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SYSTEM REQUIREMENTS FOR SERVICE QUALITY  
APPRAISAL SYSTEM (SQAS) TO BE USED IN COMMERCIAL  
BANKS BY BLIND CUSTOMERS

BY:

MOGOMOTSI BANABOTLHE

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ABSTRACT

**SPECIFYING SYSTEM REQUIREMENTS FOR  
SERVICE QUALITY APPRAISAL SYSTEM (SQAS)  
TO BE USED IN COMMERCIAL BANKS BY BLIND  
CUSTOMERS**

By:

MOGOMOTSI BANABOTLHE

Chairperson of the Supervisory Committee: Dr. Audrey Mbogho  
Department of Computer Science

In a fast moving competitive sector like banking, the customer service department often finds it difficult to keep up with the pace at which customer concerns are raised. On the other hand, the speed at which this department responds to customer concerns determines the difference between keeping a customer and losing one. Thus, most banks have moved to technology to expedite the process of capturing and processing customer complaints. Unfortunately, not every customer serviced by these banks finds the deployed technologies accessible and usable. Among the customers who find technologies in the banks inaccessible and unusable are blind customers. In part, the inaccessibility of technologies used in banks may be attributed to poor requirements engineering. Poorly elicited requirements lead to the design of products which fail to satisfy the needs of the diverse population they service.

The purpose of this project is to specify neatly validated requirements using the SMART criterion for a system that can be used to evaluate levels of customer satisfaction with services offered to them by banks. The envisaged system should be able to cater for the needs of the blind customers served by these banks.

Data for the study was collected from blind people in a vocational school in Botswana, customer care managers in five different bank brands and the system designers. Data was collected through guided interview sessions, which on average lasted for thirty minutes per respondent. Data from the respondents was analyzed qualitatively and quantitatively. Data was summarized into tables, graphs, diagrams and charts to reveal trends. Data was further analyzed to specify the requirements of a system that allows blind customers to provide feedback to their banks. In an attempt to align the requirements to the specific needs of blind customers the specified requirements were reviewed and validated, guided by the principles of the SMART criterion.

Interestingly, the few blind people who use the services offered by banks express keen interest to use technology to access them, especially if it fosters their independent living. Blind people are forced to interact with technologies designed for a standard user to avoid being over-charged for services rendered to them by banks. Banks charge customers more for over-the-counter-services and information on paper. Consequently, blind customers are forced to be dependent on their sighted counterparts for assistance or to memorize the layout of technologies for effective interaction with them. A remedy to the plight of blind customers is the deployment of a system that allows them to interface with it using braille keypad inputs or speech software.

In conclusion, efforts should be made to define SMART requirements that cater for the physical and mental limitations of the wider range of customers serviced by banks. Later during the process of system design and development SMART requirements translate into a quality product commensurate with proficiency of its target users. The SMART criterion, with its well defined

metrics of classifying requirements as good or bad, provides a means of thoroughly reviewing and validating system requirements.

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# CHAPTER 1: FOUNDATION OF THE RESEARCH WORK

## 1.0 Introduction

This chapter lays a foundation for the activities of the research work. It provides the discussion of the background to the study being undertaken, other research work related to the current study, and the problem that mandated the study to be carried out. The chapter also briefly describes a solution to the problem identified by the study, the methodology of implementing the proposed solution and how the results of the study will be analyzed.

## 1.1 Background

A Commission instituted by the Office of the Attorney General in Australia (2000:4) and Pattanaik (2005) report that a lot of research confirms and reiterates the common understanding that digital technologies provide more effective and economical access to government and business information and services. The same Commission (2000:4) identifies ways in which digital technologies benefit the disabled people by offering them improved prospects for equal opportunities in many areas of life, and providing access to information and services in formats and locations which they can use. Furthermore, the same Commission (2000:4) credits digital technologies for offering organizations that provide services and information great potential gains in efficiency and effectiveness.

Currently, these benefits are inaccessible to many people of the world who are visually impaired. Resnikoff et al (2004:846) estimates people who are visually impaired to be approximately 161 million: - a figure that represents about 2.6% of the world population. The same authors also report that among these 161 million people who are visually impaired, 37 million of them are completely blind. The nature of the disability of these blind people makes it difficult for them to benefit much from the implementation of ICT services. Research shows that most of the legally blind people do not use computers and only a small fraction of them have access to the Internet (Kaye, 2000:5). Arguably, the recent growth in assistive technology coupled with concerted efforts to ensure accessibility of information technology to all potential users has great potential to help blind people to benefit from the implementation of IT tools.

Research confirms that IT accessibility is at a critical turning point, with more individuals having access to IT tools such as personal computers and the Internet (Kaye, 2000:5). In fact, while research points to an increase in IT accessibility, this boom in IT accessibility does not significantly affect disabled people (Kaye, 2000:5 & Mellors, 2004:14). Disabled people suffer from marginalisation from IT tools and also experience many problems when interacting with them (Sandhu, Saamio & Wiman, 2001:3). As a result, disabled people have been excluded from e-commerce and e-government due to the inaccessible design of IT tools (Mellors, 2004:14).

Commercial banks use IT tools to perform business activities such as employee performance assessment. As an assessment tool, digital technologies are meant to collect and analyse feedback about the quality of service banks offer their clients. In this era of increased business competition, soliciting, responding to feedback and being open to criticism helps institutions to ascertain their level of efficiency and effectiveness in relation to service delivery. Feedback provided by customers can serve institutions in two possible ways. Firstly, customer feedback acts as a “dash board” that indicates how well institutions serve their clientele. Secondly, customer feedback helps institutions to identify the service delivery anomalies on time and plan an appropriate solution. Depending on the nature of the anomaly identified, the institution may correct it either via redesign, changes of service delivery style or simply managing customer expectations.

When banks procured and implemented the digital technologies to use for employee assessment, no effort was made to cater for the needs of the visually impaired customers. Hence, visually impaired customers are denied an opportunity to participate in the process of service quality assessment using the available ICTs. American banks defy the Americans with Disabilities Act of 1990, which mandates them to provide an alternative means of services and ICT products for effective communication with a disabled person (Sandhu et al, 2001:16). Banks seem not to see it as imperative for the disabled members of the society to have access to and the use of information and services comparable to the same available to non-disabled members.

In part, the problems of ICT tools accessibility and interaction faced by disabled people in the banks are a result of poorly designed systems caused by poorly elicited and specified system requirements

(Mannion & Keepence, 1995:42). Hence, there is an urgent need for system designers to implement SMART requirements commensurate with the challenges faced by disabled people when using ICT tools (Mannion & Keepence, 1995:42). SMART requirements are a foundation upon which designers can define system characteristics such as functional capabilities, performance, interface design and development requirements in a simple, concise and verifiable manner (Tran, 1999:2). In addressing issues of accessibility for the disabled people, system analysts need to capture system requirements using modern methods of requirements engineering which allow the design process to be done iteratively and incrementally within a fixed time period (Firesmith, 2002:58 and Mannion & Keepence, 1995:42). These modern techniques of requirements capture further allow for a structured product planning and development that facilitate an easy way to specify customers' wants and needs. On the other hand, modern modelling techniques such as use cases help to keep the system functional requirements in an easy to read and track format for an accurate implementation during the design process (Scanlon & Percival, 2002:4). Use cases help to organise the system functionality into user goals for effective implementation during the development process to produce a system commensurate with the skills and proficiency of its target users (Scanlon & Percival, 2002:4).

Requirements analysis is more effective when anchored by a user centred approach. During requirements analysis, the approach helps the stakeholders to establish correctly the needs of the customer, specify the system function needed by the customer and the domain within which the system will be used (Hutt, 1994: 11).

In addition to specifying SMART requirements, banks need a paradigm shift that will encourage a positive attitude to embrace assistive technologies as another means of eliminating barriers that prevent disabled people from accessing ICT tools. Instead of looking at assistive technology exclusively as rehabilitative tools banks need to use them to plan an individualised service delivery plan for their disabled customers. In this context, assistive technologies will help to increase the access of the already marginalized group of people in the society to the decision-making process.

## **1.2 Related work**

Research in requirements specification has been quite diverse. Different researchers focus on different aspects of requirements specification. Some have focused on the design guidelines and others have

focused on the guidelines for accessibility and harnessing the benefits of ICTs. The following are just some of the areas that research on assistive technology for the blind has focused on:

### **1. Design For All**

This research advocates for the adoption of inclusive design in Europe. It examines the background to the various guidelines of design and proposes some priorities for future research in this area. Inclusive design advocates for the design of mainstream products and services that are accessible to and usable by as many people as reasonably possible (Mellors, 2004:15). These products need to be usable in a wide variety of situations and to the greatest extent possible without the need for special adaptation or specialised design (Gill, 2002:1). Furthermore, it calls for the establishment of detailed technical guidelines on the design features required by various groups of disabled users (Mellors, 2004:18). The work concludes by suggesting that an effective and affordable assistive device is only attainable where all players in every field agree on a set of protocols to be used in communication between assistive devices and the relevant ICT devices.

### **2. The Development of Information and Communication Technology System to Include People with Visual Impairment**

This research supports the notion of the design for all approach, which attempts to make “products usable by all people, to the greatest extent possible, without the need for specialised adaptation” (Gill, 2002:1). The work reveals that access to ICT for all may be achieved through a thorough review of users and their needs (Gill, 2002). User requirements can be satisfied by assessing the physical demands arising from a disability and reconciling them with a wish list of users. It attempts to set standards and guidelines that can help system designers to incorporate the principles of the inclusive design approach.

### **3. Design Guidelines for Set-up Procedures of Mobile Terminals and E-Services**

The research was conducted as collaboration between a group of researchers, industry players and the European Telecommunications Standards Institute (ETSI). It was founded on the initiative by the ETSI technical committee on human factors for the development of guidelines for the design of set-up procedures for mobile terminals and e-services. The research aimed at developing design guidelines for user interfaces based on the specific use cases (Hufschmidt, Niman, Ketola, Tate, Williams, Bocker, Parodi and Flygt, n.d.). In designing the use cases the research wanted to find out and understand the difficulties users experience when configuring their devices or accessing services. The work culminated in presenting a selection of use cases and design guidelines developed from these use cases to receive feedback.

### **1.3 Description of the problem**

Financial institutions seem to handle IT accessibility issues exclusively on an ad hoc or as needed basis, instead of integrating accessibility issues into development and procurement of their mainstream IT tools. These institutions hold the mistaken belief that persons with disabilities can always be accommodated upon request by using widely available assistive technologies (AT). However, without adequate planning the possibility of accommodating people with disability may be foreclosed.

Indeed, the opportunity to allow blind people to assess the quality of service offered by these institutions has been foreclosed. Financial institutions use digital technology to assess the performance of their frontline staff. When the procurement of these technologies was done, no effort was made to cater for the needs of blind customers. As a result, blind customers are denied a voice and access to a service on the grounds of their disability, which makes it difficult for them to use mainstream IT tools. A denial of a right to proper service means an automatic exclusion and/or limitation to participate in the decision-making process. In the absence of an alternative way of assessing the quality of service in these institutions, blind people are left at the mercies of their sighted counterparts who often feel burdened to care for them. Hence, much action is needed to integrate assistive technologies in the internal structures of the financial institutions to aid blind people to participate in the decision making process through the provision of feedback and evaluation of the services rendered to them.

#### 1.4 Specific problems encountered by blind customers

- Limited control over many aspects of their environment
- Difficulty in communicating with available ICT equipment

#### 1.5 Description of the proposed solution

The key solution to the dilemma faced by blind people is to design and install a Service Quality Appraisal System (SQAS) that caters for the demands of their disability. The design and installation of SQAS will require big investments in time and other resources such as personnel. This makes it impossible to design the system as a sole researcher working under time constraints and a limited budget. As a result, the current study will restrict itself to the generation of requirements specification for SQAS, which will accommodate the nature and demands of the disability of blind people. It uses the use case modelling technique to represent the functionality of the envisaged system. In ensuring that the proposed requirements specification adheres to the standards set by the IEEE, the project shall validate them using the SMART criterion (Mannion & Keepence, 1995:42).

#### 1.6 Methodology

The project started by generating a wish list of user requirements through brainstorming. The requirements were generated from expert experience, real data and interaction with blind customers who use the services of the bank. After the requirements were generated, they were described focusing on the error cases. Next, lists of use cases were defined from the requirements and their descriptions. Finally, the specified requirements were reviewed and validated by the representatives of banks, system designers, academics and blind customers. The stakeholders further validated the requirements using the SMART criterion, to help align them to the standards of good requirements prescribed by the IEEE standards. At the end, a clear use case list and requirements specification was drawn from the feedback provided by the stakeholders.

Data was collected from the stakeholders using guided interview sessions. Data was collected from blind people in a vocational school in a semi-urban village called Mochudi, five (5) different bank brands in Cape Town and Gaborone and a representative of the system developer in Botswana.

### **1.7 Result analysis**

Data was analysed into figures, tables and diagrams to reveal trends. The analysed data was used to generate use cases and requirements specification for SQAS. In future, the system designers can infer from the use cases and requirements specification the users' expectation for systems similar to SQAS. In this project, the use cases and requirements specification are used to present the result of the study to other experts and users' representatives.

## **CHAPTER 2: BLINDNESS AND ACCESS TO INFORMATION COMMUNICATION TECHNOLOGY (ICT).**

### **2.0 Introduction**

The chapter gives an overview of blindness and Information and Communication Technology (ICT), describes factors that impede disabled people to access ICTs, the implications of using technology to assess service delivery, the role of system analysis and requirements engineering in addressing the accessibility of technology to disabled people and the capabilities of the universal design approach to address the weakness of assistive technology. The chapter further describes the extent of the digital divide between disabled people and non-disabled people. At the penultimate it will evaluate the existing research on the issues of accessibility and close with a conclusion.

### **2.1 An Overview of Blindness and ICT**

The American Foundation for the Blind defines blindness as “a disability where an individual lacks visual perception.” Contrary to this definition, in medical circles, the same foundation reports that the definition of blindness is extended to include differing degrees of visual perception shown by people. Medicine categorises the visual acuity of people for easy planning of a specific remedy peculiar to each group.

Resnikoff et al (2004:846) group visual impairments into low vision and blindness on the basis of visual acuity (the clarity of vision). Resnikoff et al (2004:846) classify an individual as blind when he/she has a visual acuity of less than 3/60 while in medical circles a person is certified blind when his/her visual acuity is not greater than 20/200. According to the American Foundation for the Blind (2005:1), a visual acuity of 20/200 implies that the affected person sees at a distance of 20 feet what a fully sighted person sees at 200 feet. A commonality between medicine and Resnikoff et al (2004:846) is the realisation that

blindness does not only imply complete lack of form and visual perception. Legal blindness, as minimal visual acuity is called in medical circle, defines conditions of varying vision such as tunnel vision, no central vision, cloudy or extremely blurred vision or no vision at all (National Federation for the Blind, 1995:2).

Blindness is caused by an array of factors that may either be physiological or psychological. The National Federation of the Blind (1995:1) and the American Foundation for the Blind (2005:6) identify the causes of the different types of blindness as conditions such as “diabetes, retinitis pigmentosa, cataracts and macular degeneration.”

In this study, the definition of blindness shall be restricted to no vision at all. This condition of no vision at all cannot be corrected and therefore it makes it difficult for people to do major life activities independently.

The quality of life of blind people can be improved through the use of information and communication technology (ICT). A lot of research submissions credit ICT for its great potential to accord blind people access to information, social interaction, cultural activities, employment opportunities and consumer goods ( Brewer, 2002 & Kaye, 2000:1). On the business landscape, ICT tools help organisations to manage and process information (Bogart, 1985:204). In information management, ICT tools have allowed organizations to convert, store, protect, process, transmit and retrieve information (Pattanaik, 2005).

The ease of access to ICT products by businesses has caused them to increasingly move to charge higher fees for higher-cost forms of services such as over-the-counter-services and information on paper (Office of Attorney General, 2000:4 & Klenke, 1991:85). Consequently, digital divide leads to a personal and social cost caused by disparity in accessing ICTs by members of the same society.

## **2.2 Barriers to ICT Access by Blind People**

Many of the potential obstacles to ICT access by blind people also affect the general population.

The major barrier imposed by ICT on blind people lies in accessibility (Sandhu et al, 2001:3). Many of the available ICTs in the institutions are inaccessible to blind people. As a result, blind people are forced to adapt to a norm set by design and operation of technology (Sandhu et al, 2001:3). In attempting to interact with the available ICTs deployed in the financial institutions, blind people are forced to use adaptive devices or memorise the layout of information on the ICT tools for an effective communication with them (Sandhu et al, 2001:3).

More often than not disabled people are the poorest citizens of the world (Brewer, 2002, Kaye 2000:8 & Sandhu et al, 2001:3). As such, blind poor people find affordability as another barrier to access ICT. Blind people who are poor find it difficult to secure the much needed adaptive technologies to operate equipment designed for a standard user. The factors that deter blind people to access ICTs are high cost of computer hardware and software, telecommunication services for Internet connections and assistive and adaptive technology (Brewer, 2002 & Sandhu et al, 2001:3).

Beyond technological accessibility, blind people are deterred from accessing ICTs by their disability, which limits their ability to do their daily activities. Due to their disability and poor economic status, most blind people have a low literacy level which affects their rate of acquiring the skills required to operate technological systems (Sandhu et al, 2001: 3). In instances where finances are available, disabled people are deterred from accessing ICT tools by total lack of opportunities that can allow them to acquire skills needed to operate ICT tools (Sandhu et al, 2001:3).

All the barriers to ICT accessibility can be removed through an ICT planning process. Such a planning process should foster the development of locality specific assistive technology such as screen readers, screen enlargers and speech recognition software (Brewer, 2002). In addition, an effective solution to eliminate the barriers to ICT access starts with finding alternative ways to lower the cost of computer hardware, software and assistive technology and provide free public access points for the Internet (Brewer, 2002).

### **2.3 Pillars of ICT Accessibility: System Analysis & Requirements Engineering.**

System analysis and requirements engineering are the pillars of ICT accessibility for the disabled people as they provide them with a platform of communication about the envisaged system (Maciaszek, 2001: 11 and Redmond-Pyle & Moore, 1995:19). The activities of system analysis, driven by a universal design approach stands to transform the accessibility of technology to the disabled people.

System analysis, driven by a user centred approach, provides a platform of dialogue between stakeholders affected by the envisaged technology (Redmond-Pyle & Moore, 1995:19). System analysis allows stakeholders to establish the weakness of the existing systems, set expected performance standards and to analyse skill and proficiency among the target users of the system (Hutt, 1994: 12).

Again, system analysis helps stakeholders in decision making processes. Feedback information provided by the analysis process helps designers to determine whether to create a new system or extend the functionality of the existing system. The feasibility studies conducted during the analysis helps the design team to assess the technical and economic constraints such as forecasted developmental budget, availability of skills and technological options available to solve the problem (Muller-Glaser, Bortolazzi & Tanurhan, 1992: 238 and Tuner & McCluskey, 1994: 5). During the analysis process, system requirements are transformed into a system model that represents a solution to the problem of the customer (Tuner & McCluskey, 1994:5). Once constructed the model allows the stakeholders to change the requirements from being assertive (what is wanted) to being constructive (how the consumer will get it). In an attempt to enhance communication and establish a common understanding among stakeholders, analysis uses different model to capture users' possible experiences when interacting with the envisaged system (Hutt, 1994: 12 and Shemer, 1987:509). On the basis of users' experiences, stakeholders are able to evaluate available technological alternatives to identify the one that satisfies the functions and requirements of the envisaged system (Hutt, 1994: 11 and Muller-Glaser et al, 1992: 238).

System analysis, which involves organizing, collecting and evaluating facts, provides a platform of communication needed by stakeholders to establish the functional, behavioural and data-oriented requirements of the envisaged system (Muller-Glaser et al, 1992: 238).

The activities of system analysis provide a platform for capturing and establishing the system requirements (Shemer, 1987:509). As a process, the activities of requirements engineering provides stakeholders with an opportunity to model users' expectation of the system at a high level of abstraction (James & James, 1998: 1, Maciaszek,2001:95 and Shemer, 1987:509). The process of requirements engineering, as attested to by the IEEE 830 standard cited by Japenga on their website, offers the stakeholders a platform and an opportunity to:

- Establish the basis of agreement between the customer and the system designer on what the system has to do. This helps to highlight deficiencies in performance that would be inherent within the system measured against user expectations.
- Reduce the development effort by forcing all stakeholders to seriously analyze the system details before the actual design can begin. Detailed analysis of the requirements helps to reveal omissions, misunderstanding and inconsistencies. This thorough analysis of the requirements by all stakeholders helps to reduce later redesign, recoding, and retesting of the system.
- Estimate cost and schedules of the design process. Requirements description is a realistic basis for estimating project costs and can be used to obtain approval for bids or price estimates.
- Establish a baseline for validation and verification for compliance with set rules and regulations.
- Establish the basis for enhancement of the functionality of a system.

Modern methods used in requirements engineering encourage the design of an accessible system for all through a user centered approach. Under modern methods, requirements engineering is executed as an iterative process to allow for correction of errors as they are identified (Firesmith, 2002:55, Flynn & Diaz, 1996:13, Huff, 1994:12, Maciaszek, 2001:25 and Mandel, 1997:252). In

instances where the projects requirements are too large to execute at once, modern methods encourage that the process of requirements engineering be done incrementally, with some activities done in parallel to ensure timely completion of the project (Firesmith, 2002:55).

Modern methods of requirements engineering involve the users of the system in the decision making process at all times. These methods encourage that stakeholders continually review the requirements at every stage of the system design process and implement appropriate changes as mandated by the design process (Firesmith, 2002:55 and Huff, 1994: 12). Under these new methods, requirements specification is rarely kept as a constant, stable and up-to-date document but evolves with changing conditions of the development process (Firesmith, 2002:55).

Furthermore, a new method of capturing requirements called concept analysis process starts by analyzing the problem domain and operational environment for purposes of specifying the characteristics of the proposed system from the users' perspective (Fairley and Thayer, 1997: 75). In contrast to the traditional approach of requirements analysis, concept analysis process facilitates communication among stakeholders and encourages them to specify the operational requirements of the envisaged system (Fairley & Thayer, 1997:73).

