Evaluating User Satisfaction of University Administration Systems in the South African Context

Tatenda Watungwa

Thesis submitted in fulfilment of the requirements for the degree of

Master of Commerce in Information Systems

in the Department of Information Systems

Faculty of Economic and Management Sciences

University of the Western Cape

Supervisor:

Prof. Shaun Pather

Co Supervisor:

Dr. Kanayo Ogujiuba

November 2019

Abstract

Evaluating User Satisfaction of University Administration Systems in the South African Context

T Watungwa

Master of Commerce in Information Systems (Full Thesis) Department of Information Systems, Faculty of Economic and Management Sciences, University of the Western Cape

---

Information Systems evaluation (ISE) is an area of research that has been conducted in depth across various contexts in relation to all phases of the systems development life cycle. In practice though, ISE is an often-overlooked dimension in the management of technology. Outcomes from carefully planned ISE exercises can potentially add value to an organization especially from a knowledge management context. Data derived from ISE can provide the managers of organizations with insights into users' knowledge about systems operations and the efficiency thereof.

IS evaluation is especially relevant in system environments that are constantly changing. The higher education system in South Africa is one such environment. In a university context, administrative procedures are highly dependent on information systems and there needs to be surety in the effectiveness of the technology being utilized. The importance of this study which focuses on evaluating administrative information systems in a university stems from the large increase in student enrolment (massification of education) in South Africa in the post-apartheid era. Massification provokes questions of the ability of administrative information systems to handle the increase in the administrative workload. Thus, to govern the success of these systems, an evaluation tool is required. This is imperative to maintain a high level of quality in the education system and ensure the information systems are providing the necessary support to administrative processes.

This study adopted a Case Study approach to investigate the administrative system of a selected South African university. It used the selected case as a basis to investigate *What are the appropriate dimensions to measure user satisfaction as an indicator of IS success in a university information System*? The study examined IS success from a user satisfaction perspective with regards to system quality dimensions. Three quality dimensions which were identified in the literature provided an initial point of departure for the empirical investigation. These included. service quality (SQ), information quality (IQ) and systems quality (SysQ). This research used mixed methods in the form of one-on-one interviews to verify and assess applicability of these evaluation dimensions. Following on this a structured survey of users was conducted to refine and validate pertinent system evaluation dimensions. The main research question was answered after the quantitative analysis which resulted in refinement from 5 dimensions (Business Process Quality, System Functionality, Information Quality, System Quality, Service Quality) to 2 dimensions (System Process Satisfaction, System and Service Quality).

Keywords: University administration, Marks administration system, Information system success, Information systems evaluation, User satisfaction, Information quality, System quality, Service quality, Business process quality, System functionality

Declaration

I declare that *Evaluation of Information Systems in a university administration context: Measurement of User Satisfaction* is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

This thesis has been submitted for examination after approval by my academic supervisors.

Full name: **Tatenda Watungwa** Date: **08/11/2019**

Signed

Approved by

.....	.....
Professor Shaun Pather	Dr Kanayo Ogujiuba
Main Supervisor	Co-supervisor

Acknowledgements

The process of completing a Masters degree is not a challenge I could have ever prepared for, each paragraph, section and chapter came with new and sometimes frustrating challenges. The time, effort, dedication and sacrifices that went into this research, are all pieces to the puzzle that resulted in a full thesis which I am proud to have seen through to completion. With this being said, I could not have accomplished this alone and my utmost gratitude goes to my supervisor Professor Shaun Pather who was fully supportive, extremely helpful and kept me motivated from the beginning to the end of this journey. His teachings and guidance are something I will forever be grateful for.

Secondly, I would like to show appreciation to my parents Rodney and Esther Watungwa and my sister Chiedza Watungwa. My family has played a big role in being a strong support system. They never gave up on me and constantly reminded me of how proud they are of how far I have come.

Last but far from least, I would also like to thank my friends and other members of UWC staff who assisted, participated and offered words of wisdom to help me get to the point of submission.

Table of Contents

List of Tables

List of Figures

List of Acronyms

BPQ:	Business Process Quality
DIY:	Do it yourself
FA:	Factor Analysis
IS:	Information System(s)
IQ:	Information Quality
KMO:	Kaiser-Meyer Olkin
MAS:	Marks Administration System
PCA:	Principal Component Analysis
SASI:	Student Administration Systems Integration
SF:	System Functionality
SPSS:	Statistical Package for the Social Sciences
SQ:	Service Quality
SysQ:	System Quality
US:	User Satisfaction
UWC:	University of the Western Cape

Chapter 1: Introduction

1.1. Background & rationale of the study

South Africa is a country which has faced momentous political and social transformation over the past few decades. The source of the changes were based on the racist policies established during the colonial period (McKeever, 2017). The apartheid structure which included racial segregation in education (Msila, 2007), separated people of colour from other races which led to ramifications on its higher education system. The end of apartheid was a historical milestone for South Africa, with the education sector taking on a monumental shift. In the post-apartheid era, equality in access to university had become a demand by the citizenry. Following this period, there was said to be massification of student enrolment in university institutions (Machingambi, 2011). The term massification was devised to describe the massive increase in enrolment in higher education (Mohamedbhai, 2014). Post-apartheid, there was a need to redesign the education system to promote equality among the different ethnicities.

