provides corrective considerations to apply in addressing the information quality limitation, it is the authors' opinion that the objective of contributing towards improving the information quality in the banking supervisory information has been achieved.

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APPENDIX: QUESTIONNAIRE

Section I: Background Information

[1] What is the name of your Central Bank?
[2] What is your gender? (2 options given)
[3] What was your age in years at your last birthday?
[4] Which option best describes your current position? (5 options given)
[5] For how many years have you been working in your current position? (4 options given)
[6] In your Central Bank, what system do you use to collect and analyse Bank Supervision Returns? (4 options given)
[7] How many years have you been using the system?
[8] Do you have any access to the submitted returns, analysis reports or the system database?
[9] Have your received any form of training on the usage of the application?
[10] Do you have access to any reference or user manuals to guide you on how to use the application?

Section Ii: Data Quality Assessment – Accessibility And Representation

[11] In your assessment how easy is it to access information from the system? (5 options given)
Please indicate why accessibility is not optimal and its implication if rating is 4 or below:
[12] In your assessment is the data adequately protected against unauthorised access?
Please indicate why security is not optimal and its implication if rating is 4 or below:
[13] In your assessment is convenient is it to obtain information from the system? (5 options given)
Please indicate why convenience is not optimal and its implication if rating is 4 or below:
[14] In your assessment how easy is it to interpret the data obtained from the system? (5 options given)

Please indicate why interpretability is not optimal and its implication if rating is 4 or below:
[15] In your assessment how easy is it to understand the information from the system? (5 options given)
Please indicate why understandability is not optimal and its implication if rating is 4 or below:
[16] In your assessment how concise is the representation of the data? (5 options given)
Please indicate why concise representation is not optimal and its implication if rating is 4 or below:
[17] In your assessment how consistent is the representation of the information obtainable from the system? (5 options given)
Please indicate why consistent representation is not optimal and its implication if rating is 4 or below:

Section Iii: Data Quality Assessment – Contextual And Intrinsic Data Quality Aspects
[18] In your assessment how relevant is the data obtainable from the system? (5 options given)
Please indicate why relevancy is not optimal and its implication if rating is 4 or below;
[19] In your assessment how timely is the availability of the data? (5 options given)
Please indicate why timeliness is not optimal and its implication if rating is 4 or below;
[20] In your assessment how complete is the data obtainable from the system? (5 options given)
Please indicate why completeness is not optimal and its implication if rating is 4 or below;
[21] In your assessment how would you rate the value added by the information obtainable from the system? (5 options given)
Please indicate why value addition is not optimal and its implication if rating is 4 or below:
[22] In your assessment how appropriate is the amount of information obtainable from the system? (5 options given)
Please indicate why information volumes are not optimal and its implication if rating is 4 or below:
[23] In your assessment how accurate do you find the data? (5 options given)
Please indicate why accuracy is not optimal and its implication if rating is 4 or below:
[24] In your assessment how believable is the data? (5 options given)
Please indicate why believability is not optimal and its implication if rating is 4 or below:
[25] In your assessment how reputable is the data? (5 options given)
Please indicate why reputability is not optimal and its implication if rating is 4 or below:
[26] In your assessment how objective is the data? (5 options given)
Please indicate why objectivity is not optimal and its implication if rating is 4 or below;

Section III: Data Quality Management Practices And Measures For Improvement
[27] What actions do you take when you encounter data quality problems in your area?
[28] What efforts do you make to improve data quality in your area?
[29] Do you have any quality checks/audits for your banking supervisory data in your area? (2 options given)
If yes above, please indicate how often these checks are made and in what form are they undertaken:
[30] In your assessment what considerations do you think can be undertaken to improve the quality of the information required in your area?