Again, innovative modelling techniques such as use cases have made it possible and easy to identify, clarify and categorize system requirements (Morabito & Amilkumar, 1996:172). Use cases provide a suitable platform for describing the interaction between the users and the envisaged system in performing a task (Rumbaugh, 1997:123). In an attempt to encourage a common understanding of requirements, use cases describe interaction between the users and the system as a structured, chronologically listed narration (Scanlon & Percival, 2002:4). Not only does the use cases technique encourage structure and order for the presentation of requirements but also advocate for the requirements to be written in a language that is domain specific, simplified to a level that permits a common interpretation by all stakeholders (Rumbaugh, 1997: 124 and Scanlon & Percival, 2002:4). As a further means of encouraging communication and users' inputs throughout the design process, use cases and the associated model evolve during the design process to accommodate changes mandated by the design procedures (Rumbaugh, 1997: 123 and Scanlon & Percival, 2002:4). Hence, use case modelling supports a high level of code

reuse and provides a means of communicating product output to both non-technical stakeholders and technical stakeholders from the engineering discipline (Eriksson et al, 2006 and Maciaszek, 2001:95). Importantly, use cases help stakeholders to avoid the implementation of the same functionality more than once (Eriksson et al, 2006).

## **2.4 Rationale for Designing Accessible and Useable ICT tools for the Disabled People.**

Usability and accessibility of ICT tools and products are not a matter of aesthetic and professional pride but present themselves as of great importance to all commercial stakeholders (Mandel, 1997:4). ICT tools designed with good interfaces allow the relationship of humans and computers to augment each other to produce a system that is greater than the sum of its parts (Mandel, 1997: 15). Usability and accessibility are system characteristics that are only attainable through a user centred approach, which allows for the design of products basing on the user's beliefs, wants, needs, experiences and expectations (Mandel, 1997:15). In relation to disabled people, usability and accessibility need to be considered for the reasons discussed below.

Firstly, a usable system is the doorway into a personally fulfilling interaction with technology. Such a system is easily identifiable by characteristics such as the ease to learn it, to remember the commands for using it and to efficiently use it with fewer errors (Flynn & Diaz, 1996:15 and Redmond-Pyle & Moore, 1995:2 and Tanaka et al, 2005:139). A usable system distinguishes itself from others by two characteristics, namely, forgiveness and feedback. A forgiving system allows users a multi-level undo operation (Flynn & Diaz, 1996:15). A user may take a wrong route but the system always provides a way to get back to the starting point. A usable system always updates users on what is going on while the program executes (Flynn & Diaz, 1996:15).

Secondly, a usable system is a product of thorough requirements communication between the system users and the design team. The designers of the system have made all attempts to consult with system stakeholders to establish accurately the users of the system, the specific goals they would like to achieve

with the system, and the context under which the system shall be used and also consider how well the system can be designed to help the users achieve their goals efficiently (Flynn & Diaz, 1996:15 Redmond-Pyle & Moore, 1995:2). Consequently, a usable system translates into a technology that matches well the skills and proficiency of its target users (Tanaka et al, 2005:139).

Thirdly, a usable system allows users to achieve their task easily and efficiently. At face value, this may sound simple, but Maurer (2004:1) and Redmond-Pyle & Moore (1995: 4) correctly noted that people always feel great when they achieve a task using a computer without any frustration. Arguably, a usable system is more likely to create a loyal repeat-user-base than an unusable one. Users have no reason to abscond from using the technology and will always want to use it again for a similar task (Redmond-Pyle & Moore, 1995: 4). Deploying an unusable system will cause users of technology to want to use it only after rigorous training or when under pressure from organisational management (Redmond-Pyle & Moore, 1995:4)

Fourthly, a business that provides disabled people with a useable system will always have a well laid information system for business intelligence and decision making process. In return, such a business will cut on training and support cost while making productivity gains (Redmond-Pyle & Moore, 1995:4 and Tanaka et al, 2005:139). Furthermore, a usable system improves quality of work by reducing the frequency at which users make errors when using the system (Redmond-Pyle & Moore, 1995:4). Indirectly, the reduced frequency of making errors when using the system translates into high productivity emanating from less time spent on reconciliation or sorting out the consequences of the errors on the business output (Redmond-Pyle & Moore, 1995:4). On the other hand, a business that implements a system that is unusable incurs substantial loss in terms of sales, customer satisfaction, and staff productivity (Maurer, 2004:2).

Fifthly, a usable system allows businesses to cut on training overheads which often form a bigger portion of the system installation costs (Redmond-Pyle & Moore, 1995:4). A system that is easy for its users to learn allows for flexible staffing practices. An organisation can easily rotate an employee over a

number of systems to do aspects of a complex task (Redmond-Pyle & Moore, 1995:4). Hence, a usable system is a key to the success of business reengineering initiatives.

Again, a usable system allows business to continue to adapt their practices and activities to changing conditions under which they operate. Organisations continually undergo changes in their structure, products and operating procedures and therefore need a system that is flexible to support users when changing their business practices (Redmond-Pyle & Moore, 1995:4). A system that lacks flexibility acts as a barrier to organisational change and requires that money be spent regularly to amend the user interface to keep up with new business practices (Redmond-Pyle & Moore, 1995:4). A usable system helps businesses to improve their business performance and implement strategic programs of Total Quality Management or Business Process Re-engineering (Redmond-Pyle & Moore, 1995:4).

In spite of the usability user tests being time consuming, laborious and expensive, they should be done throughout the process of system design (Tanaka et al, 2005:140 and Spolsky, 2001:93). These usability tests will help designers establish the human abilities and limitations of target users and their proficiency in using the system (Maurer, 2004:2 and Redmond-Pyle & Moore, 1995:4).

Unlike usability, accessible systems accord all people universal equal benefits from technology irrespective of their age, physical disability, race and economic status (Choi et al, 2006:87). Designed with accessibility in mind, a system serves a wider community of users, and eliminates all possible barriers that prevent disabled people from being legal beneficiaries of technology (Rosmaita, 2006:271). As a result, an accessible system helps marginalized groups of people like the disabled to be full participants in the information society (Takagi, Asakawa, Fuduka and Maeda 2004:177 & Tanaka et al, 2005:140).

Accessibility is an issue that needs to be embraced as early as during requirements analysis. Disabled people interact with technological systems using methods other than the conventional known hardware, which means they need to be provided with alternative ways of interacting with them. In this case disabled people can be accorded accessibility to technological system through the use of adaptive and

assistive technology and reformatting of information contents to meet the demands and needs of their disabilities (Sandhu et al, 2001:15).

The rationale to ensure accessibility to technology is fostered by three arguments based on moral, legal, or market issues (Law, Jacko, Peterson and Tobias 2005:2). The moral argument calls for the inclusion of all in the design of technology. Many countries have enacted laws that make it illegal to discriminate against any person on the basis of their colour, physical disability or race (Takagi et al, 2004:177 & Sandhu et al, 2001:16). In America, Rehabilitation Act, 1973 and Americans with Disabilities Act are some of the legal documents that advocate and mandate for a non-discriminatory design of technology (Sandhu et al, 2001:16). The market argument follows the realisation that much business is done using technology.

Businesses need to worry more about issues of accessibility because of the increasing number of disabled people, who if care is not taken can be excluded from being beneficiaries of the advances in technology due to poor system design (Mellors, 2004:14 and Seeland & Nicole, 2006). Sandhu et al (2001:16) report that the number of disabled people in India alone stands at 80 million people. As the incidence of disability increases, there is an urgent need to create accessible technologies commensurate with the disabilities of each person (The Institute of Social and Ethical Accountability, n.d.: 9).

Accessibility as an attribute of system design offers businesses huge returns for investing in technological tools. Horn (2007:2) argues that a business that implements accessible systems offers its customers a better service, boost of a motivated workforce and has high operational efficiency.

Finally, a company that produces accessible systems gives itself a competitive edge over others. Such a company has an enhanced advantage of selling its products to the government. In many countries the government stands out as the biggest buyer of ICT tools and advocate for strict compliance with all established laws to ensure equal access to ICTs by its entire citizen (Horn, 2007:2).

Apart from benefiting the financial institutions, accessible ICT tools and products can improve the quality of life of disadvantaged people such as the blind. When used well, ICT has the potential to help this group of marginalised people to escape the poverty trap and help them to have a voice in their societies. ICT does not only give a voice to disabled people but frees them from dependence on others to do their daily activities (Sandhu et al, 2001: 20). For instance, in Colombia the implementation of ICT tools has led to many benefits such as improved trade practices, better coordination of services to the public and created employment and business opportunities (Sandhu et al, 2001:20).

ICT has the potential to bring education and training facilities nearer to the people who need them. Sandhu et al (2001:20) reveal that ICT has made it possible to teach new skills to young illiterate prostitutes in different countries using standard shipping containers as classrooms.

Industrialised countries have benefited from using the Internet as a learning tool. The Internet has allowed African countries to set up a virtual university that offers courses to the masses dispersed all over the continent (Sandhu et al, 2001:21). Virtual universities can help blind people to acquire the skills needed to operate digital technologies. These universities need to tailor their contents to the needs and demands of the disabilities of blind people.

Again, the Internet acts as a vehicle for dispersing information and services to people in formats and in locations where they can use them (The Human Rights and Equality Commission, 2000:4). The Internet benefits blind people by reducing the impact of transport and building access barriers that make it difficult or impossible to get to places where information and services are produced. In addition, information content and services on the Internet can be formatted to be accessed in Braille, audio or large print for the benefit of blind people who cannot read normal print. Blind people who cannot read English have the option to access appropriately configured Web pages using screen readers that convert text to speech and read the content.

In addition to making virtual universities possible, ICT has made it possible to transcribe textbooks and course materials into Braille, read them on tape and /or reformat them into a usable form by blind people without delays (Kaye, 2000:1).

ICTs such as telephone banking, bill payment and other interactive voice response systems offer substantial efficiencies in service delivery. They offer greater convenience and availability of service and information for citizens on a 24-hour basis (Backus, 2001; 2). In this regard, digital technologies save customers time by eliminating the queuing required for direct human assistance. Hence, digital technologies carry much potential to give blind people independence and equality of opportunities with non-disabled people.

Generally, issues of accessibility can be solved by the adoption of the design for all approach driven by a user centred approach. Currently, the implementation of the concepts of the design for all approach is hampered by the mindset of many designers, who know about these approaches and yet hardly employ them during the system design process (Hanson, 2004:1, Takagi, Asakawa Fukuda and Maeda, 2004:177 & Tanaka Bim and Viera da Rocha, 2005:139). Usability and accessibility are entwined, yet easily distinguishable from each other. Again, the existence of well laid accessibility design principles does not automatically translate into a good experience for all technological system users (Hanson, 2004:1). Consequently, an urgent need arises to improve the accessibility of most technological systems to ensure compliance with set legislation (Takagi et al, 2004:178).

## **2.5 Transforming ICT Accessibility through the Universal Design Approach and Assistive technology**

In the past, disabled people interacted with ICT tools using the assistive technologies. This sole dependence on assistive technologies created some problems which limited the accessibility of technology to the disabled people.

Assistive technologies, which are limited to a segment of the general population, created an exclusive demarcation in the way technology is used (Choi et al, 2006:88). This exclusive demarcation has created

a niche market for assistive technologies, which has caused their prices to be higher than that of mainstream products (Choi et al, 2006:88). Hence, assistive technologies slowly became unaffordable to disabled people who are without a stable means of earning an income.

Assistive technologies are designed with fewer built-in features than mainstream products. Consequently, assistive technologies limited the extent to which disabled people could benefit from the deployment of ICT tools and services (Choi et al, 2006:88). In some instances Assistive technologies were found not to be user friendly and therefore disabled people were forced to still learn long commands or memorise the layout of information on them for effective interaction with them (Sandhu et al, 2001:3).

On the technological market, there existed a developmental gap between assistive technologies and mainstream products. Consequently, whenever mainstream products are upgraded they created compatibility problems between them and existing assistive technologies (Choi et al, 2006:88).

System Designers devised the Universal Design Approach (UDA) as a means to redress the weakness and limitation of assistive technologies (AT). Universal design approach is an integrated approach that attempts to cater for the needs of a diverse population of users while at the same time it overcomes the weakness of the available assistive technologies. In other words, Universal design approach was established to curb the exorbitant prices charged for AT, bridge the developmental gap that exists between AT and mainstream products and to ensure conformity of AT to the mainstream products (Choi et al, 2006:87).

Universal design Approach, anchored by a user centred approach, distinguishes itself from other design methodologies by its extensive involvement of the users of the system throughout the stages of the design process (Mandel, 1997: 37,249, Redmond-Pyle & Moore, 1995:4). Under the Universal design

approach, the driving principles of the design process are guided by the beliefs, expectations and needs of the users of the system (Mandel, 1997:15). Hence, the approach provides a doorway into managing users' expectation in relation to the performance of the system.

Universal design approach stands to transform the accessibility of ICT tools and services to disabled people. Currently, its ability to impact on the accessibility of technology to the disabled people is prevented by slow adoption of its concepts by system designers. Law et al (2005:3) blame the slow pace at which UDA concepts infiltrate the design industry on corporate culture and the absence of a well laid argument to convince the corporate stakeholders and decision-makers to embrace it. In addition, Choi et al (2006:88) blame the slow adoption of UDA concepts on the absence of a sizeable number of qualified practitioners, who can spearhead its advocacy and monitor its implementation. Research needs to be done to find ways to popularise UDA concepts among designers and encourage them to adopt and use them in their designs.

## 2.6 The Digital Divide

The Organisation of Economic Co-operation and Development (OECD), cited by Sandhu et al (2001:8) defines digital divide as:

*“The gap between individuals, households, business and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies and to their use of the Internet for a wide variety of activities.”*

The definition given by OECD shows that the digital divide is a widespread phenomenon that exists between people at a family level right through to a national level. This study will focus on the digital divide that exists between disabled people and non-disabled ones. Digital divide between individuals in a population is caused by factors such as gender, racial segregation, age and physical disability (Black and Atkinson, 2007: 4, Kaye, 2000:5, Riley, 2004:3 & Sandhu et al, 2001:8). Disabled people are more likely to be affected by the digital divide because of their disability, which makes it impossible for them to acquire skills needed to operate ICT tools (Sandhu et al, 2001:2).

In America, disabled people are less than half as likely as non-disabled people to own a computer (Kaye, 2000:1). Kaye (2000:1) further asserts that disabled people are about one-quarter as likely to use the Internet as non-disabled people. On the other hand, Sandhu et al (2001:14) attribute the poor surfing of the Internet by disabled people to the inaccessible design of the Web pages and the difficulty in accessing adaptive hardware and software needed to use it. The Institute of Social and Ethical Accountability (n.d.:2) reports that 8% of the American population has visual, learning, cognitive, auditory or physical dexterity impairments, severe enough to affect their ability to use the Internet given the current design failures. The same Institute (n.d.:2) estimates that as much as 78%-99% of the online content is inaccessible to people with disability. A report by the Royal National Institute for the Blind (RNIB) cited by The Institute of Social and Ethical Accountability (n.d.:3) estimates the number of disabled people in United Kingdom having difficulty in using the Internet due to its poor design at two million.

The figures above suggest that a high percentage of disabled people are excluded from e-government and e-commerce. Arguably, a business that deploys ICT tools that cater for the needs and demands of the array of disabilities in many societies stands to benefit in terms of efficiency and productivity (The Institute of Social and Ethical Accountability n.d.:3). Such a business will further the economic and social inclusion of people with disability while making economic gains for itself.

Secondly, the figures above show that disabled people form a significant market that any business can exploit. The Institute of Social and Ethical Accountability (n.d.:7) reveals that disabled people in UK have a disposable income of 50 billion pounds while in America the annual discretionary spending of disabled people is estimated at US\$175 billion by the same institute. In Australia, the same institute estimates the discretionary income of disabled people to be at least AUS \$26 billion.

Businesses that fail to provide access to ICT for this group of people miss a great deal on the financial gains and other unique benefits that come with doing business with them. ICT, when used well, can break down existing divides, leading to more integrated and productive societies. Disabled people need to be empowered to live independently and be encouraged to acquire skills that will help them to participate in the economic development of their societies.

## 2.7 Implications of Using Technology for Service Delivery Assessment

Technology stands to transform the way daily business activities are carried out in many institutions. The transformation of business activities will be profound in instances where a balance is struck between the technology and the people who use it. Such a balance can be achieved through the designing of proper interfaces from equipment level right through to the organisational level.

Once implemented, technology creates flexible work habits in people, builds team spirit, and improves management efficiency and communication of work based issues (Attaran, 2003:586). When used for service delivery purposes, technology stands to benefit both the business and its respective customers. Technology, when used for service delivery assessment purpose offers customers a way to quickly get valuable feedback information to the personnel within the business who need it (Attaran, 2003:586). Consequently, technology allows customers to promptly and effectively participate in the decision making process relating to how they are served. An easy flow of feedback information from customers to businesses makes it easy for them to respond quickly to emergencies and opportunities. In other words technology has made it possible for businesses to rapidly identify and respond to service delivery anomalies.

Technology provides the potential to trace information and eliminate the bureaucratic and physical boundaries that have always impeded easy information flow within organisations (Attaran, 2003:586). Attaran, (2003:586) further asserts that technology offers improved information access and coordination across organisational units. In this regard, technology provides business with intelligence that helps it to identify its strength and weakness, establish its market structure and opportunities and the potential to expand its business activities.

Unlike the traditional method of workplace monitoring, technological systems offer improved ways of monitoring workplace performance with their built-in capacity to identify productivity levels of individual workers or those of the organisation at large (Klenke, 1991:81). Interestingly, technological systems are better than traditional methods of workplace monitoring because they never slumber or sleep like a human supervisor.

Technological systems readily generate feedback information which provides businesses with intelligence to establish performance standards of an individual worker, a group of employees or the entire organisation (Klenke, 1991:83). Feedback information from these technological systems help businesses to promptly determine patterns of production, estimate workloads and plan for personnel and budget forecast, (Klenke, 1991:83).

Technology has made Automated Information Management (AIM) in the business arena possible. Unlike the traditional approach of information management, AIM offers business improved output with minimal investment on resources such as time and finances (Bogart, 1985:204).

Technology as an instrument of monitoring workplace performance has been associated with a few side effects. Klenke, (1991: 84) argues that when technology is used for workplace monitoring, it contributes to employee stress and stress related illness. Technology curtails interactions and communication among workers, violates their right to privacy and creates a feeling of being watched all the time (Klenke, 1991:85). On the other hand, technology fails to provide customer feedback on higher order skills such as evaluative skills, design skills and synthesis skills. Secondly, many people have started to question the fairness of performance standards set by computers. Many of the doubts cast on standards set by computers are instigated by how computer monitoring process and computer generated performance assessment are used in employee evaluation (Klenke, 1991:85).

## **2.8 Research on ICT Accessibility by the Blind**

Much of the research that relates to ICT accessibility by the blind focused on the accessibility of the Web to all. This focus on the accessibility of the Web pages was done to the detriment of other vital issues such as access to technological tools used in the delivery of services by different institutions in the society.

Nonetheless, research on Web accessibility is vital as it would make it possible for people to access an enormous amount of data on the Web. Leporini, Andronico and Buzzi (2004:57) assert that computers

and the Internet empower disabled people to work independently in education, field of employment and during leisure.

Leporini et al (2004) have laid the foundation for making access of information by blind people possible. The study recognises that search engines need to be formatted to meet the needs and demands of people who are visually impaired. Initial studies had shown that blind people have more problems searching for information on the Web than their sighted counterparts. While sighted people could easily select their favourite option from a search result or discard irrelevant information, blind people struggled to do so because of “the serial access to the Web page content” (Leporini et al, 2004:58).

Much research has also been done that advocates for the accessibility of ICTs to all disadvantaged members of society. The trend of the research that advocates for the rights of the disadvantaged members of society focuses much on the needs of women, children and old people at the expense of the disabled ones within each group (Gregor and Newell, 2001:90-92 & Pattanaik, 2006).

While research in this area seems to be discriminatory of disabled people, overall it promotes equal access by all members of society to technology. For instance, Pattanaik (2006) argues that ICTs are for everyone irrespective of their physical location, economic status and physical impairment. Pattanaik (2006) goes on to assert that all people should be equal beneficiaries to the advantages offered by technology and the products and processes that emerge from their use.

Secondly, research in this area acknowledges the potential of ICT in empowering and improving the quality of life of the different members of society. Pattanaik (2006) argues that ICTs have many ways in which they can positively impact the lives of women in the society. The same can be said about the effect of ICT on disabled people. ICT coupled with other forms of communications, has the potential to reach those members of society who have not been reached by other media (Pattanaik, 2006). In recognition of the positive effects ICTs have on the lives of women, they can be used to help disabled people to effectively participate in economic and social progress and make informed decisions about issues that affect them.

Research has been done to make ICT accessible to blind people through the use of adaptive and assistive technology. Research that advocates for the use of adaptive and assistive technology by disabled people is encouraged by the realisation that the design for all approach is not always possible (Mellors, 2004:1). Gregor and Newell (2001:90) argue that the design for all approach is not always able to satisfy the needs of some severely disabled users of the digital technologies as they age. Age or disability makes it difficult for individuals to interact with interfaces of many ICT tools (Gregor and Newell, 2001:90).

Research that advocates for the use of adaptive and assistive technology (AT) by disabled people recognises and campaigns for all Assistive technologies to be compatible with mainstream products (Law et al, 2005:2). ICT products that are compatible with assistive technologies will enable disabled people to remain independent for as long as possible. Secondly, ICT products that are compatible with assistive technologies will facilitate the integration of disabled people into the new information society.

In attempting to ensure compatibility of ATs with mainstream products, intense research needs to be undertaken to find ways to synchronise the evolution of AT to that of the mainstream ICT tools. Mainstream products should have a built-in feature that makes their compatibility with AT an ever-possible feature without a need for upgrading, adaptation or reformatting. Again, other research needs to be done to empower disabled people to overcome social and institutional barriers and strengthen their involvement in the economic, social and political processes for an overall improvement of the quality of their lives.