The resultant rise in the number of students enrolling into universities placed a greater demand on various aspects of University business. One of the areas of impact is the ability of Universities to ensure that their Information Systems (IS) are able to effectively support administrative functions. Qureshi & Qazi Abro (2016) posited that the role played by IS is imperative in improving educational administration. They further argue that ICT has become one of the main tools for educational administration (Qureshi & Qazi Abro, 2016). In addition, higher education institutions are also businesses. They therefore require robust, operative IS to support the key functional and administrative areas to ensure that business objectives are met in a timely manner. Briefly put by Aithal (2015, p.16) IS *"simplifies the complex duties in organizations related to managing people".* This statement is supported by Jaleel (2014) who comments that ICT is the backbone for efficient management and administration in the field of education. There is an undeniable need for IS in universities with specific relation to administrative procedures illustrating high reliance on IS.

When considering the impact university administration has across departments, faculties and other business units, it is evident that the university is highly supported by administrative activities. Selwyn, Henderson & Chao (2018) argue, that since universities generate a mass of data related to students and the courses that they study, 'data work' using digital technologies and digital systems is integral to educational administration within universities. The IS that assists staff in their "data work" needs to be delivering high levels of effectiveness to achieve high user satisfaction.

IS supports the universities' administrative staff and the underlying business processes which support the day to day running of the university. One approach to ensuring system effectiveness is by evaluating the success of the system. There are several evaluation approaches which are based on the three main perspectives of IS success which are product, process and service (Pather, 2017). Pather also discusses that the approaches can also be used in various ways such as conducting a cost benefit analysis evaluation or evaluating for quality or user satisfaction. In this regard there are several IS evaluation studies which use user satisfaction as a basis such as Melone (1990);Thong & Yap (1996) and Wixom & Todd (2005).In the context of university systems, the question as to whether and how User Satisfaction may be used as a basis for evaluation further investigation.

A review of the literature shows minimal research conducted to date on the usage of user satisfaction as a dependent variable to evaluate IS in a university administrative context. User satisfaction should be a matter of high value from an IS management perspective, in ensuring that the needs of users are being adequately met for them to perform their administrative duties effectively. Therefore, given the pressure created, due to post-apartheid massification, this has made it paramount for university managers to establish whether the quality of their systems is compatible for the system users and administrative demands of universities. This provided the underlying context for this study, viz an investigation into the appropriate evaluation dimensions for university administration systems.

IS evaluation is a well-researched topic with seminal literature going back decades (Beynon-Davies, Owens, & Williams, 2004; Cha & Park, 2018; DeLone & Mclean, 2003, 2016; DeLone & McLean, 1992; Klein & Myers, 2017; Kumar,1990); Pather, 2017; Roky & Meriouh, 2015; Smithson & Hirschheim, 1998; Stockdale & Standing, 2006). There is a multi-perspective nature when it comes to the quality of IS, as it involves a number of different entities and to be able to formulate a universal evaluation model based on the quality of a system is not possible (Andersson & von Hellens, 1997). It has been suggested that IS does not have boundless measurement tools for gauging success (Pitt, Watson & Kavan 1995). In the literature it has been identified that there is a need to develop approaches which are tailored to specific contexts of the IS (Davies, Baron, Gear, & Read, 1999; Tate, Sedera, Mclean, & Burton-Jones, 2014). This study therefore examined the evaluation context of a typical university IS to establish and define evaluation dimensions.

This study reviews the existing literature on this topic is relation to the use of user satisfaction as a proxy to measure IS success. User Satisfaction refers to the users judgement and perceptual response to a product or service after usage (Song, Kim, Jones, Baker, & Chin 2014). As administrative systems in a university mainly being used by administrators, user satisfaction serves as a dependent variable in

developing an evaluation regime. The study probes the literature to establish a starting point in gauging possible dimensions and uses a mixed method approach to collect data.

To note a couple of the influential IS success models over the past two decades, the most significant was the IS success model by (DeLone & McLean, 1992) which was later updated in 2003 (DeLone & Mclean, 2003). Soon after the updated IS success model Wixom & Todd (2005) produced a model which fused together User Satisfaction and Technology Acceptance. Among these models and many others, the literature is structured around the common element which is quality. To be more precise, the three quality dimensions, System quality (SysQ), Information Quality (IQ) and Service Quality (SQ) (individually and together) have provided a baseline for a vast amount of literature in the domain of Information Systems Evaluation.

1.2. Problem Statement

During the apartheid era the segregation in education, the variation in quality of education and lack of access to education was at an all-time high. The end of apartheid saw a shift in the political environment which demolished the act of racial discrimination while creating a platform for equality. The new political reign allowed for equality in the higher education system, which allowed for equality in access to education among all races. As a result of this change, massification of higher education in South Africa began and universities were forced to deal with a greater demand from an influx of students. The increase in demand for higher education needed to be supported by the university's administrative procedures. As a result, massification of higher education created pressure for the universities to ensure that the IS can deliver effective services to users. IS evaluation and IS success are well researched topics in the extant literature to date. However, there are limited evaluation indicators to assess IS Success in the form of User Satisfaction in the environment of administrative systems in a university setting. Therefore, the rationale of this study is to investigate what might comprise evaluation dimensions for this context.

1.3. Research Questions and Objectives

The main research question of the study is: What are the appropriate dimensions to measure user satisfaction as an indicator of IS success in a university administration information System?

To guide this study sub research questions and research objectives were established. Table 1.1 shows the sub research questions and objectives and the methods that were used to answer the questions.

Table 1.1: Sub Research Questions & Objectives

Sub Research Questions	Methods used to answer sub research questions	Research objective that was achieved by sub research question
1A. What models and theories have been used to measure IS success?	Literature review	1.To determine which extant models of IS evaluation are applicable in this research context
1B. What are the IS evaluation models relevant to determine IS success in the research problem context?	Literature review	
1C. Which evaluation dimensions are suitable to investigate IS Success in a university environment?	Synthesis of the literature review	
2A. Which IS dimensions relate to administrative systems in a university setting?	Interviews and Qualitative Data Analysis (Phase 1)	2.To qualitatively assess the relevance of dimensions derived from the literature and to identify possible new ones (as related to university administrative IS)
3A. What items best describe each dimension	Analysis of interview data Survey (Phase 2)	3.To develop a measuring instrument and to validate its associated dimensions to measure the success of University admin information systems
3B. Which dimensions best represent user satisfaction with respect to university administrative IS?	Analysis of survey data (Phase 2)	

1.4. Significance of Research

This research is valuable to aid university IT managers in assessing the administrative systems that support the university. As the years go by, the number of students enrolling continues to increase. As more students enrol, it warrants investigation to determine whether the administrative systems can handle the increased workload from the student massification. University administrative systems play a vital role in the management of student data from the start of their academic journey when they apply, till the end of their journey when they graduate. The users rely on the administrative system to fulfil their duties which cater to the universities administrative needs. The user's perception of the system needs to be measured through variables that can be associated with user satisfaction which will result in a better understanding of how well the system functions. What makes this research important, is that the measurement of user satisfaction as a proxy for system effectiveness can help lead to the betterment of university administration, which supports the university processes.

1.5. Overview of Research Design and Methodology

The design of this study was a single case study as the research is centred on an information system within the administrative operations of a specific university. This case study research entails a mixed method approach through use of both qualitative and quantitative methods respectively. The research was built on a qualitative foundation, dealing with existing literature in the field of information systems evaluation which guided the design interview schedule. Following the interviews qualitative analysis of the interview data resulted in dimensions being developed from the analysis of the responses. The dimensions were a mix of dimensions that presently exist in the literature and some which emerged from the data.

Thereafter, items were established to describe each of the resultant dimensions and were presented in the form of a Likert scale survey. Analysis of the survey data sought to assess the relevance of the a-priori system evaluation dimensions. Together, the qualitative and quantitative phases of data collection engaged with the users to emphasize the importance of the users throughout the study to define user satisfaction.

1.6. Thesis Outline

The study searched for evidence of relevant IS evaluation dimensions, thereafter data collection methods are used to, enhance and redefine the dimensions for the context. This chapter briefly outlines the historic nature of the problem within the higher education setting of South Africa pre and post-apartheid and a brief description of the topic of information systems evaluation. The remainder of this thesis presents research on the topic of Information Systems Evaluation within the context of University administration systems, framed in several chapters as follows:

Chapter Two - Literature Review

The second chapter presents a literature review where a large collection of literature will be scrutinized for relevant evaluative dimensions and provides the foundation for the themes presented throughout the research.

Chapter Three - Research Design and Methodology

Chapter 3 discusses the Research Design and Methodology of this study which is based around a Single Case Study and usage of qualitative then quantitative approaches as methods of data collection and analysis.

Chapter Four - Phase 1: Qualitative Findings and Analysis

The qualitative approach which is covered by Chapter 4 discussed the qualitative data collection process for one-on-one interviews that were conducted with users of the system analysis of the interview transcripts by use of qualitative software ATLAS t.i

Chapter Five – Phase 2: Quantitative Findings and Analysis

The quantitative phase, encompassed by Chapter 5, is where the findings from the interview analysis were used to create an online survey deployed to all users of the system. Following the survey, the results were used in descriptive statistical tests and analysis to give meaning to the findings.

Chapter Six – Conclusion and Recommendations

The final chapter, Chapter 6 concludes the study addressing the main points and findings of the research, also giving recommendations for further research using these findings.

Chapter 2: Literature Review

2.1. Introduction

The education system holds importance to the economy of a country. Higher Education South Africa (HESA) developed a comprehensive strategic framework addressing a five-year plan for public universities in South Africa from 2015 to 2019. The main purpose for this framework revolves around the important role universities play in the overall welfare of the country, and the need to ensure the continuous improvement in efficiency and effectiveness of university operations (Higher Edcuation South Africa, 2014). University operations are often supported by technological advances such as information systems (IS) that aid the university functions. The technological revolution has increased the potential for universities to function more efficiently and effectively. According to Jaleel (2014), the education system structures a nation and information technology holds great significance in ensuring effective administration in the education sector. In the past decade, the importance of the use of

technology has gained significance as higher education institutions are employing information systems to improve performance and increase productivity (Badwan, Al Shobaki, Abu Naser & Abu Amuna, 2017). This is derived from the number of university administrative procedures that are highly dependent on the use of information systems in daily operations. Due to the evolving nature of universities and the services they provide, the use and need for information systems will continue to grow with the growing number of students enrolling at universities. Although uses of IS will be extensively discussed in later sections, Juma, Raihan, & Clement (2016) identified a few of the IS in the administrating activities of a university which include development of online applications, management of administrative records and rendering of prompt and organised information services such as students' academic records.