## **2.9 Conclusion**

Generally, more research needs to be done to find ways to lower the prices of assistive technology (AT) and make the compatibility of AT with mainstream products an intrinsic property that is catered for during early design stages of the products (Choi et al 2006: 87). A tentative solution will be the adoption of the Universal Design Approach (UDA) anchored by a user centred approach. Currently, research reveals that adoption of these approaches to design has not been done to any reasonable scale (Choi et al, 2006:87). It can then be hypothesised that the failure to adopt the principles of these approaches to design is what has led to the digital divide and inaccessible and unusable technologies.

## **CHAPTER 3: THE PROCESSES OF DATA COLLECTION AND ANALYSIS**

### **3.0 Introduction**

The chapter describes the process of data collection from the service providers (banks), customers and a representative of the system designer. Data collected from all respondents shall be analysed into graphs and diagrams to reveal trends. The chapter closes with a conclusion.

### **3.1 The Process of Data Collection from the Service Providers**

The instrument used to collect data from the respondents (customer care managers) that participated in the study was a questionnaire with nine questions. The questionnaire contained questions that aimed at establishing the number of blind customers among the bank's clientele, establishing the current methods of feedback collection used by the various banks and to evaluate the possible benefits derivable from the automation of the process of feedback collection in banks. The questionnaire ended by enquiring about areas of service delivery that the service providers would want their customers to provide feedback on.

In Cape Town, data was collected from banks in Rondebosch, Mowbray, Salt River and Claremont while in Botswana data was collected from two bank brands both located in Gaborone. There were five different bank brands that participated in the study. Each bank brand was represented by two branches sampled from different geographical areas of the city: e.g. one branch was from Mowbray and another from Salt River. In all the banks, data was collected from the customer care managers (CCM). The managers indicated their responses to questions asked by ticking the alternatives of their choice. Any additional information provided by the managers such as concerns, explanation, comments and recommendations was written down on a notepad.

### 3.2 Analysis of the Results from the Service Providers

Bank Brand	Estimated number of blind customers served by each bank brand
ABSA	3
BBS	8
Barclays Bank	2
Nedbank	1
Standard Chartered	3

Table 1: An estimated number of blind customers in each bank brand.

The results in table 1 show that Botswana Building Society (BBS) bank has the highest estimate of blind customers using the services offered by their bank. Standard chartered bank and ABSA are estimated to offer services to the second highest number of blind customers. Nedbank has the lowest estimate of blind customers among its clientele while Barclays bank is estimated to service the third largest number of blind customers relative to other banks in the study.

	Nedbank	Standard Chartered	ABSA	BBS	Barclays'Bank
Web			X		
E-mail	X		X		
Direct mail	X				X
Bank Consultant	X		X		X
Automated System					X
Phone	X	X	X	X	X

Table 2: Methods used by different banks to collect feedback from their customers.

The results in table 2 show that ABSA, Barclays' and Nedbank bank use the highest combination of methods (four different methods per each bank brand) to collect feedback from their customers. Standard Chartered and BBS bank collect feedback from their customers using the telephone only.

**Key:** X = Bank uses the method for feedback Collection

	ABSA	BBS	Barclays'	Nedbank	Standard Chartered
Personal Interaction	X		X	X	X
Queue Management	X		X	X	X
Quality of Service	X			X	X
Customer Satisfaction	X	X	X	X	X
Query Management (General opinion)			X	X	

Table 3: Areas of service delivery that banks want their customers to provide feedback on

**Key:** X = area of service delivery that customers should provide feedback on.

Table 3 shows that the managers of Nedbank identified the highest number of issues on which customers should provide them with feedback. In contrast to the other managers from other banks, the managers at BBS wanted customers to provide them with feedback on only one issue. Managers at ABSA, Barclays and Standard chartered bank wanted customers to provide them with feedback on four different issues that relate to service delivery.

Problems of methods currently used by banks for feedback Collection.	Percentage of respondents that affirmed the factor as a side effect.
Delayed responses	40
Uses customer resources	0
Risk of a complaint never reaching its target	7
Limited sample number	10
Time wastage	30
Problems of communication breakdown during process of feedback collection	0
Report on past transactions	13

Table 4: The side effects of methods currently used by different banks to collect feedback from their customers

The results in table 4 show that there are four major disadvantages associated with the various methods currently used by banks to collect feedback from their customers. The commonest disadvantage among these methods is their failure to instantly respond to customer queries and complaints. In addition, these methods are prone to time wastage, reporting on past transactions, limiting the sample size of customers who can provide feedback and the risk of a query and complaint not reaching the right officer in the bank.

	Nedbank	Standard Chartered	ABSA	Barclays'	BBS
Quick Data Analysis and Reporting		X	X	X	
Aid Quick Alignment of products To market needs	X	X	X	X	
Aid Quick Responses to Service delivery Abnormalities	X			X	X

Table 5: The benefits of automating the process of feedback collection by the different banks

The results in table 5 show that the manager of Barclays Bank identified the highest number of benefits that can be derived from automating the process of feedback collection within their bank. In contrast to the managers of Barclays bank, the managers of BBS bank identified only one benefit that can be derived from automating the process of feedback collection. Managers of Nedbank, Standard Chartered and ABSA bank identified two possible benefits that can be derived from automating the process of feedback collection within their banks.

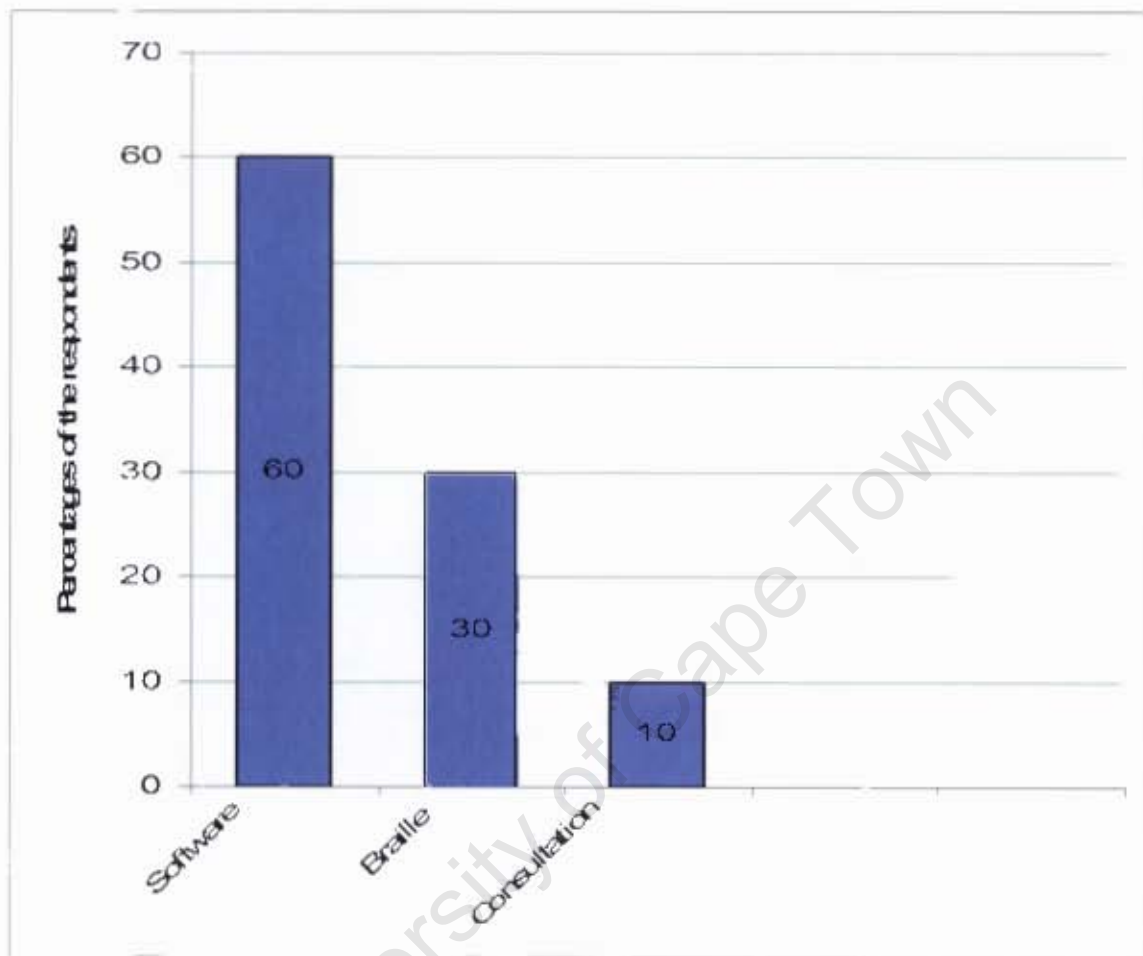


Figure 1: The modes of interacting with system interface preferred by bank managers

Figure 1 shows that the highest percentage (60%) of the managers preferred customers to interact with the interface of the system using software. The second-highest percentage of the managers wanted the customers to interact with the system using Braille. A small percentage of the managers (10%) wanted their customers to interact with the system aided by a bank consultant.

### 3.3 The Process of Data Collection from the Customers

Data was collected from blind people in a vocational school called Pudulogong. The school is located in a semi-urban village called Mochudi, which lies 40km north of Gaborone the capital city of Botswana. The sample from which data was collected comprised of staff members of different ranks and students. The total number of people interviewed was fifteen (15). The designations of employees interviewed included course instructors, receptionists all the way to grounds men/ gardeners.

Data was collected using a questionnaire. The questionnaire had fifteen questions which solicited information from the respondents about their professional designations, where they kept their incomes, how they provided feedback to their banks, their views on automating the process of feedback collection in their respective banks and their preferred method of interacting with the system interface. Data was collected from each person through a confidential interview session. Each interview session lasted for half an hour and it took two days to interview all the fifteen subjects.

During the interview session, questions and responses were read to each subject in English and where necessary they were translated into Setswana to aid a common understanding of what is wanted from the respondent by the question. The interviewer marked the responses selected by a respondent with a tick on the questionnaire. Furthermore, any specific elaborations given by a respondent on an issue that pertained to their chosen response were recorded next to the answer with a pencil. Any concerns, complaints and appraisals given by the respondents about the current system that needed to be retained or addressed were also recorded on a separate notepad.

### 3.4 Analysis of the Results from the Customers

The analysis of the results was done for each question. Data was analyzed as follows:

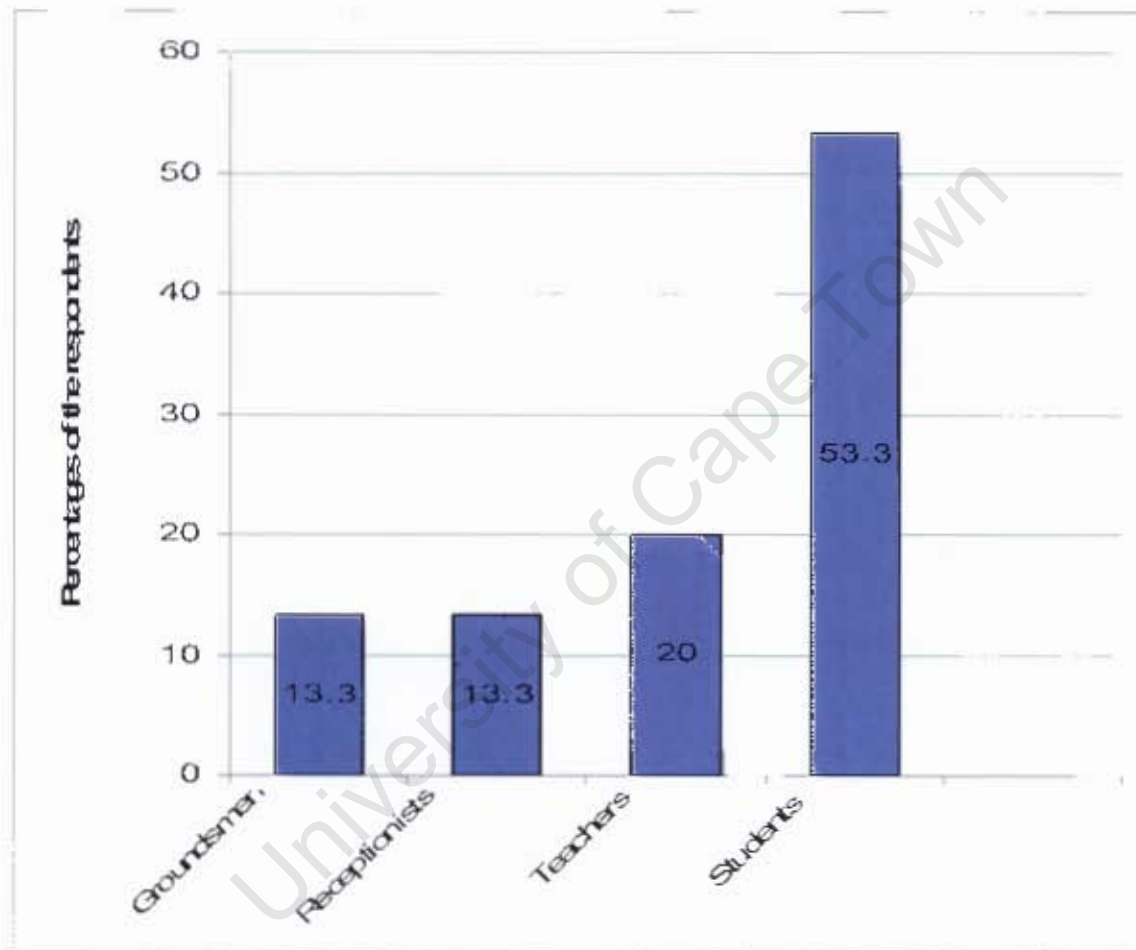


Figure 2: The professional designations of the respondents

Figure 2 shows that the highest percentage (53.3%) of the subjects interviewed were students while the grounds men and the receptionists formed the lowest percentages of the subjects interviewed respectively. Teachers made up the second highest percentage of the subjects interviewed.

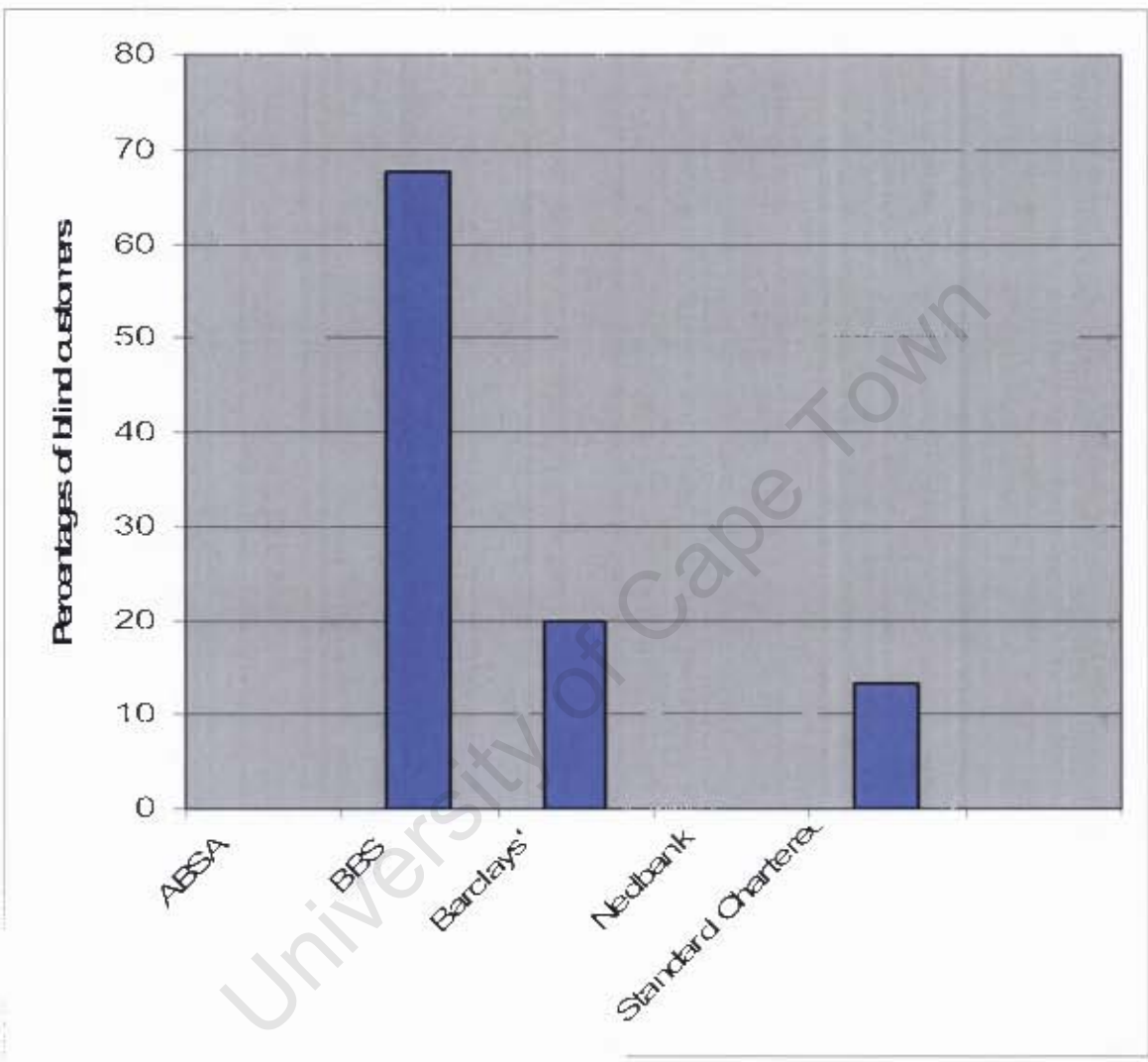


Figure 3: The distribution of the respondents among the different bank brands

Figure 3 shows that the blind customers interviewed were distributed among three banks only. The highest percentage of the customers interviewed was serviced by BBS bank, followed by Barclays and Standard Chartered bank respectively. There were no customers who used the services of Nedbank or ABSA bank.

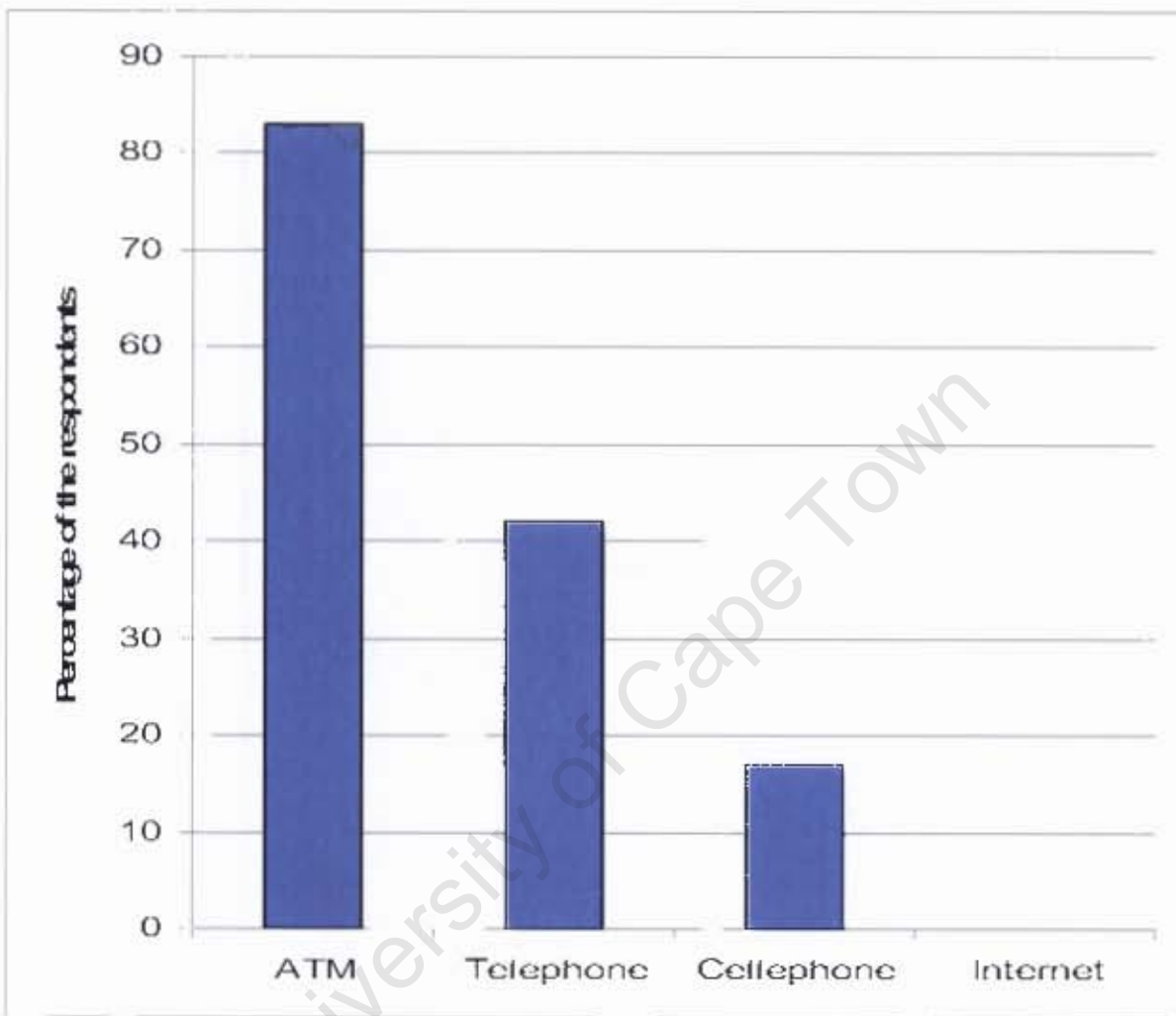


Figure 4: The technologies used by the respondents to access services offered by the different banks

Figure 4 show that the Automated Teller Machine (ATM) is the technology most commonly used by the customers to access services of their banks. There is no blind customer in the study who uses Internet to access the services offered by his/her bank. The customers identified the telephone as the second most commonly used technology to access services offered by their banks.