Following on from the above named uses, Information Systems thus helps in the facilitation and effectiveness of the foregoing activities, thereby leading to greater success for the institution and its overall purpose of providing proficient services. Pather (2017) affirms that due to the great amounts capitalised by organisations into technology, the necessity of assessing IS becomes a paramount management concern. For the administrative information systems to be deemed as successful, they need to be continuously evaluated against their purpose and use. This is the crux of the research problem of this study. As such, this chapter will address the context of the problem and examine the literature on the topic of information systems evaluation. The extant literature is reviewed to understand, in more depth, the underlying concepts of the research problem.

The chapter outline table (Table 2.1) gives an outline of the remainder of the chapter.

Table 2.1: Chapter Outline

Literature Review Section	**Summary**
2.3 South African Higher Education Context	A background to the setting of the higher education environment in South Africa pre- and post-apartheid.
2.4 The Role of IS in University Administration	Research into the uses of IS in a University administration context.
2.5 IS Evaluation	Exploration of the topic of Information Systems Evaluation throughout the literature over the past 3 decades.
2.6 IS Evaluation Models and Theories	This section delves into the models and theories developed by authors in the field of IS, highlighting the most seminal and relevant.
2.7 Overview of Seminal Models	A synopsis of the seminal IS evaluation models and theories discussed in section 2.6.
2.8 User Satisfaction (US)	Reflection on the User Satisfaction concept within the literature with focus on its history within IS literature.

2.9 Determinants of User Satisfaction	A deeper introspection into the factors that underpin the US construct
2.10 Establishment of descriptors of US as an IS Evaluation dimension	This section sums up the in-depth review of IS evaluation literature to determine relevant dimensions of US in this context.

2.2. South African Higher Education Context

In this section I will address the importance of the research for the South African higher education context and describe the research problem. It will be addressed through an explanation of the revolutionary aspect of higher education and its transformation from the apartheid era and beyond. The important policies from two pivotal points in this transformation will be discussed followed by a description on the use of IS within South African Higher Education institutions.

2.3. Education environment: apartheid and post-apartheid

In the post 1994 era, South Africa was left in a position where it became necessary to revamp the education system due to national changes post-apartheid (Le Grange, 2011; Msila, 2007). The Apartheid era altered legislation which enhanced the divide among the different racial groups in the country was detrimental to society in the fact that it confined the rights of non-whites (Beinart, Dubow, Histories & Censer, 1995). This commenced in 1948 and resulted in national policy which strengthened discrimination towards black South Africans which enabled imbalanced education requirements which favoured non-blacks (Teeger, 2015). Hall & Symes (2005) posit that the governance and policies with regard to higher education were more focused on the welfare of the white minority as opposed to other races. Bunting (2006), in agreement, went on to break down the dynamics of the universities and their acceptance of difference racial groups. In 1985, there were 19 institutions which were labelled as being for the education of white students only, 6 were for the use of black students, 2 institutions for coloured students and 2 institutions for Indian students. Out of the 29 institutions, over 65% of institutions were for the sole use of white students who are a minority in the South African population and roughly 35% for other races. Figure 2.1 shows the low distribution of institutions that catered to non-whites which visibly displays the intensity of unequal access to higher education during the apartheid era.

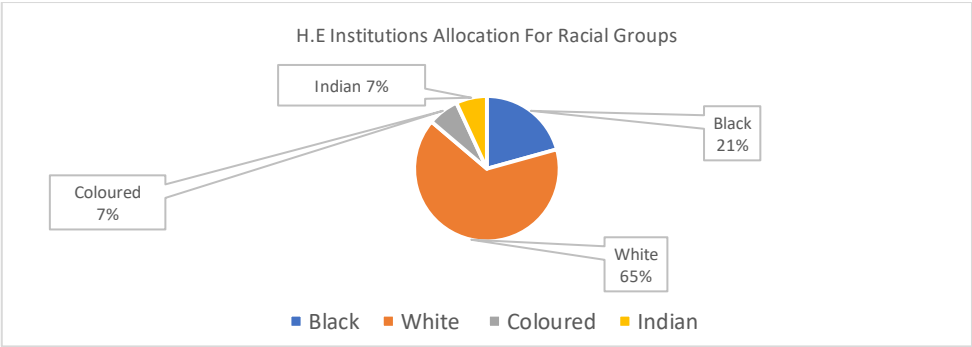

Figure 2.1: Higher Education Distribution of Institutions for Racial Groups in South Africa (Source: Bunting,2006)

The end of apartheid had a major impact on the country thus creating an educational environment, which required reconstruction. One of the major challenges that was faced by the higher education system post-apartheid was the swift increase in the amount of black learners (Gray & Czerniewicz. Laura, 2018). Historically white universities experienced momentous changes in the student demographics which also led to the need for decolonizing the curriculum (Le Grange, 2016). The ten-year period from 1994 to 2004 marked the first decade of democracy under the government of national unity in South Africa. During this period, major reforms took place within South Africa, which included the provision of publicly funded higher education (Hall & Symes, 2005). The 1997 Higher Education white paper stated that the principal problem to be addressed was the issue of inequalities of the past, and ensuring that the higher education system caters for the present society (Department of Education, 1997). The department of education in South Africa has previously looked at the need for higher education reform and a deliverable of this was the National Plan for Higher Education (Ministry of Education, 2001). These imperative changes were needed to compensate for economic changes such as the increase in job opportunities that were now available for non-white citizens. Thus, in the post-apartheid era, greater opportunities in terms of education for most of the South African population led to increases in enrolment numbers in universities. Access to higher education is a major political imperative that needed to be accommodated for, as the massification in South African higher education became a major concern post-apartheid (Akoojee & Nkomo, 2007).

Table 2.2: University enrolment in South Africa from 1995-2004

Year	No. of students enrolled	Reference
1995	367 958	Stats SA (2000)
2000	504 056	Stats SA (2002)
2004	744 488	Department of education (2005)
2007	761 087	Department of education (2009)
2010	892 936	Education Series Volume III Educational Enrolment and Achievement, (Stats SA,2016)
2013	983 698	

The student population of South Africa doubled after abolishing the apartheid system (Le Grange, 2011), Table 2.2 shows a fragment of this, presenting the annual enrolment statistics from 1995 to 2013. The progressive increase in enrolment supports the formerly discussed massification. The statistics underscore the research problem of this study and support the need to ensure optimally functioning university administrative systems. With an increasing number of students, accommodation for the labour that is needed for a university to function must be made. Along with this, the standard of service being provided must outweigh the challenges of catering for high volumes of students. The White Paper on Post-School Education and Training discussed that the focal point will be the improvement of overall quality (Department of Higher Education, 2013).The improvement is vital based on the circumstance of increased numbers of students in an education system which was structured to cater for a lower percentage of the population. It is imperative that the higher education system remain effective in times of the evolving economic atmosphere and the effective use of IS can help achieve this. The interactions between students and the institution remain vital in the changing higher education environment. This interaction is where the importance of the administration department comes into play (Struwig & Smith (2009) and Li (2019), expands this by stating that university administration is student focused. There are abundant uses for ICT in higher education and for administrators, the use of IS can easily help to decrease the amount of work assigned to them (Juma et al., 2016) and improve the effectiveness of their functions. In the next section, the usage of IS in an administrative context in universities is explored.

2.4. The role of IS in University Administration

The previous section highlighted the challenges of the higher education system that were created by apartheid and the policies initiated to overcome them. It underscored the importance of effective administration. This section examines the use of IS in a typical university context with a focus on administrative IS usage.

The higher education environment in South Africa needs the support of Information Systems and its underlying technology to effectively support the institutions – especially the quality dimension which is highlighted in the White Paper on Higher Education. In the early years of the post-apartheid era, South Africa's education white paper notes that it takes the right technology to be implemented in the area of administration and management to promote superlative functioning of institutions (Department of Education, 1997). This still carries relevance currently, as the administration operations are a major part of universities' daily functions. Krishnaveni and Meenakumari, (2010) also affirm the importance of IS for administration in universities and the role it plays in supporting effective and proficient

administration. Similarly, Jumare, Tahir & Hamid, (2017) in recent years, provided input that use of ICT in university administration at Nigerian universities is essential.

Some of the ways in which administrative IS are used are listed in Table 2.3. In recent years various authors addressed the importance of the use of IS in procedures of university administration. Many of the uses overlap and can be placed into three general categories: Student Administration, Staff Administration and General Administration. Administrative activities of universities can benefit highly from technological intervention in ways such as lessening bureaucracy and reducing the manual labour work load of staff (Juma et al., 2016).

Table 2.3: Uses of IS in Universities Administrative Activities

Use	Author(s)
Scrutinizing student progress Organizing and processing large student records swiftly and accurately Communication between different departments To search and retrieve data in real time	(Juma et al., 2016)
Student application and registration Processing and display of student results Distribution of information Communication between staff and to parents	(Krishnaveni & Meenakumari, 2010)
Student enquiries Staff recruitment and administration Scheduling venues for classes and examinations Student financial management	(Jaleel, 2014)

A primary objective of designing and deploying IS is to improve organisational efficiency and effectiveness and from a university's perspective, this starts with administrative operations which support the university. It is important to recognise that when university administration systems offer less than adequate service, this can create extra pressure on administrators who are the direct users. Selwyn, Henderson, & Chao (2018) argue that since universities generate a mass of data related to students and the courses that they study, 'data work' using digital technologies and digital systems is integral to educational administration within higher education. Therefore, with the increasing number of students attending and enrolling into universities it brings about the need for such systems to be working adequately to provide a quality higher education service. Therefore, because of the pressure created by post-apartheid massification, the role of IS has become more paramount than ever. This has led to the need to understand whether administrative IS are providing requisite levels of quality. Without regular evaluation of IS, university managers will not be able to gauge if their systems are providing administrative outcomes at a level deemed to be satisfactory. Hence the significant need for evaluation of this subset of university information systems.

2.5. Overview of Information Systems Evaluation

Historic literature on the topic of Information systems in organisations has led to authors such as DeLone and McLean (1992), Seddon (1997) and Irani (2002), amongst others, researching IS evaluation and IS Success. A reason for the interest in IS evaluation is the role it plays in supporting various areas of businesses such as management and operations (Helia, Asri, Kusrini, & Miranda, 2018). The core purpose of IS evaluation is to assess the value of the systems being used to support a business function. In other words, research on IS evaluation provides insight on benefits achieved through IS usage and for whom it benefits in different conditions (Carlsson, 2003). In this section of the literature review, I examine the history of IS evaluation with specific focus as to when the evaluation procedure can take place and the importance of the process.