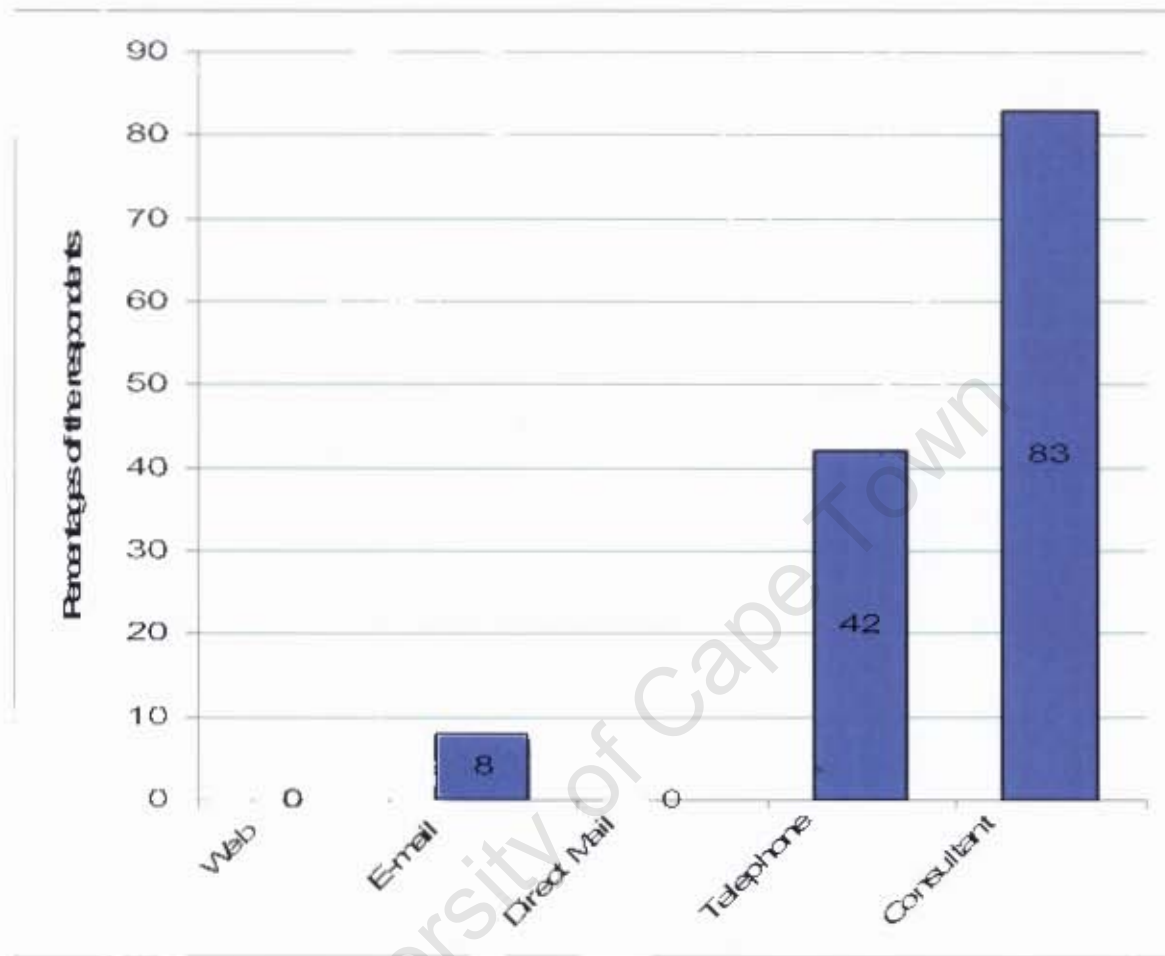


Figure 5: Methods used by customers to provide feedback to their respective banks

Figure 5 shows that blind customers use three methods to provide feedback to their respective banks. The highest percentage of the customers provides feedback to their banks through a bank consultant. E-mail is the method least used by the customers to provide feedback to their banks.

Disadvantages of the Current Method of Providing Feedback To The Banks	Percentage of the respondents in support of a factor.
Delays Responses to Complaints	40
Uses Customers' Resources	13
Report On Past Transactions	67
Limited to a few number of Customers	13
Requires Queuing for Service	80
Prone to communication breakdown	-

Table 6: The common problems associated with the methods used by blind customers to provide feedback to their banks

The results in table 6 show that there are five disadvantages associated with the methods currently used by banks to collect feedback from their customers. The most common disadvantage among these methods is their need for customers to queue for service. There is no method currently used in banks that is prone to communication breakdown during the process of feedback collection.

Benefits of Automating Feedback Provision to banks	Percentage of respondents supporting each advantage
Quicken responses to complaints	80
Prevent customers from using their resources	20
Evaluate events as they happen	67
Available to all customers	100
Service available all the time	67

Table 7: The benefits of automating the process of feedback collection to blind customers

The results in table 7 show that automating the process of feedback collection will offer six benefits to the customers of the different banks. The customers identified the highest benefit of automating the process of feedback collection as its “non discriminatory nature” of customers on the basis of their financial status. On the other hand, customers identified as the least benefit, the capability of automation to prevent customers from using their resources when providing feedback to their banks.

Functions Of SQAS	Percentages of respondents in support of a function
Measure Customer Satisfaction	93
Aid in identification of service anomalies	93
Assess performance of frontline staff members	93
Rate the performance of each branch	67

Table 8: The business processes to be evaluated by Service Quality Appraisal System (SQAS)

The results in table 8 show that customers want the system to be able to perform four tasks. The highest percentage of the respondents want the system to be able to perform functions such as measuring customer satisfaction, helping in identifying service delivery anomalies and assessing frontline staff members' performance. The lowest percentage of the respondents wants the system to be able to compare and rate the performance of the different branches of each bank brand.

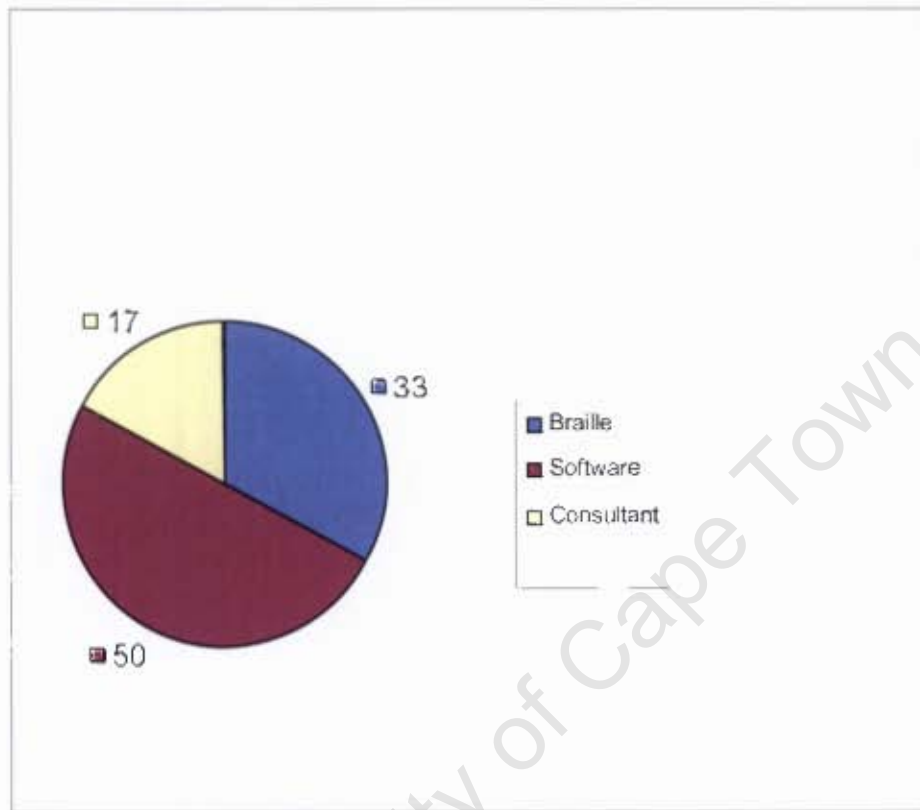


Figure 6: The modes of interacting with the interface of Service Quality Appraisal System preferred by customers

The results in figure 6 show that the highest number of customers want to interact with SQAS using speech software while the least number of customers want a bank consultant to aid them during their interaction with SQAS.

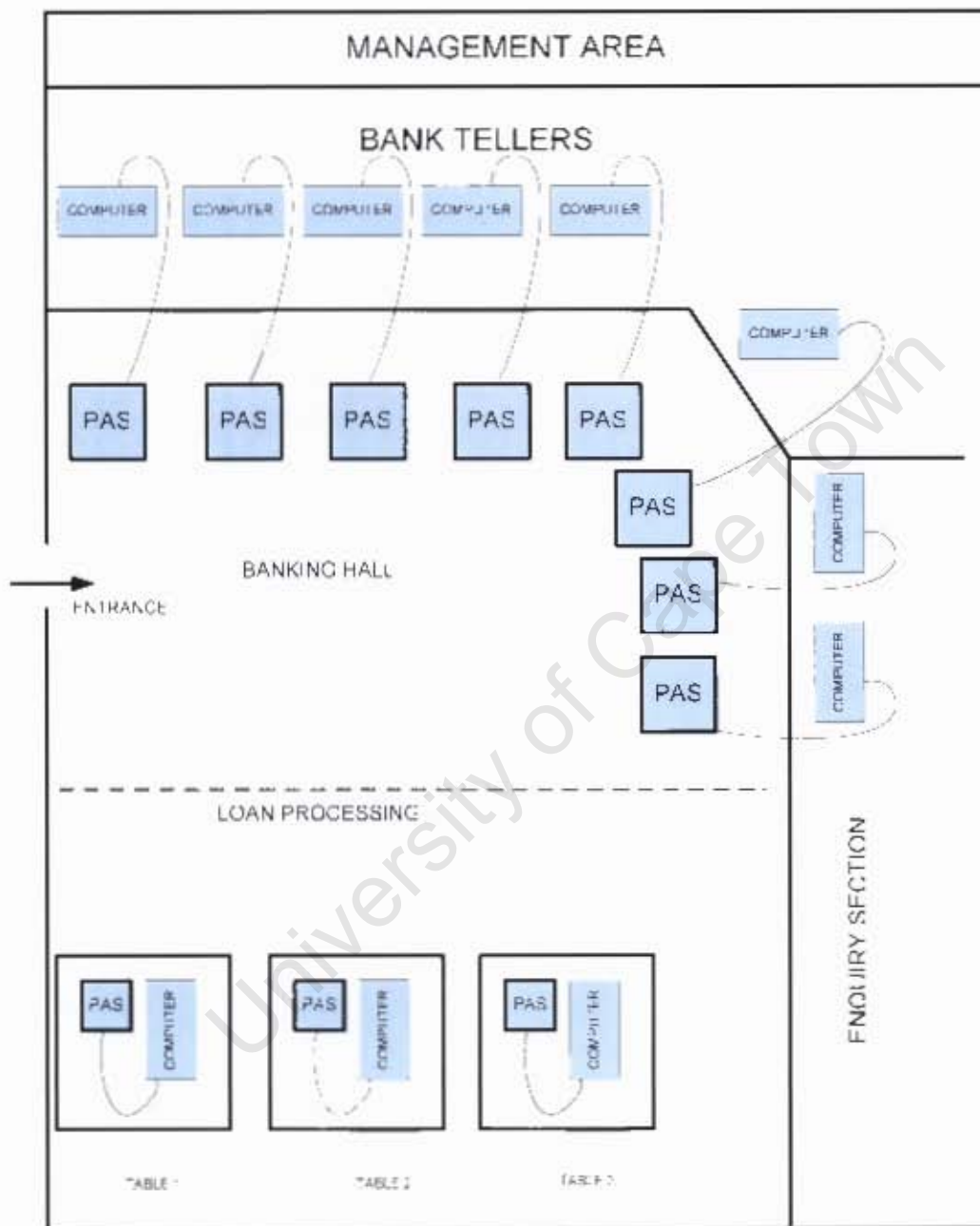
### 3.5 The Process of Collecting Data from System Designers

Data was collected from a representative of the system designers using an open-ended questionnaire. The questionnaire contained nine questions, which were meant to collect information about issues that pertain to system performance, hardware configuration and frequency of system maintenance.

Data was collected from a privately owned company called Cable for Africa, which is a networking company that has its offices in Botswana. The company does not design customer feedback systems but has been charged with the responsibility to distribute and maintain similar products by a South African Company called Customer Feedback System (CFS).

Data was collected from technicians who are involved in installing and servicing the products. Data was collected from each technician using an open ended questionnaire. Each technician was given a questionnaire to answer in his own spare time. Additional information on how the system works was obtained through a visit to Barclays bank, where a similar system is installed and used.

Data collected from the representative of the designers of the system was analysed qualitatively aided by the diagram below:



Key: PAS == indicates the points where SQAS is placed in a bank.

Figure 7: The different positions where SQAS can be placed within the banking hall

Data is collected from customers using a small machine placed in areas where bank employees directly interact with customers. As depicted by figure 7, Barclays bank has placed the system in three specific sections: - at the bank tellers, the loan processing section and the general enquiries section. At this bank, the machine is placed at “a reachable height” on a counter/table where customers can access it. Customers indicate their level of satisfaction with the service they received by pressing five buttons in response to five questions. At the end, customer responses are forwarded electronically to a database housed in Johannesburg, where data processing and report compilation is done. In this case, the machine’s role is limited to capturing data from customers while the churning of data into useful information is done automatically outside the points of data collection.

According to the respondents, the actual software and hardware requirements differ from one business to the next. These requirements depend in part on the system configuration and the applications and features each business wants to install. The respondents cited the minimum requirements on a client environment as a desktop and tablet PC platform that supports any Microsoft windows XP professional edition and Microsoft windows XP tablet PC edition SP2. In addition, the respondents reported that the machine can easily be configured to work on any operating system platform.

According to the respondents, system failure is a rare occurrence in the bank they service. Respondents estimated the occurrence of system failure to once in a quarter. The system rarely experiences mechanical faults. The major servicing done on the system is usually the replacement of the electronic pads, which over-time get worn out from over-use by customers. Once the system is installed it is easy to operate, maintain and configure, which has led to CFS “outsourcing” the routine maintenance to the internal IT department.

The respondents could not specify the speed at which the system processes transactions from customers. The respondents speculated the time taken to process a response and move to the next question to be in milliseconds. One respondent stated:

*“Transition between questions is so fast that the internal working of the system is kept opaque to the user.”*

In the statement above, the respondent suggests that how the system processes the user input is not made explicit to them.

University of Cape Town

## CHAPTER 4: RESULTS INTERPRETATION

### 4.0 Introduction

The chapter synthesises data into a larger coherent whole. It interprets observations or data by formulating hypotheses and/or theories that account for observed patterns and trends in data.

### 4.1 The Benefits of Automating the Process of Feedback Collection

In the information age, the need to automate and improve business processes is a critical step that helps institutions to adapt and align their services and products to the ever changing business climate (Ashton & Kelly, 2006:1 & Aceva technologies 2005: 4). Similarly, the results in table 5 and 7 show that automation of the process of feedback collection leads to positive gains in the improvement of service delivery and business efficiency. Thus, the automation of business processes has become a mandatory step in this era of heightened competitiveness, economic uncertainty, ever-increasing regulation and global turmoil, which makes businesses continually strive to improve operational efficiency (Bogart, 1985; 289 & Javaway Inc. 2002a:1).

The benefits that emanate from automation of feedback collection in the banks as shown in tables 5 and 7 are discussed below:

Firstly, the managers of the different banks used for the study differ greatly on the number and types of benefits that automation of the process of feedback collection can bring to their institutions. The managers of Barclays Bank identified the benefits of automating the process of feedback collection in their institution as quickening the process of identifying and responding to service delivery anomalies, helping to align their products to market needs at any particular time and quickening data analysis and reporting procedures. In support of the views of the managers at Barclays Bank, Monger and Keen (2004:5) credit the process of automating business processes for its capability to offer benefits such as increased customer satisfaction and loyalty and improved employee productivity. Similarly, Knowledge Institute Inc. (n.d:1) extends the benefits of automating business processes to areas such as employee

management, employee retention, employees' goals alignment to those of the institution, employee productivity and optimised employee compensation.

The managers of Nedbank, ABSA and Standard Chartered Bank limit the benefits of automating the process of feedback collection to two areas. The two areas from which each institution expects to benefit are discussed below.

First and foremost, the manager at Nedbank refutes that automation of the process of feedback collection can quicken the process of data analysis and reporting. In his opinion, automation of business processes cannot impact data analysis and reporting when the points of data collection and analysis are geographically separated. The manager argues that the current setup creates an additional time overhead when data is moved from collection points to a centralised processing centre. The manager further argues that the process of data analysis is delayed at the processing centre because one centre is burdened with the responsibility of processing data from so many branches dispersed all over the country.

In contrast to the views of the manager at Nedbank, Knowledge Institute Inc. (n.d.) and Phillips et al (2004: 2) support the notion that the automation of business processes provides accelerated gains in the process of data analysis and reporting. Phillips et al (2004:2) attest that outsourcing of the data analysis and reporting process leads to reduced time requirements for analysis and reporting of data caused by increased level of automation used for the different tasks. Arguably, the rapid advances in microprocessor speed and transmission technologies have provided some means to offset the minimal time delays caused by transmission of data between geographically dispersed places.

On the other hand, the managers of Standard Chartered and ABSA banks refute that automation of the process of feedback collection can help their institutions to respond to service delivery anomalies faster. In contrast to the views of these managers, Javaway Inc. (2002b:1) reports that automation of the process of feedback collection has led to shrunk cycle time for survey instrument creation, administration, data collection and reporting by more than 50% while realizing cost savings of more than 30%. Secondly, Javaway Inc. (2002b:1) reports that regular analysis of feedback information helps business leaders to improve their business processes and align their products to market needs and

demands. Unlike the traditional approach, automation of the process of feedback collection supports a program of ongoing feedback collection with strong data analysis capabilities and versatile real time reporting; a feature that makes service delivery anomalies easy to identify and remedy (Javaway Inc., 2002b:2).

The effectiveness of the automation of the process of feedback collection to impact service delivery is well summed up in the words of Patricia Roberts of Workplace Effectiveness Group, which says:

*“At the end of the day we can pull up analytical reports, instantly view our progressive performance and learn what we are doing right and where we need to improve.”* (Javaway Inc., 2002b:2).

The statement above corroborates the effectiveness of the automation of business process to notice, and respond to service delivery anomalies immediately.

Again, automation of business processes does not cause any delays in the process of data analysis and reporting as suggested by the managers at Nedbank and Standard Chartered bank. eXplorance (n.d.) reveals that the automation of the process of feedback collection reduces the lag time between the time of logging a complaint and responding to the complaint to a day instead of a month and beyond. In view of the contrasting evidence from research work, the opinions of the managers at Standard bank and ABSA bank may be seen as a research flaw caused by misinterpretation of the question asked or the zeal to proactively defend the methods currently used by their bank over automation.

In conclusion, businesses should thrive to ensure that blind people benefit from automation through encouraging social change, driving policy revision and providing appropriate technologies to encourage their independent living. Furthermore, it is important for businesses not to focus much on the ability of automation to provide consistency and economies of scale alone. Businesses need to ensure that each individual branch has the capacity to collect and analyse feedback and use the information to drive improvements in the service delivery procedures within its settings (Morais and Matias, 2003:14).

#### **4.2 The distribution of blind customers among different bank brands**

According to the results in table 1, the average number of blind customers per branch is not more than three. These numbers are not a true reflection of the reality as it is in these banks but a rough estimate based on the daily interactions of managers with a few blind customers they service. All the banks in the study confirmed not to have any recorded statistics on their blind customers. In part, the absence of proper statistics on blind customers in the banks may be blamed on an instrument used for opening bank accounts. A key deficiency in the aforesaid instrument is its inability to identify customers according to their needs for a specialised service mandated by their physical limitations. Consequently, blind people have been forced to adapt to non-user-friendly structural setups and systems not commensurate with the limitations of their disability.

Secondly, figure 3 shows that none of the interviewed people bank with ABSA or Nedbank. The subjects of the study were from Botswana, where Nedbank and ABSA do not exist. On the other hand, Figure 6 and table 1 show that the BBS bank services a larger proportion of blind customers than any bank. Unlike the estimation made by the managers in Table 1, figure 3 shows that more blind customers use the services of Barclays bank than those of Standard Chartered Bank.

Arguably, with an estimation of over 200,000 blind people living in South Africa, it raises concern to hear that bank managers only interact with a few of them (Mdunyelwa, n.d.:2). The low turnout of blind people in banks can be attributed to a number of factors, some of which are discussed below.

Firstly, most African societies have wrong perceptions about blindness, which has led them to shun their disability and view them as a burden (Sandhu et al. 2001:2). The negative perception about blindness has led people to treat blind people badly. In some instances, they are left to sit behind houses while their sighted counterparts do their normal day's work (Sandhu et al. 2001:2). Many of the families with blind people consider them to be incapable of fending for themselves or effectively participating in activities that can generate income for them (BBC News, Thursday, October, 2003). If blind people are left idle without a job or any means of generating an income, they do not need the services of a bank, which in part explains their low turnouts at such places.

Secondly, blind people are amongst the most illiterate citizens of the world, with only one out of three disabled people having gone to school (International Labour Office, 2006:5 & Sandhu et al, 2001:1).