Technology has proven to be extremely progressive with rapid advancements. Such advancements have led to IS being a tool for attaining organisational success in terms of competitive advantage and profits (Helia et al., 2018). IS evaluation is a topic that has been researched in detail for decades from around the early 1990's and the literature clearly validates the shortfalls of different evaluation methods (Brown, 2005). There is no one unique way of measuring or evaluating information systems (Delone and Mclean, 1992) and the evaluation process is not an easy task according to Avgerou (1995). In support of this view point over 20 years later, Daghouri, Mansouri, & Qbadou, (2018) believe that IS evaluation is an intricate subject based on the various complex layers of an information system. Some of the formative papers that provide instructive guides on the evaluation and success of IS include Delone and McLean (1992,2003), Irani (2002), Beynon-Davies, Owens, & Williams (2004), Brown (2005) and Petter, DeLone & McLean (2008).

Insight from Beynon-Davies, Owens, and Williams (2004) distinguishes four different evaluation techniques which coincide with phases of the IS life cycle. The four phases are pre-implementation evaluation, formative evaluation which occurs whilst development is in process, post-implementation evaluation and lastly, post-mortem analysis which is defined by the evaluation of partially or fully abandoned projects. Pather (2017) also maps out a similar framework for IS Evaluation which will be discussed in the next section. According to DeLone and Mclean (2003), evaluation occurs at three different levels: technical, semantic and effectiveness. It is therefore important for researchers to be clear as to the level of evaluation they are focusing on.

However evaluation is quite a dominant topic within IS literature (Chen, Osman, Nunes, & Peng, 2011), as it is a key part of determining the success of a system. In order to progress with IS evaluation research,

researchers should adhere to the changes of the IS environment and adapt the method(s) of evaluation accordingly. Good research into IS success, requires researchers to constantly enhance methods that have already prevailed, and as such to devise and utilise new methodologies of measurement (Tate, Sedera, Mclean, & Burton-Jones, 2011). Evaluation studies from the extant literature can be placed in accordance with three high level phases of the Systems development life cycle (Planning/Analysis, Design/Implementation and Deployment/Support) which are also encompassed within the four stages previously mentioned. These four stages can be deemed as a principal structure for the classification of grouping the types of IS evaluation in organisations. Though, the type of organisation can also be a determining factor of the way the evaluation is taking place as the environment differs from organisation to organisation, hence the context is necessary to define.

The evaluation of IS must be suitable for the type of IS and the environment it works under. Evaluation is a necessary procedure in the development of IS (Abdelgawad & Comes, 2019) however, the context, purpose and use of the system is a crucial part of understanding the evaluation process. This study focuses on the evaluation of administration systems in university environment at the post-implementation or deployment phase of the SDLC. The system utilised in the case study that will be the subject of evaluation in this study, is an administrative system which is currently in use. With this system, the users are familiar with its operations and functionality, making it easy to use them as the unit of analysis for a summative evaluation. Summative evaluation is practical at a time where the IS has already been deployed and can assist in effective maintenance of a system as it provides intuition on how the system can be improved (Beynon-Davies et al., 2004). It is therefore plausible to consider summative evaluation as highly essential. The importance of summative evaluation has been supported and explored by a number of authors (Chen et al., 2011; Farbey, Land, & Targett, 1993; Kumar, 1990; M. Visser, Van Biljon, & Herselman, 2013).

The reason why the evaluation of IS in general is deemed to be so important is that it provides managers a basis to justify the implementation of such systems in the anticipated benefit for their organisations. Authors in support of this, Kaisara & Pather (2011) for example, argue that there is a high dependency on IS and that evaluation of IS success is a challenge faced by managers. The benefits that can be achieved through IS are that they can easily transform inputs into outputs which will help improve productivity levels and assist with both strategic and tactical decisions (Al-adaileh, 2009). From an organisational perspective, evaluation procedures have the ability to prove the value of the IS investment to relevant stakeholders, which is done through assessing the IS against the objectives of the investment (Al-ghamdi, 2017). In order to ensure realisation of these benefits, evaluation of the information system should be conducted to assess the success of the system. The outcomes of such

evaluation, is important to ensure managers can justify the organisational investment in IS. Therefore, over the years, researchers have been developing new models, strategies and theories or thereafter adapting existing techniques to fit specific studies.

2.6. IS Evaluation Models and Theories

Within the extant literature on IS success and evaluation, the number of models and theories that have been created or reconstructed are in abundance. Stockdale & Standing (2006) support this by affirming that there are many arguments advocating different methods and approaches for conducting effective evaluations. Over the year's researchers have been developing new tools or adapting existing tools to fit specific studies. As previously mentioned, there are different types of evaluation and stages at which the evaluation can take place, figure 2.2 shows some of the different stages.