Research points out that the high illiteracy level among blind people is attributed to factors such as the nature of their disability, unavailability of educational facilities and bad attitude of sighted people to blindness (International Labour Office, 2006:5, Kaye, 2000: 8 & Sandhu et al, 2001). Consequently, poverty, illiteracy and the nature of their disability constitute a formidable combination that excludes them from enjoying their right to employment (Kaye, 2000:2 & Sandhu et al, 2001:1). In South Africa, 18% of the 2.25 million disabled people are in full time employment (International Labour Office, 2006:5). Indirectly, the absence of many disabled people on the labour market may be caused by their inability to read or write. Thus, in the absence of a secure employment, disabled people are forced to depend on their family members, non-profit-organisations, government departments and “good Samaritans” for their daily survival needs (Sandhu et al, 2001:1). Arguably, this dependency on donations and food rations offered by governments and others puts them outside the brackets of citizens who qualify for a bank account.

In conclusion, the results in table 1 discredit the efforts of South Africa as a country, to emancipate the disabled people. In argument, the lower turnout of blind customers at banks suggests failure on the part of the government to realise its promise of equitable employment, skills provision and equitable access to service (International labour office, 2006:9, 10). As a result, the quality of life of blind people is compromised by their lack of skills and training opportunities (Sandhu et al, 2001:1). In order to circumvent the effects of physical barriers to banks for disabled people, banks should deploy ICT tools that permit them to access their services and products everywhere in formats commensurate with their physical limitations.

### 4.3 The Methods Commonly used by Blind Customers to Provide Feedback to their Banks.

As depicted by table 2, banks predominantly use the traditional approach to collect feedback from their customers. Despite their wholesale preference for the traditional approach, these banks differ slightly on the choice of methods from the approach they use to collect feedback from their customers. All banks but standard Chartered bank and BBS use a combination of methods such as direct mail, e-mail and in-person conversation to collect customer feedback. An inquiry into why banks preferred a combination of methods from the traditional approach revealed two possible answers.

Firstly, most methods under the traditional approach allow for easy planning and scheduling of the process of feedback collection during the same period each year (Counting Opinions Inc., 2006). Again, the approach offers customers as many opportunities as possible for them to provide feedback. In addition, as attested by Counting Opinions Inc. (2006), the approach is practical and affordable as it allows feedback to be collected when necessary and from a specific group of customers for a specific purpose.

While banks prefer to use the methods of the traditional approach, research reveals some flaws with them, which if not managed well can result in financial losses. According to Counting Opinions Inc. (2006), if not managed well the approach may lead to skewed results caused by misrepresentation of a particular group of customers. The skewed results cause businesses to base their planning on invalid assumptions.

Furthermore, research points out that some methods of the traditional approach such as period specific and point-in-time approach to feedback collection allow businesses to compare long term trends without an opportunity to monitor the impacts of specific changes and events or to determine the specific timing of changes that impact customer satisfaction (Counting Opinions Inc., 2006). In return, businesses that use these methods miss out on key benefits and opportunities such as the valuable feedback information provided by the principal users of their service (Counting Opinions Inc., 2006).

Table 2 shows that Barclays bank is the only bank that has automated its process of feedback collection from customers. Arguably, the bank implemented the system for two reasons. Firstly, it has embraced automation for its many benefits, which are described below.

Automating the process of feedback collection helps the institution realise financial gains in areas such as employee productivity, employee retention and employee compensation (Klenke, 1991:83 & Knowledge Institute Inc. n.d.:1). Furthermore, Knowledge Institute Inc. (n.d.: 1) credits automation for its ability to empower managers of employees to create a more engaged workforce, which is highly productive and motivated to improve the business's profit line.

Again, automation has been credited for the quickening of the process of data analysis and reporting, which provides a faster way of benchmarking the performance of the different branches of the same bank. As a process, benchmarking enables each individual branch to compare all its modes of operation and periodic output to an established yardstick of performance in a systematic way (Morais & Matias, 2003:12). As a result, the expedited result analysis and reporting brought forth by automation allows banks to continually align their products and services to the needs and demands of their specific market. In addition, the rapid analysis and reporting of data allows banks to make prompt decisions that affect service delivery and pay-for-performance (Knowledge Institute Inc., n.d.:5).

The implementation of an automated system by Barclays bank may have been mandated by the need to remedy the flaws of the methods of the traditional approach highlighted above. This study (tables 4 & 6) has revealed that the methods of the traditional approach are susceptible to flaws such as delayed response to customer queries, wastage of customer resources, discrimination of customers on the basis of their financial status and misdirected complaints and queries along the chain of management.

Investigations during this study revealed that Nedbank and ABSA had previously automated their process of feedback collection. An inquiry into why these two banks stopped the automation of the process of feedback collection revealed two assumptions based on the personal opinions of the respondents (customer care managers).

In the opinion of the managers at Nedbank, the system was terminated because of its poor design, which made it possible for the staff members to abuse it. In response to why the bank opted to discontinue the automation of the process of feedback collection, one manager at Nedbank responded as follows:

*“It had no means of stopping dishonest staff members from evaluating themselves and a single customer from unnecessarily over evaluating a staff member.”*

On the other hand, the manager at ABSA attributed the termination of the system used to automate the process of feedback collection on its failure to record customers’ opinions, attitudes or preferences. The manager argued that the system only expedited the process of data analysis and reporting at the expense of interpersonal relationships with customers. Westin (1987) quoted by Klenke (1991:85) affirms the opinions of the manager above by highlighting that if not used well employees may consider the presence of the system as invading their privacy.

Beyond the opinions of these two managers, some research discredits automation for its link to contributing to employee stress and stress related illness (Klenke, 1991:84). Most systems used for automating business processes lack some means (quality control) of validating customer comments. A system that provides only numeric values has low credibility and amplifies the liability of the person being assessed without validating the claim (Monger and Keen, 2004:7). As a result, for as long as there is no means of providing data cleansing to ensure that the numeric assessment values and the assessed aspect/person are justifiable by reason, the employee would always have reservations about the authenticity of the assessment results.

While these arguments may not be extrapolated to all banks, they may in part explain why banks are sluggish to automate the process of feedback collection as supported by data on table 2 in **chapter 3**.

Table 2 shows that Standard Chartered and BBS Banks use only the telephone to collect feedback from their customers. The process of feedback collection in these banks is done quarterly and has been outsourced. The telephone is used as a supplementary tool to augment the other methods used for the collection of feedback by a contracted company.

The telephone, as a tool of feedback collection, is discredited for weaknesses such as being costly, time consuming and daunting to manage, analyse and publish data collected through it (eXplorance, n.d.: 1). Hence, the use of a telephone for feedback collection is deemed to be more suitable for small samples of customers, where it would be economical with resources such as staff time and finances. In medium-sized organisations such as modern banks, the most suitable mode of collecting feedback from customers is through an automated system designed to gather, trigger, analyze, convey and share information (eXplorance: n.d.:2 , Javaway Inc. 2002b: 1 & Klenke, 1991;82). Again, it is impossible to reach a large number of respondents simultaneously using the telephone.

Another weakness of the telephone is its tendency to report on historical business transactions (eXplorance, n.d.:3). In all the instances where the telephone is used to collect feedback from customers, there is always lag time between the occurrence of an anomaly in service delivery and the time when it is diagnosed, planned for and corrected. This delayed time for corrective actions impact negatively on the tactical and strategic planning of how well to deal with uncertainties as they arise within a business (eXplorance, n.d.:4).

In conclusion, it is not about which method a company uses to reach its customers but how effectively the method allows the business to serve them well. Currently, there is a universal outcry from customers calling for companies to opt for methods and strategies that enable them to respond quickly to emergencies, opportunities and to quickly get valuable information to people in the company who need it (Attaran, 2003:595 & Monger and Keen, 2004:6). Secondly, a bank should opt for methods that allow it to gather as much customer intelligence as possible. Monger and Keen (2004:9) considers the ideal method being the one that would allow banks to identify and track underperformers in their staff, assesses the rate of resource usage relative to output and capture customer reaction when interacting with their staff. In addition, such a method should be flexible enough to provide a platform to gather additional customer intelligence within the confines of the objectives for collecting feedback.

#### 4.4 The Technologies Used By Blind People to Access Services Offered By Their respective Banks

Blind people have reported that they use three different technologies to access services offered by their banks (Figure 4). These technologies are Automated Teller Machine (ATM), telephone and cell phone. No blind person in this study uses the Internet for the purposes of feedback provision. Investigations on why they preferred to use their chosen type of technology provided varied answers discussed below.

According to the respondents, they do not use ATMs out of choice but are forced by operational laws enforced by their banks. In Botswana, where the highest number of blind people reported to use ATMs, banks charge more for over-the-counter transactions than for an electronic transaction using an ATM machine. One respondent when quizzed as to why he uses an ATM responded by saying:

*“We struggle with the ATM machine in an attempt to save ourselves from being over charged for using over-the-counter services”*

The argument of this respondent is corroborated by Kuell (n.d.) who also argues that banks prefer to render services to customers using the ATM because it is relatively cheaper for the bank than to employ a staff member to perform the same service. The current design of many ATMs discriminates against blind customers because they use text displays for instructions and keypads for entering transaction information. Consequently, blind people are forced to rely on a sighted assistant or to memorise the instructions and commands of these machines to facilitate smooth interactions with them (Kuell, n.d.).

Inaccessibility of ATMs to blind people denies them the convenience of accessing banking services anywhere, anytime. Blind people are excluded from using ATMs for services such as paying for airline tickets, gas, stamps, ski-lift tickets, and buying airtime (Kendrick, 2001:1 & Kuell, n.d).

All the managers interviewed could not commit to a specific date when their banks would be able to provide ATMs that cater for their blind customers. Kuell (n.d) reveals that banks blame the inaccessibility of ATMs on their designers, who until recently have been failing to provide accessible

models for the blind. On the other hand designers of ATMs blame their slow responses to provide machines that are accessible to the blind on poor demand for them by the banks, which in turn blames it on poor turnout of blind customers at their institutions, (Kendrick 200:1 & Kuell, n.d.). Arguably, today banks can no longer attribute their failure to provide machines that cater for blind people on the absence of such machines on the market. Inexpensive plug-them-in ATMs that convert text into synthesized speech are available on the market for use by blind customers (Eisenberg, 2007, Kendrick 2001:1 & Kuell, n.d.).

Research supports a common trend where disabled people generally make less use of the Internet than their sighted counterparts (Kaye, 2000:5). The low usage of the Internet among blind people may be attributed to the absence of opportunities, poor literacy level and economic hardships (Kaye, 2000:13 & Sandhu et al, 2001:3). In an attempt to use the Internet, blind people find themselves struggling to learn strange commands or computer languages and to handle non-user friendly input and output devices (Sandhu et al, 2001:3). Availability of assistive technologies has not solved the problems of accessibility of the Internet for the blind people. Assistive technologies are often expensive and unaffordable for many blind people living under economic hardships (Sandhu et al, 2001:3). Research attests that disability and poverty are linked, which means that the majority of blind people live under economic hardships that make it difficult for them to have access to technology (Kaye 200:13 & Sandhu et al, 2001:1).

Blind people are among the least educated citizens of the world. This means that they are a dominant group without the necessary skills to use the Internet. While the respondents of this study knew how to read and write, none of them had received formal education beyond high school. Research affirms a positive correlation between educational attainment of a person and computer ownership (Kaye, 2000:13). According to research, computer ownership is higher among educated people than among people with lower literacy levels (Kaye 200:13). Kaye (2000:13) further points out that educated people with computers have a high probability of connecting them to the Internet.

Again, blind people are deterred from using the Internet by the lack of opportunities where they could access it for free. The respondents of this study reported that in their school Internet use is only reserved for educational purposes.

Respondents use telephones and cellphones for inquiry purposes only. These technologies suit this purpose very well. When used for inquiry purposes, telephones and cellphones are cost effective, allow for dialogue, allow for building of relationships and provide immediate feedback.

In conclusion, the success of any technology within an organisational setting is dependent on its popularity among its users and the other stakeholders. Klenke (1991: 90) shows that the success of any new workplace technology depends partly on non-technical factors such as management, employee attitudes, corporate culture and relative power relationship. Consequently, any technology that is introduced in an organisation becomes effective when there is a proper balance between people and itself. The balance between people and the new technology can be attained by designing good interfaces from the equipment level right through to the organisational level (Hom, 2007:2 & Klenke, 1991:90).

#### **4.5 The Business Processes to be measured By SQAS**

Respondents want the system to provide metrics to measure levels of customer satisfaction, staff-customer relationships, identify service delivery anomalies and benchmark branches (Tables 3 and 8). In support of the results (tables 3 and 8), Karten (2006:2) affirms that businesses collect feedback from customers for reasons such as finding ways to service their customers better, establishing poor performers among their staff and monitoring the progress of the organisation towards achieving its vision and goals.

Information generated from collected data helps businesses in many ways. Firstly, feedback information can be used to validate service delivery in a business. As Marker (n.d.) points out, feedback information provides a platform to communicate anticipated changes in service delivery styles to customers. Adjustment and alignment of service delivery styles to the needs of customers is quick when the process of feedback collection allows for real time measures of business processes.

Feedback information is useful in revealing levels of satisfaction of customers about the services and products offered by a business. Businesses use information on customer satisfaction to establish a company's market entry threshold and distinguish itself from its competitors in a positive way (Morais

and Matias, 2003:13). Furthermore, feedback information provides businesses with intelligence that helps them to identify and implement processes that improve customer retention, renewals, referrals and new customer conversion (Gurasich, 2007; 2). Morais and Matais (2003:13) argue that customer satisfaction and value perceptions influence customer loyalty behaviours and subsequent financial outcomes of a business. In support of their argument, Morais and Matias (2003:13) reveal that Johnson Controls earned itself 91% contract renewal because of its high number of satisfied clients while at Bailey customer satisfaction translated into 13 million dollars worth of service contracts.

Businesses use feedback information to monitor customer-staff relationships. Research reveals that good, well rounded customer-staff relationship solidifies customer loyalty (Gurasich, 2007:2). According to Gurasich (2007:2) customers' loyalty is greatly improved by small gestures such as reaching out to unhappy customers, fixing their problems and leaving them with a positive experience. Feedback information on customer-staff relationships provides insights on patterns of staff behaviour disorders and mandates investigations of their root-cause (Aceva technologies, 2005:3). At a managerial level, feedback information guides decision-making processes such as allocation of tasks to employees to match their temperament, skills and maturity (Aceva technologies, 2005:6).

Feedback information acts as a "barometer of performance" between entities of the same institution. Feedback information helps management to evaluate each entity's practices, processes and monthly returns against a set standard of excellence. When used as a benchmarking tool, feedback information gives entities an opportunity to learn, share information and best practices in order to improve their standard of performance (Morais and Matias, 2003:12).

Research reports that technology has transformed the way businesses deal with performance management issues (Knowledge Institute Inc. n.d:1). Advances in technology have provided businesses with solutions that allow them to operate at lower cost, increase customer loyalty through satisfaction and allowed employee to multi-task (Monger and Keen, 2004:3). Designed with no particular business entity in mind, technological systems fail to meet the specific objectives of performance management in the different entities they service. Performance management is entity specific and therefore needs to be planned around the needs of the people served by that entity. Therefore businesses need to implement

solutions that effectively meet their organisational objectives, accurately measure business processes and reach as many customers as possible without discrimination on the grounds of disabilities.

#### **4.5 The Preferred Modes of Interacting with the Interface of Service Quality Appraisal System by Banks and Customers.**

Respondents preferred three ways of interacting with SQAS, namely, using speech software, braille keypad inputs or being aided by a bank consultant (Figure 1 and 6). Respondents expressed different reasons for their choice of the method(s) of interacting with SQAS.

According to figure 1 and 6, the highest percentage (60% and 50% respectively) of the respondents wanted to interact with SQAS using speech software. These respondents credited the speech software for its capability to empower disabled people to do their daily life activities independently. Respondents highlighted that the speech software empowers them to do activities such as writing letters, managing their finances or performing work related tasks. In line with the results, research identified synthetic speech software as the technology commonly used by blind people in accessing information from a computer (Education Development Centre, Inc., 1998).

A few respondents criticised speech software for creating noise during data entry. While this is true, it is a minor inconvenience that can be compensated for by using headphones. Not only would the headphones eliminate noise but ensure secrecy of each transaction during the process of feedback provision.

Figure 1 and 6 shows that 30% and 33 % respectively of the respondents wanted to interact with SQAS using Braille. Like speech software Braille devices provide another easy way of accessing technology. In contrast to speech software, Braille accords users the opportunity to learn the format of data on the screen, a chance to proofread their work, check for grammatical errors and accidental capitalisation (Education Development Centre, Inc., 1998). Unlike speech software, most Braille access devices are portable, flexible, cheap and make no noise during data entry (Education Development Centre, Inc., 1998).

Figure 1 and 6 shows that only 10% and 17 % respectively, of the respondents wanted to interact with SQAS aided by a consultant. In their arguments, the respondents felt that the presence of a consultant could affect their responses negatively. In the words of one respondent:

*“The presence of a bank consultant will compromise our right to privacy, our obligation to give honest feedback autonomously and undermine the very reason why such a system was implemented”*

In support of this argument, research shows that technology has great potential to assist blind people to live an independent, meaningful and productive life (Sandhu et al, 2001:1). Technology, when designed to meet the needs and demands of blind people, easily compensates and substitutes for their physical impairment which limits their participation in many social activities (Kaye, 2000:13 & Sandhu et al, 2001:1).

The past decade has seen monumental advances in the improvements of the opportunities for disabled people in both access technology and societal awareness (Education Development Centre, Inc., 1998). In spite of these advances, Education Development Centre, Inc. (1998) shows that blind people still do not have equal access to information as their sighted counterparts. The greatest challenge faced by businesses is to provide blind people with the same pictorial information as other sighted customers. There is no single method of interaction that can cater for the widespread spectrum of blind customers. Hence, a fast moving business would make its services and products accessible to its blind customers by implementing technological systems that have a variety of features to facilitate easy access to them. Such a bank would use a combination of access strategies that accords users more than one way of accessing technology that is commensurate with their skills, proficiency and their disability.

#### **4.6 Summary**

Generally, all the banks have a small number (slightly above 3 people per branch) of blind customers. These small numbers of customers have contributed to the sluggish responses by banks to cater for the needs and demands of their disability in relation to service delivery and the layout of their structures.

The few available customers rely mostly on banks' generosity to fulfil its social responsibility to make its services accessible to all.

Instead of accessing their services in one bank, blind people are sparsely distributed among different banks. Arguably, their distribution among the different banks can be attributed to poor layout of available infrastructures, which makes accessibility of the banks on foot difficult for them. Secondly, their small numbers in banks, make it difficult to push for their rights of equal access to services through the implementation of accessible ICT tools comparable to the ones available to sighted customers.

Technologies currently used by banks to access their services are discriminatory of their blind customers. They lack built -in features to make them compatible with AT. Consequently, they need to be reformatted, upgraded or adapted to cater for the needs of blind people. Otherwise, blind customers are forced to use non-user-friendly technological systems meant for sighted customers. In the process, blind customers are forced to memorise long lines of commands or trade off their privacy for assistance by sighted customers to facilitate an effective interaction with the available ICT tools.

Similarly, most methods of the traditional approach used by banks for feedback collection discriminate against blind customers. Among the methods that make up the traditional approach, telephone and in-person-conversation are the only methods that are easily accessible to blind customers. Arguably, banks choose methods of feedback collection on the basis of cost and their effectiveness to meet the objectives of the bank at the expense of the needs of the customers who provide feedback. Banks are deterred from automating the process of performance management by poorly designed systems. In comparison to automation, methods of traditional approaches are linked to delayed responses to customer queries, misdirected complaints and evaluating past transactions.

Increasing accessibility of ICT technologies to blind people can be achieved through a combination of access methodologies. Combined modalities of accessing technology enable the user to input Braille directly and monitor the input rapidly through speech. Speech software and Braille are at the forefront in opening doors for blind people to access technology

All banks reported collecting feedback from their customers to identify and correct service delivery anomalies, monitor staff-customer relationship, queue management and bench mark performance of different branches. Hence, automation of the process of feedback collection is a better option for the bank as it provides continuous feedback information, which expedites the process of service delivery anomalies identification and rectification.

University of Cape Town

## **CHAPTER 5: SYSTEM REQUIREMENT SPECIFICATION DOCUMENTATION**

### **5.0 Introduction**

The chapter develops the use cases and a list of requirements specification for the Service Quality Appraisal System (SQAS). It starts with documenting the system requirements specification, followed by summarising the requirements into an activity diagram and goes on to develop the use cases from the requirements specification. The chapter closes with a conclusion.

### **5.1 System Requirements Specification Document**

The documentation of the system requirements specification for SQAS was done following the template provided by Williams (2004:10-16). The reason why this template was preferred is because it conforms to the IEEE standards and has been developed from a System Requirements Specification using an evolutionary method. Secondly, the template documents the specification in an easy to read format convenient to all stakeholders. The template is also suitable for the project of SQAS's magnitude, which is relatively large with stable requirements. The system requirements specifications for SQAS are documented as follows:

## SERVICE QUALITY APPRAISAL SYSTEM (SQAS)

### SYSTEM REQUIREMENTS SPECIFICATION

**Version 1.1**

September, 2007.

**Project Team:**

Mogomotsi Banabotlhe

**Document Author:**

Mogomotsi Banabotlhe

**Customer Representative(s):**

Pudulogong Vocational School for the Blind (PVSB), Mochudi, Botswana

#### **1. Introduction**

SQAS is a feedback collection system that will be used by service-oriented businesses. SQAS is designed to act as an instrument that measures customer service level in banks. SQAS will be designed guided by the principles and concepts of the universal design and great efforts will be directed to making the system accessible to the blind customers served by banks. The objective of this document is to produce, in detailed form, the requirement specifications for SQAS.

#### **Current system**

Similar systems as SQAS are designed, manufactured and sold by a South African company called Customer Feedback System (CFS). The systems designed by CFS are used in different sectors of the economy. A recent survey by Microsoft Corporation (2004:1) showed that CFS products are used in areas such as banking halls, healthcare lobbies, and retailing and government offices. The same survey reported a sudden increase in the clientele of the company, which has been attributed to the efficiency

of its products to adequately determine customer service level in different businesses. CFS products are now sold as far as in Latin American countries.

Among the many products designed by CFS, SQAS will be designed to resemble one called Service Tracker in structure and function. SQAS, just like service tracker, is designed to act as a “digital board” that measures customer service level within a business and sensitises staff members about their performance standards and behaviour. Unlike some of the CFS products SQAS shall not extend its functionality to measure the levels of staff satisfaction within a business.

The survey done by Microsoft Corporation (2004:2) attributed the popularity of the CFS products, particularly service tracker, to their efficiency to provide real time feedback to managers, their versatility to measure a number of business processes simultaneously, and their cheapness, which makes them affordable to small businesses.

SQAS will be designed in such a way that it inherits and exhibits many of the attributes that have popularised the CFS products in different institutions.

### **Limitations of Current System**

Service tracker does not cater for the demands and needs of the disability of the blind customers served by the different banks. Consequently, these groups of customers are either forced to memorise the layout of information on service tracker, modes of interacting with it or to manage non-user-friendly inputs. Secondly, service tracker lacks the capability to minimise abuse from dishonest staff members who may find it fit to evaluate themselves. As a result, the reliability of information gathered using service tracker is questionable and misleading.

### **Proposed System**

The project prescribes a non-discriminatory system that is similar in purpose, size and design with service tracker. The scope of the project will focus on proposing a system that can minimise abuse by dishonest staff members and one that allows blind customers to use it to provide feedback independently.

In a bid to fight abuse from dishonest staff members, SQAS shall not be made accessible to them. The staff members would be denied access to SQAS by blocking their debit cards to access its services. SQAS shall only be accessible to bank customers who have a valid debit card. SQAS shall not allow a customer to provide feedback more than twice in a day. In contrast to the current system, SQAS will interface with its users through headphones, Braille and speech software.

### **Objective of the Proposed System**

SQAS is designed to capture real-time customer feedback that will be used to assess and monitor patterns of service delivery and customer-staff relationships within commercial banks.

### **3. Functional Requirements**

#### **Functional System Requirements Specification (FSRS) 1.0 Service Initialisation**

**FSRS 1.0:** Initiates the process of feedback collection.

#### **FSRS 1.1: Click a prompt on the monitor.**

The process of feedback collection shall be initiated by the staff member, who upon activation of SQAS advises the customer to put on the headphones. When SQAS terminates the introduction remarks, the customer either presses **EXIT** button to decline participation in the process or **CONTINUE** button to take part in the process of feedback provision.

### **FSRS 1.2 Customer Authentication**

In order to make the interaction with SQAS simple and easy, blind customers will interact with the machine using contactless debit cards. Contactless debit cards with embossed symbols shall be easy to identify and pick among other cards in a wallet. Again, these cards would be detected automatically by the machine from a distance of up to 10cm and therefore eliminate the hassle of locating the card slot on the machine. Once SQAS picks up the card, it verifies the customer's details from the bank's customer database and checks the number of times a customer has already provided feedback on that day. SQAS shall notify a customer when she/he has exceeded the permissible number of times they are allowed to provide feedback in a day.

### **FSRS 2.0: Feedback provision by a customer**

#### **FSRS 2.1: Read questions**

**FSRS 2.1:** Reads the questions to the customer in English.

A recorded voice shall slowly read the questions to the customer, who would be listening through the headphones. After reading a question, the system shall pause for 10 seconds to receive an input from a customer. At the lapse of 10 seconds, a voice reminds the customer to enter a response or seek help from the nearest bank consultant available on the ground.

#### **FSRS 2.2: Change Input**

**FSRS 2.2:** Allows a customer to alter a response already given when necessary.

SQAS shall allow a customer to change inputs already given by pressing the **CHANGE** button. SQAS shall wait 10 seconds for a customer to alter the response given. If at the end of 10 seconds the customer fails to provide a new alternative, SQAS instructs the customer to seek help from an available nearest consultant.

#### **FSRS 2.3: Input Responses**

**FSRS 2.3:** Allows a customer to input his/her responses to the questions.

Each question shall be evaluated using five response alternatives. The response alternatives shall be represented on the electronic pad as numbers ranging from 1-5. These numbers shall be inscribed on the electronic pad using Braille. The numbers shall represent words that indicate the level of customer

satisfaction with the process being assessed by the question asked. The numbers shall represent the following words on the electronic pad:

“**Excellent**” represented on the pad by number 1

“**Good**” represented on the pad by number 2

“**Average**” represented on the pad by number 3

“**Bad**” represented on the pad by number 4

“**Very bad**” represented on the pad by number 5

#### **FSRS 2.4 Service Completion**

**FSRS 2.4:** Notifies the customer of the end of the feedback provision process.

SQAS shall conclude the process of feedback collection with a thank you notice and an invitation to the customer to use it in future. All said, the system shall cut the voice and wait idle for the next customer.

## Non-Functional System Requirements Specification (NFSRS)

### **NFSRS 1.0: Performance**

SQAS shall capture users' input one at a time and temporarily store it in its backup memory. Once all the questions have been answered, SQAS bundles the responses together, tags them with the staff identification number and passes them electronically to the processing centre. SQAS shall complete all these functions promptly and opaquely to the customer and the staff member.

### **NFSRS 1.1 User Response**

The system shall handle users' input within a second.

### **NFSRS 1.2: Authentication of Card.**

SQAS shall authenticate customer's card details within two seconds. SQAS's performance shall rely much on the connections of the terminals to the server.

### **NFSRS 1.3: Updating users' responses.**

SQAS should update users' responses within a second.

### **NFSRS 2.0: Usability**

SQAS shall read the introduction and other instructions slowly (*three words/second*) to aid the user to capture clearly what is required of her/him. The key fields will be made very large, with a "dead area" between them. The numeric keys on SQAS will be arranged following the telephone layout, which is easy for blind people to memorise and use. The function keys will be laid on the far right of SQAS, separate from the numeric keys, to minimise the possibility of pressing a wrong button during data entry. The **Exit** button will be the uppermost key, followed by the **Proceed** button and on the bottom will be the **Change** button.

### **NFSRS 2.1: Response Options**

SQAS shall provide response alternatives arranged following the telephone layout on an electronic pad. The telephone layout is easy for blind people to memorise and use, especially if the number identification is enhanced with embossed numerals.

### **NFSRS 2.2 User Interface**

SQAS shall allow users to interface with it through speech software, headphones and pad inputs. SQAS shall limit the use of pad inputs to entering responses only.

### **NFSRS 2.3 User Errors**

SQAS shall catch wrong user input within itself, e.g. *pressing two buttons simultaneously to answer a question.*

### **NFSRS 2.4: Transaction Volume**

SQAS shall be robust enough to service an average of one thousand customers a day for over a period of three months without a need for service and maintenance.

## **4. Special User System Requirements Specification(SUSRS)**

### **SUSRS 4.0: System Security**

SQAS shall provide security to inputs and customer's biographic information by executing transactions opaquely to the user and the staff member.

### **SUSRS 4.1: Feedback Quality**

The services of SQAS shall only be accessible to customers who have a valid contactless debit card.

### **SUSRS 4.2: Securing Customer Information**

SQAS shall verify and authenticate customer card details opaquely to the staff member and its user.

### **SUSRS 4.3 Data Retention**

SQAS shall only store data temporarily while the customer keys-in the responses.

## **5. OPERATING ENVIRONMENT REQUIREMENTS (OER)**

### **OER 5.1 Hardware**

SQAS shall need a bandwidth of no greater than 56k/bits. SQAS shall need a browser that supports XHTML 1.0, CSS 2.0 and Sun Java 1.4.2. Again, SQAS shall work well with common browsers such as Internet explorer 7.0 and Firefox. SQAS shall require between 2MB and 3MB of available storage space depending on the processor and the type of components installed.

### **OER 5.2 Software**

SQAS shall require no particular operating system on the client. SQAS shall work well with common operating systems such as Windows XP, Windows Vista and Macintosh OSX 10.5. SQAS shall require a Microsoft SQL server 2000 with Intel or compatible Pentium 600 MHZ processors.

## 6. Constraints

SQAS shall ensure security of data through the use of a contactless debit card that would be used for customer authentication and initiation of the process of feedback provision. SQAS shall be developed in Visual Studio 2005. To ensure unlimited scaling, SQAS shall be built on Microsoft's Enterprise Patterns. The database used at the processing centre shall run on its own server and shall scale up on the hardware side.

## 6. Project Glossary

**Constraints:** *conditions that are set by the customer that may limit the implementation/ the development process of a proposed system/ software (Williams, 2004: 26).*

**Functional requirements:** *requirement statements that state clearly the specific functions the system/ software must perform to meet the needs of a customer (Williams, 2004:26)*

**Opaquely:** *the act of processing system transactions internally without exposing the details to a third party.*

**Non functional Requirements:** *requirements statement that specify design restrictions relating to factors such as system performance, data securities, usability standards and hardware specification.*

**Requirement:** *IEEE (1990) cited by Williams (2004:26) defined a requirement as a "condition or capability needed by a user to solve a problem or achieve an objective."*

**Requirements Specification:** *a document that describes the requirements for a proposed system/ software that outlines a solution to a customer's needs.*

**System:** *a technological solution that can be implemented to address the needs of a customer through design and development*

## 5.2 Activity Diagram

The activity diagram below is meant to reveal the operational step-by-step workflows of the components in the feedback provision process. The diagram summarises the overall flow of control, the swimlanes for every role participating in the scenario, data needed and produced by each activity and the ordering needed for different activities. Data is represented as objects that flow between different activities with a volatile state.

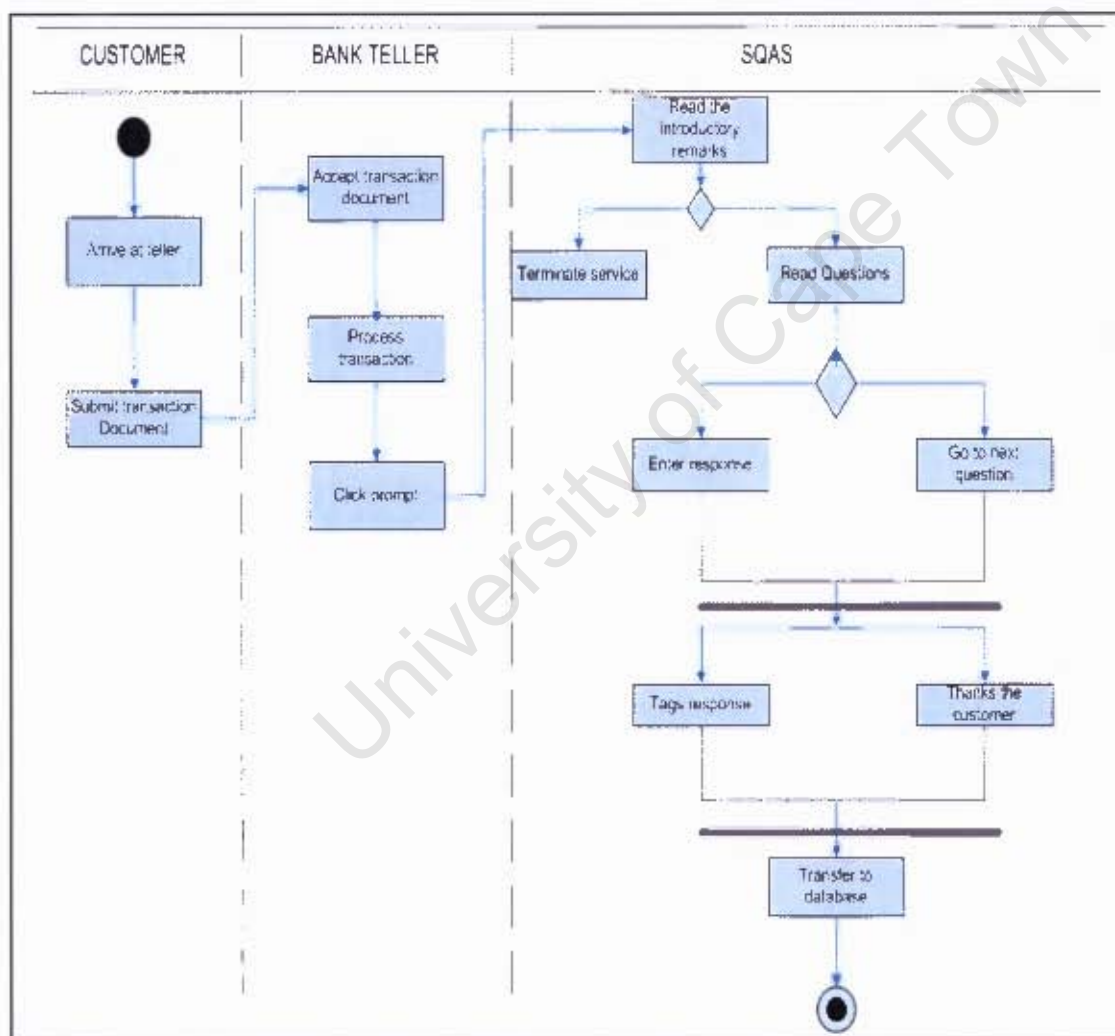


Figure 8: The step by step workflow of the components in the feedback provision process

### *5.2.1 Summary of the Events on the Activity Diagram*

1. A customer arrives at the bank teller. Upon arrival at the teller, the customer submits transaction documents to the staff member for processing.
2. The staff member receives transaction documents from the customer. The staff member processes the transaction documents and at the end invites the customer to provide feedback on the quality of service he/she has received. The staff member clicks a prompt on the desktop to activate SQAS and the customer listens to SQAS as it introduces itself and provides a synopsis of how it works.
3. SQAS reads introductory remarks to the customer.
4. Depending on the option selected by a customer, SQAS can either terminate or go on to read questions to the customer. SQAS terminates when a customer declines to participate in the process of feedback provision by pressing the exit button on the electronic pad. SQAS will move on to read questions only when the customer has pressed the continue button on the pad.
5. SQAS reads one question at a time to the customer and then it pauses for the customer to provide a response. SQAS reads back the response the customer has keyed-in. Upon hearing the response from SQAS, a customer can alter the answer given by pressing the change button on the electronic pad. If the customer is satisfied with the response given, he/she presses the continue button for SQAS to read the next question.
6. Once the customer has answered all the questions, SQAS simultaneously tags the bundled responses with the staff member's identification number and thanks the customer for taking part in providing feedback to the bank.

7. Finally, the responses are electronically passed to a database at the processing centre, where they shall be processed later.

### 5.3 Use Cases for Service Quality Appraisal System (SQAS)

In essence, the use cases will be used to capture the functional requirements of SQAS. These use cases represent the interaction between the actors and SQAS as a sequence of simple steps. Actors represent other systems, hardware devices or people outside SQAS who initiate activities that lead to interaction with SQAS. Each use case provides a description of how an actor interacts with SQAS to achieve a specified objective.

#### *5.3.1 The Transition to the Initial System Use Case Model*

The initial system use cases model of SQAS will be drawn from the events of the activity diagram. The individuality of the events of the activity diagram allows them to be associated with a single system use case. In this project, use cases that will be supported by the system will be created from the individual events of the activity diagram. A use case created from the events of the activity diagram has the object performing the activity as its primary actor. In addition to drawing use cases from the events of the activity diagram, another set of use cases shall be defined from the insights gathered from the requirements they support. The use cases that are defined from requirements represent the functions that the system must perform to achieve the goals related to some existing system use case.

### 5.3.1 The System Use Cases Diagram

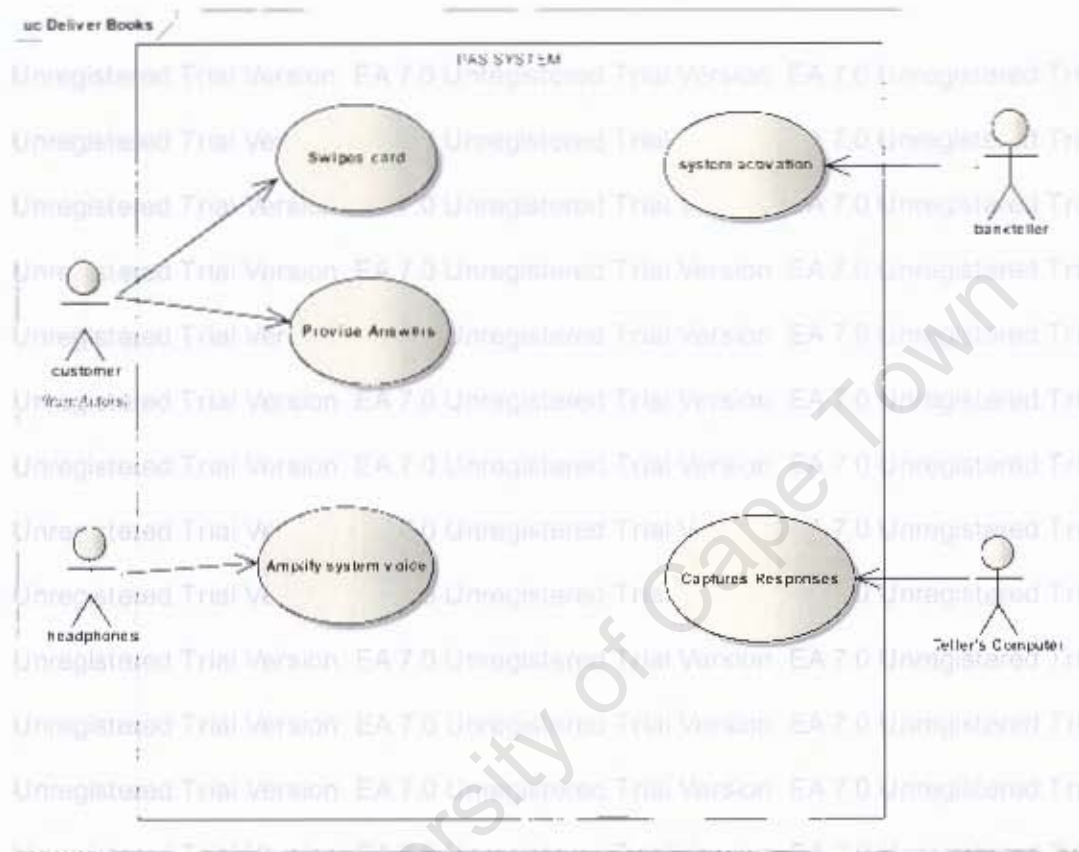


Figure 9: The functional requirements of SQAS represented as use case

### 5.3.2 The Description of the Use Cases

Each use case will be described using the template below. The template is favoured for its simplicity and completeness. The template summarises the description of each use case as follows:

<b>Use case</b>	<i>Swipes card</i>
Description	<ul style="list-style-type: none"> <li>• Accords a customer to participate in the process of feedback collection.</li> <li>• Activates SQAS to read questions and instructions to the customer.</li> <li>• Confirms customer details on the database and if that customer has not exceeded their daily limits of the number of times they are allowed to provide feedback.</li> </ul>
Actors	<i>Customer</i>
Assumptions	<ul style="list-style-type: none"> <li>• Customer's card is valid and up to date.</li> <li>• Card used to swipe is strictly a debit card.</li> <li>• Customer details are correctly entered on the database</li> </ul>
steps	<ul style="list-style-type: none"> <li>• The machine picks up the customer card</li> <li>• Once the machine picks up the card, the machines is activated to read out instructions and questions.</li> <li>• If the machine fails to read the card, a warning is given to the customer to seek help from a bank consultant.</li> </ul>

Table 9: A brief description of the swipes card use case

<b>Use case</b>	<i>Provide answers</i>
Description	<ul style="list-style-type: none"> <li>• Allows a customer to respond to questions asked</li> <li>• Allows a customer to change responses previously given to a new one.</li> </ul>
Actors	<i>Customer</i>
Assumptions	<ul style="list-style-type: none"> <li>• Electronic key pad is working well</li> <li>• Customer can read Braille and understand English language very well.</li> </ul>
steps	<ul style="list-style-type: none"> <li>• Listens to the voice as it reads out the question.</li> <li>• Selects an alternative that he/she feels adequately answers the question from the electronic pad.</li> <li>• Alters the response if not satisfied with the one previously given.</li> </ul>

Table 10: A brief description of the provide answers use case

<b>Use case</b>	<i>System activation</i>
Description	<ul style="list-style-type: none"> <li>• Activates the system to introduce itself by clicking a prompt on the computer monitor.</li> </ul>
Actors	<i>Bank teller</i>
Assumptions	<ul style="list-style-type: none"> <li>• Bank teller will be prudent at all times to remember to activate the system when serving blind customers.</li> <li>• Customer is not deaf or else he/she would not be able to hear the voice from the speakers of the headphones</li> <li>• The customer can understand English well</li> </ul>
steps	<ul style="list-style-type: none"> <li>• Reads the introductory remarks slowly and culminates by extending an invitation to a customer to participate in the process of feedback provision.</li> </ul>

Table 11: A brief description of the system activation use case

<b>Use case</b>	<i>Amplify system voice</i>
Description	<ul style="list-style-type: none"> <li>• Allows users to listen to the questions, the instructions and the remarks as they are read by SQAS.</li> </ul>
Actors	<i>headphones</i>
Assumptions	<ul style="list-style-type: none"> <li>• A customer has adequate skills to use the headphones independently.</li> <li>• The headphones permit users to set the volume to their desired standard.</li> </ul>
steps	<ul style="list-style-type: none"> <li>• Transmit sound from SQAS to the user.</li> </ul>

Table 12: A brief description of the amplify system voice use case

<b>Use case</b>	<i>Capture responses</i>
Description	<ul style="list-style-type: none"> <li>• Receives responses from SQAS and pass them to the database for processing</li> </ul>
Actors	<i>Teller's computer</i>
Assumptions	<ul style="list-style-type: none"> <li>• All questions have been answered.</li> <li>• Answers have been bundled together and tagged with the bank teller's identification number.</li> </ul>
steps	<ul style="list-style-type: none"> <li>• Bundles together the responses</li> <li>• Tags the bundled responses with the bank teller's identification number</li> <li>• Forward the tagged responses to the database for processing.</li> </ul>

Table 13: A brief description of the capture responses use case

#### 5.4 Conclusion

A good requirements specification is a product of systematically defined requirements. Unfortunately, the process of defining good requirements is not easy and is “more of an art than a science” (Tran, 1999: 2). Since establishing good requirements is an art rather than a science, it requires that the project team should be made up of people with good technical and communication skills. As a tool for requirements capture, use cases help to establish requirements that match the solution needs of a customer.