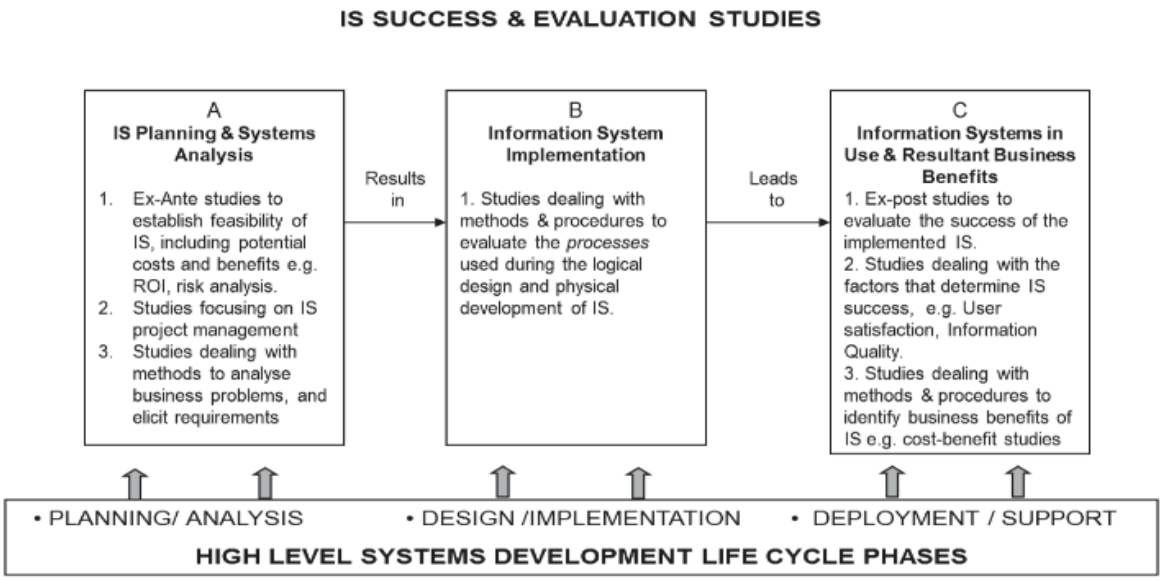

Figure 2.2 IS Studies mapped against SDLC (Source: Pather, 2017)

Within the literature on IS evaluation, studies on IS success and the evaluation of IS has become diverse. Pather (2017) aligned the types of evaluation and IS success papers with the high-level phases of the Systems Development Life Cycle (Figure 2.2) and further went on to categorise the three perspectives of IS success.

Evaluation taking place post implementation which is categorised in section C of Figure 2.2 and falls under the deployment/ support phase was not a common practice of organisations (Farbey, Land, and Targett, 1999). On the other hand, more than 10 years later, the importance of post-implementation

evaluation has led to a growing number of studies, models and frameworks focusing on evaluation after implementation of the IS (Song & Letch, 2012). For example, Popovič, Puklavec, & Oliveira (2019) advocate that to be able to realise the impact of IS, the usage of the system should be linked back to the performance goals which is highly associated with evaluation in the post-implementation phase.

Of the many models that have been created, the most significant to the IS literature to date is the DeLone and Mclean model from 1992 which was later reconstructed in 2003 (Mardiana, Tjakraatmadja, & Aprianingsih, 2015). The table below lists the work of a handful of informative studies looking into the methods, techniques and tools used in evaluation of information systems and the quest to measure information systems success. This section will briefly recapitulate literature in respect of methods, techniques and tools (Table 2.4) as stated earlier and the remainder of the section will highlight research which has provided strong influence in IS evaluation research.

Table 2.4: Information Systems Evaluation models and methods

Study	Authors	Year	Context and Purpose of the model/ theory
Information Systems Success: The quest for the dependent variable	DeLone and Mclean	1992	• This paper aimed to solve one of five problems identified in IS research. • The task was measuring for the dependent variable; IS Success • As a result, a model with 6 constructs (information quality, system quality, use, user satisfaction, individual impact and organizational impact) was constructed
The DeLone and McLean Model of Information Systems Success: A Ten-Year Update	DeLone and Mclean	2003	• An update on the D&M model (1992) with improvements based on new literature from other authors in the 10-year period since the initial publication • The addition of a Service Quality evaluation dimension • Addition of Intention to Use evaluation dimension • Alteration of Individual impact and Organizational Impact being grouped into one construct called Net Benefits to encompass both impacts.
Managing Information Systems for Service Quality: A study from the other side	Bharati and Berg	2003	• The authors delve into the relationship between factors that comprise information systems and service quality in service-oriented business • A model is developed portraying the relations among quality constructs and users' attributes and performance and system support • All relationships between dimensions that were presented were positive, only differing in the strength of the positive relationship

A Theoretical Integration of User Satisfaction and Technology Acceptance	Wixom and Todd	2005	• Integrating User Satisfaction and Technology Acceptance for IS Success • A model was created to better understand usage of IT and aid decision making. • The model indicates usage is derived from intention, which is caused by attitude towards usage and this is determined by factors in line with user satisfaction which can be determined through the quality aspects of a system • The study proved that mediating the roles of quality and satisfaction are imperative
An interpretive approach to evaluating information systems: A content, context, process framework	Stockdale and Standing	2006	• This paper presents a complete framework looking in detail into content, context and process aspects of evaluation • The emphasis of this framework looks at the process of evaluation from a holistic level • A model is developed based on the work of Pettigrew (1985) • The model looks deeply into what is being evaluated, in what situation and how the evaluation will be done. • A constructive aspect of the CCP model is that it provides means to analyze the internal and external environment around an IS
Strategies for Information Systems Evaluation- Six Generic Types	Cronholm and Goldkuhl	2003	The authors took the research into IS evaluation from a new perspective by looking at the type of evaluation based on the evaluation context The paper builds up to the discussion of 6 generic types of evaluation The 6 types are derived from a matrix formed with the three types of strategies of how to evaluate (goal-based, goal-free and criteria-based evaluation) against two strategies on what to evaluate (IT Systems as such and IT Systems in use) The conclusion of the study puts forward the idea of finding out how these methods can be combined for specific evaluation contexts and how researchers should try to place current methods under one or more of the 6 types presented for better understanding.