## CHAPTER 6: REQUIREMENTS REVIEWS AND VALIDATION

### 6.0 Introduction

The chapter outlines the process of evaluating the developed System Requirements Specification (SRS). It opens with a brief explanation of the importance of the requirements review process, followed by a description of the method used to review the SRS, and an analysis of the results of the SRS review process. Thereafter, it summarises the review recommendations in a table. It shall close with a verdict on the proposed SRS changes.

### 6.1 The Importance of the Requirements Review Process

Requirements review is a formal gathering in which all stakeholders with vested interests in a particular system meet together to scrutinise each requirement against a set standard of expectations (Williams 2004:22). During the process of SRS review, delegates work hard to remove requirements errors, inefficiency and deviation from the standard practice (Thayer, 1997: 99 & Williams 2004:22).

Requirements review is an integral part of the system design process. Once completed and accepted by all the stakeholders, SRS becomes the driving force of the development process (Thayer, 1997:98). Williams (2004:22) argues that the requirements that have not been reviewed carry a risk of producing a system that a customer asked for at the start but not what they actually envisage to have at the end of the design process. Consequently, requirements review needs to be done for the following reasons:

Firstly, failure to review the requirements is a costly process that later on affects the other stages of the system design process. The errors inherent in SRS are passed onto the implementation of the other stages of the system design process, which when recognised late become costly to rectify (Dorfman, 1997:18). Consequently, the team experiences substantial loss in efficiency caused by its delayed identification of the anomalies in the requirements (Williams, 2004:23). Again, the review process saves system stakeholders resources such as time and finance by identifying errors earlier on during the system design process.

Secondly, requirements review provides a means of validating SRS to ensure that they reflect the stakeholders' true needs and that they capture the characteristics listed in other related parts of the system design process (Dorfman, 1997:18).

Thirdly, requirements reviews are done to facilitate the evolution of the requirements through time and ensure that they are aligned to the needs of the design process (Goguen & Linde, 1997:110).

Brooks (1987), cited by Williams (2004:23), summarises the importance of the requirements review process with the following words:

*"The hardest single part of building a system is deciding precisely what to build.... No other part of work so cripples the resulting system if it is done wrong. No other part is more difficult to rectify later."*

## **6.2 The Method of Reviewing the System Requirements Specification**

A questionnaire was used to review the requirements specification. The questions used to review this specification were created following the sample titled *Reader Questionnaire: Pachyderm Requirements Spec V. 1.5*. The objective of the questions asked was to collect information that assesses the accuracy, the relevance and the structuring of the requirements in relation to this project.

The sample that reviewed the requirements was made up of customer care managers, system designers, professionals and academics. The respondents of the questionnaire were sampled from the University of Botswana's faculty of Engineering, Botswana Technology Centre, Botswana Power Cooperation and Cable for Africa. Each respondent was given a copy of the requirements specification to study and critique guided by a set of questions attached to the specification document. Due to lack of resources to bring together the respondents in one place, they critiqued the requirements individually, at their convenient times.

Data from the respondents was analysed qualitatively and suggested grammatical changes to the requirements were done on the original document in **chapter 5**, section **5.1**. A record of all the modified requirements was kept in the table shown in section **6.4**.

### **6.3 Analysis of the Review Results**

All respondents affirmed that the requirements specification document is succinct and explains the objective of the project well. Respondents raised a number of concerns regarding the requirements specification. Respondents criticised the current requirements for failing to address environmental and cultural issues. Overall the respondents retained the requirements as written in the document in **chapter 5**, section **5.1**.

## 6.4 The Review Recommendations

Respondents proposed a few changes to some requirements specification as shown in **table 14**:

Specification to be changed	Proposed changes
1. FSRS 1.1 Click a prompt on the monitor	A voice should be programmed to continually invite customers to use SQAS when it is idle.
2. FSRS 1.2 Customer authentication	Each customer should activate SQAS to read questions by entering their national identification number instead of using a bank debit card.
3. FSRS 2.1 Read Questions	SQAS should be programmed to read the questions in English and in Setswana. A customer should be provided with an option to select their preferred language.
4. FSRS 2.1 Read Questions	SQAS should have speakers installed to amplify the voice that reads out instructions and questions instead of having a customer listening over the headphones

Table 14: The suggested changes to the requirements specification

## 6.5 Dealing with the suggested changes to the requirements specification

The suggestions put forward by the respondents are good and relevant to this project. Nevertheless, the project team decided not to implement the proposal immediately but to consider them in due course. The proposed changes are relevant but do not add value to the project in terms of system performance, system usability and system efficiency. The proposed changes were not embraced because of the following reasons:

Firstly, the team did not embrace the idea of having a recorded voice continuously inviting customers to use the SQAS when it is idle. A recorded voice will distract staff members who need to do their work with due diligence and care. Again, an uninterrupted voice creates additional overhead on energy expenditures.

Secondly, the idea of using customers' national identification numbers is good but may cause considerable increase in the size of SQAS as more space will be need for the number pad. In an attempt to make the size of SQAS reasonable and manageable, the team decided to stick to using a contactless card.

Thirdly, the team maintained that customers should listen to the recorded voice using headphones. Headphones are a better option that would ensure privacy of the process of feedback provision and at the same time avoiding causing distraction to the staff members as they work. On the basis of the results shown in figure 3, it is possible for banks to provide each blind customer with headphones without incurring a loss in the long run.

## 6.6 Conclusion

Requirements review is a tedious but valuable process. In an attempt to help identify the insidious requirements errors, a broad sample made up of people of different cadres was chosen to review the requirements. The review served two functions- to eliminate errors during the early stages of the process of system design and to ensure that the proposed requirements meet the stakeholders' needs. Furthermore, the reviews provided some means of ensuring that the principles of good requirements characteristics such as traceability, feasibility and consistency are upheld (Dorfman, 1997: 19 & Faulk, 1997:136). Above all, the reviews helped to minimize the requirements volatility by making the requirements elicitation activities iterative. As correctly noted by Cristel and Kang (1992), cited by Williams (2004:22) and Dorfman (1997:9) reviews help to embrace the user's needs as they mature because of increased knowledge emanating from the development activities and/or mandated by a shift in the stakeholders needs caused by unforeseen organizational or environmental pressure.

## CHAPTER 7: INTRODUCING SMART CRITERION AS A REQUIREMENTS VALIDATION TECHNIQUE

### 7.0 Introduction

The chapter starts by discussing the properties of good requirements as suggested by the SMART criterion. This will be followed by a discussion of the common problems encountered when writing requirements and how the SMART criterion can be used to solve them. The chapter also discusses the outcomes of validating the specification of SQAS using the SMART criterion and closes with a chapter summary.

### 7.1 SMART Criterion vs. Common Methods of Requirements Validation

The traditional method of validating requirements involves a formal meeting between a team of engineers that developed the SRS and other stakeholders. In this meeting, the stakeholders work together to align the requirements to the needs of the customer (Williams, 2004:22). During the meeting, a person other than the author of the specification reads the requirements aloud to other participants. The participants then evaluate the requirements to find out if the description of the solution aligns with the expectation of the customer. Furthermore, stakeholders identify any potential problems that may cause misinterpretation of the requirements and correct those (Williams, 2004:22).

The traditional method of validating requirements has some weaknesses that affect its effectiveness in validating the requirements.

Firstly, in the absence of a pre-designed checklist, the method becomes ineffective in identifying errors in the requirements. The method requires that more time be spent upfront preparing and validating the checklist that would guide the review team through the validation process.

Secondly, the success of this method is dependent on how well the review team manages its time to avoid overworking itself. When the team works extended hours without rest, it runs the risk of overlooking errors (Williams, 2004:22).

Thirdly, as Damian (2000) and Dorfman (1997:19), correctly point out, the traditional method of requirement validation is highly sensitive to the positional and personal relationships of members of the review team. The effective participation of stakeholders may be affected by the power relationships in the team. The input of the subordinates may be “over-shadowed” by those in management either deliberately or out of respect for their superiors (Damian, 2000). These psycho-social issues weaken the freedom of expression of the subordinates in the review team.

Thus, requirements validated with the traditional approach are never without insidious errors. This project further refined the requirements using the SMART criterion to eliminate the insidious error missed by the traditional approach.

The SMART criterion upholds the primary objectives of doing requirements review and validation. The SMART criterion, just like the traditional approach, aims at aligning the requirements to the needs of the customers and goals set for the project.

The SMART criterion originates from management and leadership courses (Mannion & Keepence, 1995:43). SMART is an acronym that stands for Specific, Measurable, Achievable, Realistic and

Traceable (Mannion & Keepence, 1995:43). In management, the acronym is used to guide the process of objective setting in organisations. Gradually, the requirements engineering discipline is embracing the criterion as a technique for validating requirements. In contrast to the traditional approach, the criterion offers better refined requirements for a number of reasons.

The criterion provides an inherent checklist for validating requirements. The criterion specifies what the validation team should look for in each requirement. Hence, the criterion provides a point of reference upon which to make decisions to maintain a requirement, discard it or rephrase it to ensure that it is necessary, verifiable and attainable. Arguably, the criterion provides metrics for validating the characteristics of each requirement against the standard set by IEEE 830-1998 (Williams, 2004:18).

Secondly, the criterion offers a cheaper way of refining and validating requirements to ensure a quality product. Unlike the traditional approach, the criterion is effective in refining requirements even when the validation process is done individually rather than in a group.

In this project, the SMART criterion will be used for its simplicity, practicality and effectiveness in evaluating the quality of each requirement.

## **7.2 Definition of Good Requirements by the SMART Criterion Standards**

The importance of defining good requirements cannot be undermined in the system design process. As Faulk, (1997: 130) and Damian (2000) correctly noted many of the software project that fail to meet performance and cost goals are a result of requirements inadequacies. Research attributes poorly written requirements to factors such as failure to capture clearly the needs of the customer and spending insufficient time and effort defining them (Damian, 2000). Gougen and Linde (1997:110) further

attribute failure of many software projects to inadequate consideration of social, cultural and political factors that affect system stakeholders during requirements elicitation.

Since good requirements lead to the design of a quality product, it is important to establish the metrics for validating the requirements. In this project, a good requirement is one that exhibits the five attributes described by the SMART criterion and how each attribute will be interpreted in this project is described below:

Under the SMART criterion, a good requirement is considered specific if it is liable to one interpretation by all the stakeholders. Such a requirement clearly and succinctly states what it wants to accomplish without any ambiguity.

Secondly, a good requirement provides metrics for measuring the progress of its implementation. A measurable requirement provides some means of tracking its progress from start until the end. These measures of progress towards the attainment of a requirement are called test criteria or acceptance criteria (Lagarde, 2004:1). An attribute of measure on a requirement can be verified by inspection (looking at the output), analysis, demonstration or test (Hooks, 1993:1).

Thirdly, the SMART criterion defines a good requirement as the one that allows resources to be committed to the implementation of a feasible project. Each requirement that is achievable can be implemented with the available resources of money, personnel and technology within a specified period of time (Fairley & Thayer, 1997: 73 and Tuner & McCluskey, 1994:5). Usually, customers are not certain that it would be possible to create a technological solution to their need. Thus, they leave the technical feasibility of the requirement to be assessed by the system designer, who may have knowledge of the

technologies available on the market, in the pipeline of invention or that can be modified to suit the purpose (Lagarde, 2004:2).

Fourthly, the SMART criterion classifies a requirement as realistic when it can be achieved within the constraints of manpower, budget and technological availability (Lagarde, 2004:2). Such a requirement also has some relevance to the core values of the stakeholders and the organisation concerned.

Finally, the criterion classifies a requirement as good if it provides some means of tracing it to its original source. Requirements traceability makes it possible to identify the stakeholders who initiated the requirement or associate a function of the system to the original expectations of the customer (Dorfman, 1997: 16 and Lagarde, 2004:2).

Writing good requirements is a product of intuition, practice and natural skill but not a magical process learned through academic tutelage. Good requirements are the foundation upon which the design of quality products rests. Consequently, it is worth spending time upfront defining, refining and articulating the requirements to ensure quality products and eliminate all the insidious errors that may be costly to rectify at later stages of the system design process.

### 7.3 The Qualities of Poorly Written Requirements

Hooks (1993:1) defines a good requirement as one that states something that is necessary, verifiable and attainable. According to Hooks (1993: 1) a requirement can be verified by examination, analysis, test, or demonstration. Not only should a good requirement be verifiable, attainable and necessary but it should provide a system of reference to measure acceptance, be technically possible to implement with existing resources and under prevailing constraints (Lagarde, 2004:2).

Information about how to write good requirements is readily available but the requirements of many projects are still poorly written. These poorly written requirements exhibit problems summed up by Hooks (1993: 2) as:

- Making bad assumptions
- Writing implementation (How) instead of requirements (What)
- Describing operations instead of writing requirements
- Using incorrect terms
- Using incorrect sentence structure or bad grammar
- Missing requirements
- Over-specifying

This project recommends the SMART criterion as one possible way of solving the problems common with writing and eliciting the requirements. When used for the purpose of validating requirements, the criterion helps to focus the attention of the system's stakeholders on high priority activity and creates metrics to measure and monitor performance during the design process. In all the stages of the design process, the criterion provides a "dash board system" that shows performance road-maps and allows all stakeholders of the system to recognize when things get out of order. As a result, the criterion helps the

stakeholders to plan in time for a better course of action that counteracts the effects of the anomalies that arise during the process of system design.

Again, the criterion ensures that the requirements are aligned directly with and ultimately lead to fulfilling the high level of stakeholders' needs. SMART requirements, just like specific objectives, establish activities and metrics to ascertain progress and align it with the stakeholders' expectation and needs. The criterion recognizes the value of clearly defined and well written requirements as the integral statement of principles that add clarity and meaning to the daily activities of the system design process (Thayer, 1997:99).

During the process of requirements validation, the criterion helps to eliminate the problems enumerated by Hooks, (1993:2). The process of aligning requirements to ensure that they are specific helps to eliminate errors such as making bad assumptions, using incorrect terms and poor sentence structure/grammar. Again, the criterion makes it easy to identify any missing requirements through its traceability attributes, which reveals linkages between the requirements, function of systems/or subsystems and their sources (Dorfman, 1997:16).

Furthermore, the validation of the requirements using the SMART criterion helps to avoid the implementation trap. Under the implementation trap the specification states *HOW* a solution will be implemented instead of *WHAT* is needed to solve the problem. Hooks (1993:2) and Faulk (1997:130) assert that the implementation trap can lead to the implementation of a system/functionality that is not necessary. Secondly, the trap may cause omission of very important requirements, which then forces the system designers to deliver what was asked for and not what is wanted.

The SMART criterion helps to avoid the implementation trap in two ways. Firstly, the criterion ensures that every requirement is relevant to the stated goals of the stakeholders. Relevance of a requirement is measured in terms of necessity. A necessary requirement represents an important functional capability that when omitted creates a void that cannot be filled in any way (Kar and Bailey, 1996: 3). The criterion provides a test of necessity as traceability among the requirements, which may be checked in user documentation. On the basis of this test, a requirement without any basis of traceability may be considered not necessary and therefore can easily be left out without any drastic impact on the system's functionality (Kar and Bailey, 1996:3).

SMART requirements do not state operations but requirements. According to Kar and Bailey (1996:3) and Faulk (1997:130) the two main dangers of stating operations instead of requirements are that it becomes difficult to establish metrics to verify progress of the requirement implementation and the design mission can easily be misunderstood by the stakeholders. Like the implementation trap, the SMART criterion eliminates the operational trap through confirmation of traceability and necessity among requirements.

SMART requirements are the foundation upon which all other activities of the system design process rest. The process of attaining SMART requirements eliminates the common mistakes associated with writing requirements. Again, it ensures that enough research has been done to establish a suitable course of action to implement the requirements and to establish the technological cost associated with implementing the requirement (Kar and Bailey, 1996:4).

#### **7.4 The Validation of SQAS Requirements Using the SMART Criterion.**

The validation of the requirements was done using a questionnaire. The questions asked assessed each requirement for the attributes: specificity, measurability, attainability, relevancy and traceability. The sample chosen to answer the questionnaire was made up of academics, students, the representative of system designers and bank employees. The respondents of the questionnaire answered questions independently in their own spare time. Each respondent studied the requirements on the specification document attached to the questionnaire and answered the questions asked on the questionnaire.

Data from the respondents was analyzed qualitatively. The proposed changes were effected on the original requirements specification document. The results were analysed and discussed under section 7.5 below.

#### **7.5 The Validation Recommendations Using the SMART Criterion**

This section aligns the requirements of SQAS to the attributes of the SMART criterion based on the recommendations of the various respondents. The requirements of SQAS shall be discussed grouped into five categories as below.

##### ***7.5.1. Functional Requirements***

The respondents unanimously agreed that the two functional requirements are specific. As recommended by the SMART criterion, the two requirements express a single idea in a concise and unambiguous way that makes them liable to a single interpretation by all stakeholders. The respondents

felt that clarity of meaning and interpretation is enhanced by writing the requirements in simple English and keeping the description of the requirements brief. The use of brief descriptions of activities and keeping the language used to describe requirements simple makes the validation process easy for all stakeholders.

All the respondents agreed that both FSRS 1.0 and 2.0 represent measurable requirements. The respondents argued that a requirement can only be considered measurable when it provides the metrics for evaluating the effectiveness of an adopted solution in providing the functionality that the stakeholder asked for. The respondents agreed that FSRS 1.0 and 2.0 provide metrics for evaluating the functionality to be offered by SQAS.

Again, all the respondents agreed that both FSRS 1.0 and 2.0 are attainable. One respondent stated:

*These functional requirements are highly attainable in this era of fast-track changes in technology. The programming capability exists; a company with a good credit standing has the power to source the finances and the skills to implement them are readily available from university graduates. So, it is a functionality that can be offered to a customer with reasonable budgetary constraints.*

Indeed, research shows that progress in technology has made it possible to have contactless debit cards, braille keypads and embossed cards to aid identification, ([tiresias.org](http://tiresias.org), n.d: 2). There has been much progress in providing verbal translation of the visual screen, which has simplified the way blind people interact with technology (Kendrick, 2001:2). The availability of the talking Automated Teller Machine (ATM), as attested by (Kendrick, 2001:2), is testimony to the fact that the technology, the programming skills and the finances needed to implement the functional requirements proposed for SQAS are already available on the market.

As the respondents rightfully pointed out, these functional requirements are not traceable to any parent requirement but the project objectives and other user documents. Functional requirements are the foundation upon which other requirements are based. The successful implementation of the non-functional requirements is dependent on the success of these requirements (functional requirements). For instance, there is no point in setting the standard for capturing user inputs, when the mechanism to capture them has not been provided. The only traceability inherent in these requirements is their link to the need stated by the objective of the project, which aims at implementing some ways of capturing real-time customer feedback.

The respondents accepted the requirement FSRS 1.0 and FSRS 2.0 as realistic. They represent a functionality that can be implemented within constraints of resources such as time, money and personnel.

Defining SMART functional requirements minimizes the errors of misinterpretation of the requirements statements by the stakeholders. It also helps to establish the feasibility of implementing the project and ensures that all the necessary requirements are specified to achieve the functionality desired by the customer.

#### *7.5.2 Non Functional System Requirements Specification (NFSRS)*

All the respondents agreed that NFSRS 1.0 is specific. In line with the attributes of the SMART criterion, the requirements statement of NFSRS 1.0 is written concisely in simple English, and it specifies the quantitative standards that represent acceptable levels of performance by SQAS. The respondents affirmed that all the requirements but NFSRS 2.0 were written in a consistent language for ease of reading and for efficient identification of problems.

Not every respondent was satisfied with the wording of NFSRS 2.0, which sets the metrics for assessing the usability of the system. One such respondent complained as follows:

*I feel the use of the word “slowly” as a measure of the speed at which the machine shall read the words of the question is confusing and liable to different interpretation by the stakeholders. I therefore recommend that the number of words read by the machine be measured in words per second.*

Indeed, the complaint and suggestion by this respondent was accepted and relevant corrections have been made on the specification document in chapter 6.

The respondents felt that the requirements specified the metrics to evaluate their performance when the system is operational. Moreover, the metrics are stated in a quantitative manner which makes it possible to assess them with a fail or pass test.

The respondents felt that all the NFSRS proposed for SQAS are attainable. The respondents argued that the programming skills and the manpower needed to implement these requirements already exist. The respondents highlighted that speech software, braille and headphones are technologies that are already available on the market at a reasonable price.

All the respondents accepted the NFSRS as realistic. In support of the NFSRS as being realistic one respondent stated:

*In my view a correct measure of whether a requirement is realistic is attainability. If a requirement can be deemed attainable within prevailing conditions of technological availability, budgetary constraints and scarcity of personnel, then it is realistic, for it can be implemented.*

The comment above is true. According to the SMART criterion a realistic requirement represents a requirement that is feasible to implement at a reasonable cost and limited resources as constrained by the design decision set on the specification. Again, these NFSRS are realistic for they clearly align with the core values of producing a system that can capture real-time customer feedback. In their own right, the NFSRS prescribes attainable standards of performance to be displayed by the system being developed.

The respondents agreed that there is a link between the NFSRS and the functional requirements. The respondents traced the NFSRS to the functional requirements and argued that the evolution of the NFSRS was mandated by the need to set metrics for measuring performance standards of the functions offered by SQAS. For instance, FSRS 2.0 Input responses prescribes a function that will allow customers to key in their responses, and NFSRS 1.1 User response, which is directly traceable to FSRS 2.0, prescribes the acceptable time within which the system should be able to process user input. Again, both FSRS and NFSRS are traceable to the core objective of the project, which is to produce a usable system that can help capture real-time feedback from customers.

It is mandatory to define SMART NFSRS for any system to avoid project failure. As attested by Williams (2004:4) failure of an NFSRS leads to design flaws such as unusable systems, high cost of fixing non-functional defects and starting the design process again.

### *7.5.3 Special User Requirements, (SUR)*

Firstly, all the respondents accepted the special user requirements as specific. Respondents felt the requirements statements were concise, expressed one idea per sentence and were well written in simple English.

All respondents agreed that the special user requirements provided metrics to evaluate their performance when the system is operational. The requirements failed to provide metrics for evaluating the progress of their implementation during system design. A positive measure that indicates correct implementation of SUR will be a functional system that processes customer data opaquely.

The respondents agreed that the proposed requirements are attainable. The respondents argued that some of the technologies used in banks already protect customer data by processing customer transactions opaquely. A third of the respondents cited the ATM machine as one of those technologies that processes transactions opaquely. Arguably, the presence of similar technologies on the market indicates that the programming skill and manpower needed to implement the requirements are available.

An attainable requirement translates into a realistic requirement unless it contradicts the core values of the project. The special user requirements defined for this project are realistic as there are both attainable and align to the objective of the project.

In recent years, the need for data security presents itself as a major challenge to all system designers. The advent of the Internet has changed the way people do business, learn and communicate. The

Internet has brought with it a new pattern of criminal activities that involve theft of personal information, altering person details and other forms of exploiting such information for personal gains (Williams.2004:5). It is therefore imperative for system designers to ensure that security of customer information is catered for as early as during the process of requirement elicitation.

#### *7.5.4 Operating Environments Requirements, (OER)*

Regarding the specificity of the OER, the respondents had differing views. About ten percent of the respondents classified the OER as specific. In support of their views, this group of respondents contended that the OER specify the hardware and software requirements using simple and concise sentences written in simple English.

Nearly ninety percent of the respondents classified the OER as not being specific. The respondents argued that the requirements statements contain unexplained technical terms and abbreviations such as XHTML, CSS and MB. The respondents argued that unexplained technical terms may lead to misinterpretation of the requirements by non-technical stakeholders. As a remedy the respondents suggested that all technical terms used in defining the specification should be explained under the project glossary.

In relation to the OER, the respondents identified the test of attainability as establishing the feasibility of a project against the constraints set by the customer. Hence, all respondents agreed that the OER are attainable because they prescribe hardware and software requirements that are already available on the market.

There was a universal affirmation from the respondents that OER are measurable. According to the respondents the measurability of OER is represented by project constraints that limit resource usage,

prescribe the memory requirements for the project, bandwidth coverage and software version required for the project. A project is only considered successful when it adheres to the set limits of resource supply and technological requirements. Any changes to the prescribed resource supply can only be effected after consulting with the project customer.

Under the OER, the respondents argued that a requirement may only be classified as realistic when all the resources needed to satisfy its implementation are available on the market. The respondents felt that the OER specified on the specification are affordable and readily available on the market. If any one of the resources needed for project implementation is not available on the market, then it is possible to modify an existing technology to offer the functionality specified by the requirement or create a similar technology to address the needs of the customers.

In this project, the OER have no traceability to any requirement but to the core objective of the project and other project documents, which is to produce a system that is capable of capturing customer feedback and forwarding it to a processing centre for automatic processing into useful information. The memory specified on OER 5.1 traces back to SUR 4.3, which is the amount of memory required by SQAS to temporarily hold data before passing it to the processing centre. The other specified hardware and software are needed to facilitate a smooth connection between SQAS and the processing centre technologies.

#### *7.5.5 Constraints*

In specifying the constraints, SMART criterion dictates that the sentences used should be concise, written in a language understandable to all and it should be liable to a single interpretation by all the stakeholders. It also sets the metrics to measure the limitation within which the design process should be achieved.

## 7.6 Conclusion

The SMART criterion provides some metrics to classify the requirements as bad or good requirements. The criterion classifies a requirement to be good when it is measurable and testable in relation to the existing needs of the customers. Furthermore, such a requirement is well described to a level of details that permits effective system design and development.

Again, the SMART criterion provides some means of solving the problems common with the process of requirements analysis such as lack of order during requirement capture, poor documentation of requirements and biased communication between stakeholders (Damian, 2000). The criterion provides ways to monitor and alter the changing complexities of the requirement engineering process caused by the changing operational conditions of the customer's environment and biased communication among stakeholders (Damian, 2000).

## *CHAPTER 8: CONCLUSION AND FUTURE WORK*

### **8.0 Introduction**

The chapter provides the general conclusion of the whole project and a list of key areas that need to be investigated further to increase the accessibility of ICT to blind people.

### **8.1 Conclusion**

Rapid progress made in the development technology is not dove-tailed by the designer's willingness to address accessibility and usability issues in their systems. System designers have been sluggish to respond to guidelines and legislation which sets standards on system accessibility and usability. Not only do these guidelines and legislation exist but are well publicised and known among the system designers (Law et al, 2005:2 & Takagi et al, 2004:177).

In spite of the designers having first hand information on issues of accessibility and usability, the results of this study and others suggest that many designers do not implement them during the design process (Law et al, 2005:2 & Takagi et al, 2004:177). The technologies used in commercial banks for the collection of customer feedback are inaccessible and unusable by blind customers. In contrast to the limited approach to design, a universally designed system is more accommodating of all users irrespective of their physical disability and it evolves to meet the changing times. Consequently, the diverse clientele serviced by banks makes the need for broadly inclusive design principles and practices an increasingly important element of any successful system design process.

In return, any bank that genuinely caters for the diversity of needs presented by its clientele places itself at a strong strategic advantage in relation to other banks that disregard inclusive design.

Interestingly, only one bank has so far maintained its automation of the process of feedback collection. Nonetheless, automation of the process of feedback collection has not in any way impacted the blind customers served by this bank. Like previous technologies used in banks, the system used to automate the process of feedback collection was created with no consideration for the challenges faced by disabled people when interacting with ICT tools. At present, blind customers face unnecessary barriers when attempting to access services and products offered by commercial banks. In modern times of so much reliance on technology, the greatest design challenge is to extend the many benefits of implementing technological systems to a diverse audience.

Inaccessibility and poor usability of most technological systems may be attributed to poor requirements specification, which later passes into other stages of the system design process. In turn, poor requirements specification cannot be blamed on ignorance, inefficiency and lack of skills of the system designer but rather emanates from lack of a shop-usable approach to requirements elicitation. No single technique of requirements elicitation works for all situations. Restricting requirements elicitation to the use case view fails to capture the core of some important aspects of the system design such as fluctuations in workload and the constraints under which the system will operate. An effective documentation of requirement specification is highly attained when the SMART criterion is followed. According to the SMART criterion, each requirement has to be specific, measurable, attainable, realizable and traceable. Adherence to the SMART criteria makes it possible to validate each requirement during the review process.

## 8.2 Future Work

A number of unresolved problems faced by blind people in commercial banks provide a platform for future research and development efforts. Future research should attempt to:

- **Investigate ways to design technological tools that support the processes of the early stages of requirement elicitation.**

Intensive research needs to be done to develop technological tools that can support planning and decision making in the early stages of the requirements gathering process. The resultant technological tools need to facilitate a smooth transition of the requirements documentation to a model based specification without misrepresentation of the constraints under which the system shall work.

- **Investigate the benefits of using aural style sheets for systems used by blind people.**

Comprehensive research on aural style sheets needs to assess the feasibility of incorporating them in screen readers that facilitate the interaction of blind people with ICT tools. Available research suggests that little has been done to acquaint ourselves with how they will benefit screen reader users (Bergel et al, 2005:23).

- **Investigate ways to infuse the universal design approach into the corporate culture and processes.**

Accessibility and usability need not be catered for on a “when-need-arises” situation but should be thought of as an integral part of any system designed for use by the general public. Research needs to be done to establish ways of fostering corporate citizens to embrace the concept of the universal design approach as early as during the requirements elicitation process.

- **Investigate the feasibility of integrating audio interfaces in technologies used in banks**

Most technologically supported transactions are driven by visual interaction. Any increases in opportunities for blind customers to earn a stable income will cause the demand for interactive content to increase. While research in accessible ATMs has gained momentum more efforts need to be redirected to ways of incorporating voice mediated interfaces into technologies used in banks (Kendrick, 2001:2).

University of Cape Town

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APPENDIX A

**REQUIREMENTS SPECIFICATION REVIEW: Service Quality Appraisal System (SQAS)  
version 1.0**

The project team applauds your voluntary willingness to review the requirements specification for SQAS version 1.0. In spite of the document being long, take time to read and understand its contents before answering the questions that follows. All the information provided by the respondents shall be treated with the uttermost confidentiality it deserves.

**1. Study Requirements Specification Document**

The introduction of the specification document provides a synopsis of what the project is all about. Read it to grasp the purpose of the requirements specification. Respondents' role is to provide comments which shall be used to validate the specifications.

Provide your commentary in the spaces that follows.

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**2. Acquaint self with the project**

Read section 1.1-1.4 which provides general description of the proposed system and how it is suppose to work. Answer the following questions.

Provide a brief summary of what you think the system should do when it is completed.

.....  
.....

Please provide any unanswered questions you have about what SQAS is or how it will work.

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### 3. Understanding the Requirements

**Section 2:** The section comprises of the specification SQAS is expected to fulfill. The requirements are divided into functional and non-functional specification. Study the requirements carefully and provide relevant feedback by answering the questions that follows.

1. Which one of the functional requirements should be omitted in the first release of SQAS?

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2. Give reasons why the chosen option(s) in question 1 above should be omitted.

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3. On the basis of your understanding of what the system should do, which functions or requirements should be added to the list?

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4. Provide any comments or questions about the requirements specification or about the SQAS project?

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## APPENDIX B

### Requirements Validation Using SMART Criterion.

#### 1.0 Introduction

This questionnaire is used to validate the requirements for SQAS to ensure that they reflect the attributes of the SMART Criterion. SMART is an acronym that has its origin in management courses and when applied to requirements validation process stands for:

Specific

Measurable

Attainable

Relevance

Traceability

SMART requirements are an under-pinning statement of principle that adds clarity and meaning to the activity of the system design process. They also help directly, align and reconcile the expectation of stakeholders of the system. When clearly followed the attributes of SMART criterion help system designers to produce systems that are user friendly, commensurate with the skill and proficiency of its target users without compromising the business objective it is designed for.

#### 1.1 Description of the SMART criterion terms

**Specific:** A specific requirement expresses one thought, it is concise and unambiguous. It is liable to one interpretation by all stakeholders without question / or contention.

**Measurable:** A measurable requirement provides some metrics that allow for performance to be measured and compared with targets. The criteria for measuring the requirements may be through inspection, analysis, demonstration or test (Hooks, 2001).

**Attainable:** An attainable requirement can be accomplished by one or more developed system concepts at a defined cost. There is a capability to reach the target: that is finances are available, personnel is well trained and technological requirements are all in place at a reasonable cost. It has to be possible to implement it within realistic constraints.

**Relevance:** A relevant requirement align directly with the expectations of the all the stakeholders

**Traceability:** A traceable requirement is easily tracked back to the stated need by a customer

**1.2 Instructions to the respondents**

Study the requirements attached and answer the questions that follow on the spaces provided. Circle the alternative of your choice and where necessary provide backup explanation on the spaces provided for comments. Indicate the requirements affected by your comments by citing the requirement number indicated on the specification document.

SMART attribute assessed	Additional comments
1. Specificity	
<ul style="list-style-type: none"> <li>• <i>Do all the requirements express a single idea without ambiguity?</i></li> </ul> <p><b>Yes</b></p> <p><b>NO</b></p>	<p>If not, please explain in the spaces provided below.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

<ul style="list-style-type: none"> <li>• <i>Is the clarity and meaning conveyed by each requirement liable to multiple interpretations by different stakeholders?</i></li> </ul> <p><b>Yes</b></p> <p><b>No</b></p>	<p>If yes, please explain in the spaces provided below.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p><b>2. Measurability</b></p>	
<ul style="list-style-type: none"> <li>• <i>Are the metrics for the measurement of progress clearly stated in all the requirements?</i></li> </ul> <p><b>Yes</b></p> <p><b>No</b></p>	<p>If not, please explain in the spaces provided below.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p><b>3. Attainability</b></p>	
<ul style="list-style-type: none"> <li>• <i>Can the proposed solution be implemented at any reasonable cost within the constraints of technology and manpower?</i></li> </ul> <p><b>Yes</b></p> <p><b>NO</b></p> <ul style="list-style-type: none"> <li>• <i>Does the technological capability exist to satisfy the requirements as stated in the specification?</i></li> </ul>	<p>If not, please explain in the spaces provided below.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>If not, please explain in the spaces provided below.</p> <p>.....</p> <p>.....</p>

<p>Yes</p> <p>No</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p><b>4. Relevance</b></p>	
<ul style="list-style-type: none"> <li>Do all the requirements have relevance to the needs of the stakeholders as stated in the introduction of the specification?</li> </ul> <p>Yes</p> <p>No</p>	<p>If not, please explain in the spaces provided below.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p><b>5. Traceability</b></p>	
<ul style="list-style-type: none"> <li>Can each requirement be back tracked to a parent requirement in the specification?</li> </ul> <p>Yes</p> <p>No</p>	<p>If not, please explain in the spaces provided below.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p><b>6. Language and grammar</b></p>	
<ul style="list-style-type: none"> <li>Do the requirements contain any vague words that make it impossible to interpret them?</li> </ul> <p>Yes</p>	<p>If yes, please explain in the spaces provided below.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

<p>No</p> <ul style="list-style-type: none"> <li>Does the wording of the requirements clearly distinguish between a requirement, statement of fact and goals as stated in the specification document?</li> </ul> <p>Yes</p> <p>No</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>If not, please explain in the spaces provided below.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
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APPENDIX C

Service Providers' Questions

1.0 Introduction

In a fast-forward moving competitive sector like banking, the customer service department often finds it difficult to keep up with the pace at which customer concerns are raised. In this era of heightened business competition the speed at which this department responds to customer concerns determines the difference between keeping a customer and losing one. Consequently, the bank needs to use methods of feedback collection that would allow them to capture and respond to customer concerns immediately. In recognition of a need for a feedback system that can help banks to capture, process and produce instant feedback information for effective and efficient operation, this project proposes the requirements specification for a system that can be used by the blind customers to evaluate service delivery standards within their banks.

The questionnaire aims at collecting data to be used in specifying the requirements for a system that can be used to automate the process of feedback collection in banks. All the information collected during this study shall be treated with the uttermost confidence it deserves.

### 1.1 Instruction to respondents

Answer each question on the spaces provided on the question paper. Indicate your choice(s) of alternative(s) that answer the question asked with a tick. Provide clarifications comments and queries besides each question with a pencil.

1. What is the estimated number of blind customers among your bank clientele?

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2. Which of the following technologies do your blind customers use to access the services offered by your bank?

1. ATM	
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2. Cellphone	
3. Internet	
4. Telephone	
5. Others (specify)	

3. Which of the following methods do your blind customers use to provide feedback to your bank about the quality of service offered to them?

1. Consultant	
2. Direct Mail	
3. E-mail	
4. Telephone/ Cellphone	
5. Web	

4. What are your concerns about the current methods your blind customers use to provide feedback to your bank?

1. Delayed responses to customer complaints	
---	--

2. Requires customers to use personal resources to raise a complaint, e.g. <i>money to call.</i>	
3. May misdirect customer complaints to a staff member	
4. Treat the process of feedback provision as a historical event	
5. Limit the process of feedback provision to a segment of the bank's clientele	
6. Requires customers to stand in a queue to be serviced	
7. It is liable to communication breakdown, e.g. <i>customer failing to express self in the language of the consultant assisting him/her.</i>	

5. What are the possible benefits of automating the process of feedback collection in your bank?

1. Help the bank to respond to complaint faster	
2. Minimise the incidents of complaints be directed to the wrong person	
3. Allows for evaluation of business transaction immediately they occur	
4. Provide the service to all bank customers throughout the hours of business operation.	
5. Eliminate the need by a customer to invest personal resources when giving feedback	

6. What services do you think the system used to automate the process of feedback collection should offer?

1. Measure the levels of customer satisfaction with services offered to them by the bank	
2. Help identify service delivery anomalies in the bank	
3. Measure the performance of each frontline staff member	
4. Process customer inputs promptly	

7. What are the other features this system should have?

1. Service initiation method commensurate with the demands of the disability of blind customers	
2. An option to change user input	
3. A means to signal the end of the feedback provision process	
4. Provide metrics to quantitatively measure the performance of staff members and the quality of service in the bank	
5. A backup system to temporarily store data during system failure	
6. An identification system to help match a staff member to the evaluation data.	

7. How would you like your blind customers to interact with the envisaged feedback collection system?

1. Through speech software	
2. Through Braille keypad inputs	
3. Assisted by bank consultant	

8. Which of the following aspects would you like your blind customers to provide feedback on to you bank?

1. Customer-staff relationships	
2. Length of time spent queuing for service	
3. Comparison of service quality among bank branches	
4. General opinion question	

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## Appendix D

### Customer Interview Questions.

#### 1.0 Introduction

In a fast-forward moving competitive sector like banking, the customer service department often finds it difficult to keep up with the pace at which customer concerns are raised. In this era of heighten business competition, the speed at which a department responds to customer concerns determines the difference between keeping a customer and losing one. Consequently, banks need to use methods of feedback collection that would allow them to capture and respond to customer concerns immediately. In recognition of a need for a feedback system that can help banks to capture, process and produce instant feedback information for effective and efficient operation, this project proposes the requirements specification for a system that can be used by the blind customers to evaluate service delivery processes in banks.

The questionnaire aims at collecting data to be used in specifying the requirements for a system that can be used to automate the process of feedback collection in banks. All the information collected during this study shall be treated with uttermost confidence it deserves.

#### 1.1 Instruction to the respondents

Answers each question on the spaces provided on the question paper. Indicate your choice(s) of alternative that answers the question asked with a tick. In some questions you are permitted to provide

more than one alternatives as your answers to the question asked. Provide any clarification pertaining to answers given besides each question.

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1. What do you do for a living?

1. Academician	
2. Personal secretary/receptionist	
3. Engineer	
4. Teacher	
5. Student	
6. Entrepreneur	
7. Other (specify)	

2. Do you have a bank account?

1. Yes	
2. No	

1. If yes, in which bank do you keep your money?

1. ABSA	
2. Barclays	
3. BBS	
4. NedBank	
5. Standard Chartered	

2. What is the type of your bank account?

1. Call	
2. Current/cheque	
3. Fixed deposit	
4. Savings	

3. Do you have a bank debit card?

1. Yes	
2. No	

6. If yes, do you ever use it to purchase items from shops?

1. Yes	
2. No	

7. Do you have problems using it for the purpose stated in question 6 above?

1. Yes	
2. No	

9. Which of the following technologies do you use to access the services offered by your bank?

1. ATM	
2. Cellphone	
3. Internet	
4. Telephone	
5. Others (specify)	

10. Which of the following methods do you use to provide feedback to your bank about the quality of service they offer you?

1. Bank Consultant	
2. Direct Mail	
3. E-mail	
4. Telephone/Cellphone	
5. Web	

11. What are your concerns about the current methods you use to provide feedback to your bank?

1. Delayed responses to customer complaints	
2. Calls for the use of personal resources to raise a complaint, e.g. <i>money to call</i> .	
3. May misdirect customer complaints to a wrong person	
4. Treat the process of feedback provision as a historical event	
5. Limit the process of feedback provision to a segment of the bank's clientele	
6. Requires customers to queue to be serviced	

7. It is liable to communication breakdown, i.e. <i>customer failing to express self in the language of the consultant assisting him/her.</i>	

12. What are the possible benefits of automating the process of feedback collection in your bank?

1. Help the bank to respond to complaint faster	
2. Minimise the incidents of complaints be directed to a wrong person	
3. Allows for evaluation of business transaction immediately they occur	
4. It accords all customers to participate on the process of feedback provision anytime the bank is operational.	
5. Eliminate the need by a customer to invest personal resources on providing feedback to their bank	

13. What services do you think the system used to automate the process of feedback collection should offer?

1. Measure the levels of customer satisfaction with services offered to them by the bank	
2. Help identify service delivery anomalies in the bank	
3. Measure the performance of each frontline staff member	
4. Process customer inputs promptly	

14. What are the other features this system should have?

1. Service initiation method commensurate with the demands of the disability of blind customers	
2. An option to change user input	
3. A means to signal the end of the feedback provision process	
4. Provide metrics to quantitatively measure the performance of staff members and the quality of service offered by the bank	
5. A backup system to temporarily store data	
6. An identification system to help match a staff member to the evaluation data.	

15. How would you like to interact with the envisaged feedback collection system?

1. Through speech software	
2. Through Braille keypad inputs	
3. Assisted by a bank consultant	

16. Which of the following aspects would you like to provide feedback on to your bank?

1. Customer-staff relationships	
2. Length of time spent queuing for service	
3. Comparison of service quality between bank branches of the same brand	
4. General opinion question	

University of Cape Town

# APPENDIX E

## System Designers' Questions

### 1.0 Introduction

In a fast-forward moving competitive sector like banking, the customer service department often finds it difficult to keep up with the pace at which customer concerns are raised. In this era of heightened business competition the speed at which a department responds to customer concerns determines the difference between keeping a customer and losing one. Consequently, banks need to use methods of feedback collection that would allow them to capture and respond to customer concerns immediately. In recognition of a need for a feedback system that can help banks to capture, process and produce instant feedback information for effective and efficient operation, this project proposes the requirements specification for a system that can be used by the blind customers to evaluate service delivery standards within banks.

The questionnaire aims at collecting data to be used in specifying the requirements for a system that can be used to automate the process of feedback collection in banks. All the information collected during this study shall be treated with uttermost confidence it deserves.

### 1.1 Instruction to respondents

Answers each question on the spaces provided on the question paper.

1. Describe how the system works: from the time the user keys in an input until it is processed at the processing centre.



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4. How many systems interact with this system and how are they arranged?

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5. How often does the system fail?

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6. What are the common causes of system failure?

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7. How fast does the system capture user input and process them?

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