Table 2.4 represents the ways in which different authors explore different methods of evaluation and approaches to analysing the evaluation process. The IS Success Model which is considered a seminal model was initially developed by Delone & Mclean (Delone and Mclean, 1992), and subsequently updated (DeLone & Mclean, 2003). Following on their work, authors such as Bharati & Berg (2003) and Wixom & Todd (2005) have followed suit and developed other models. Though all authors focused on measuring IS Success, Bharati and Berg's model differed as it focused on measuring Service Quality and Wixom and Todd focused on integrating User Satisfaction and technology acceptance. From a different angle however, authors like Stockdale and Standing (2006) and Cronholm and Goldkuhl (2003) looked deeply into the process of evaluation; the different aspects of evaluation and the strategies used to evaluate. The evaluation method must be suitable for the information system being evaluated

and the literature presents IS evaluation to be a deep-rooted topic which keeps evolving. Some recurring themes are present in the literature, some of which fall into the scope of the context of this study and is discussed further in the sections to follow.

2.6.1. DeLone and Mclean (D&M) IS Success Model

The DeLone and Mclean IS success models are the most cited papers in the field of information systems (Agourram, 2009). The initial 1992 version was a gateway model which gave other authors the opportunity to provide constructive criticism which lead to the updated augmented model in 2003. The following subsections will go into detail on both the initial and updated IS Success models.

2.6.2. D&M IS Success Model 1992

The IS success model by DeLone and McLean (1992) (Figure 2.3), was composed of six interrelated dimensions of IS success which are: System Quality, Information Quality, Use, User Satisfaction, Individual Impact and Organisational Impact. The study of 1992 was the result of the first Information Systems Conference where the most pressing issues of IS were discussed, and the following question posed:

(1) What are the reference disciplines for state in full (MIS)?

(2) What is the dependent variable?

(3) How does MIS establish a cumulative tradition?

(4) What is the relationship of MIS research to computer technology and to MIS practice?

(5) Where should MIS researchers publish their findings? (DeLone & McLean, 1992)

It was then established that the most pressing issue to be resolved was the 2nd of the 5, hence the development of a comprehensive model (Figure 2.3)

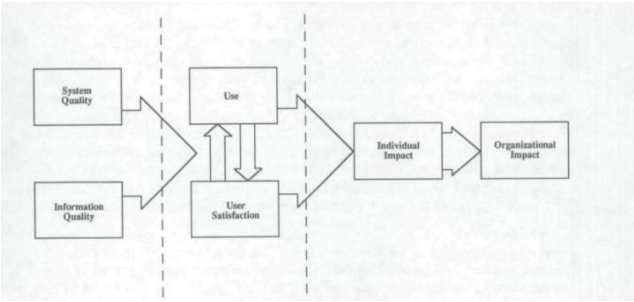

Figure 2.3: Information Systems Success Model (Source: DeLone and Mclean, 1992)

The model shown above displays the 6 dimensions used to determine the success of an information system. The model shows both process and causal relationships (Seddon, 1997) illustrated by the arrows connecting the dimensions. The inclusion of both types of association has however caused some controversy which will be discussed later. The DeLone and Mclean IS Success model is derived from the works of Shannon and Weaver (1948) in their communications research, and Mason (1978) with his information influence theory. The link between the dimensions and the work of Mason (1978) is that the technical level relates to the production of the IS, the semantic level relates to the product or the IS itself, and the effectiveness or influence level relates to the receipt, influence on recipient or the influence on the system (DeLone & McLean, 1992). Breaking down the six dimensions into the three subsections as per Shannon and Weaver (1949), System Quality and Information Quality fall under the technical and semantic level respectively, while the rest of the dimensions fall into the effectiveness or influence level.

There is a vast amount of interpretation that can be taken from the explanation and associations made by DeLone and Mclean with the above-mentioned authors' work. These exhibits reasoning and understanding for the plethora of measurement methods for IS success from various authors at different levels of observation. After discussing the basics of the D&M model Muda & Ade Afrina (2018) explained that a quality information system that promoted user satisfaction can have positive externalities in the users' performance and the organisation that it serves. With this being said, DeLone and Mclean noted at the inception of the original model, that the model is not set in stone as there is room for further development and improvements (DeLone & McLean, 1992).

2.6.3. Updated D&M IS Success Model 2003

In 2003, DeLone and Mclean provided a 10-year update on their model (Figure 2.4). They argued that since the development of the original model "*the role of IS has changed and progressed during the last decade*" (Delone and Mclean, 2003 p.10). In discussion of changes and progression in the available

research since the initial framework up until the 2003 update, there have not been any significant adaptations to the work of Shannon and Weaver (1949) and Mason (1979). Therefore, the relevance of the underlying theory remains applicable to the D&M IS Success Model as it was in 1992 (Delone and Mclean,2003). The overall impact of the model was a success as it has been cited extensively (DeLone & Mclean, 2016). However, the natural enhancement of the IS field over time brought about a need to update the model to remain relevant with the further developed field of IS. Some of the updates came as comments and critiques from other authors who contributed their input on the model which will be discussed in a later subsection.

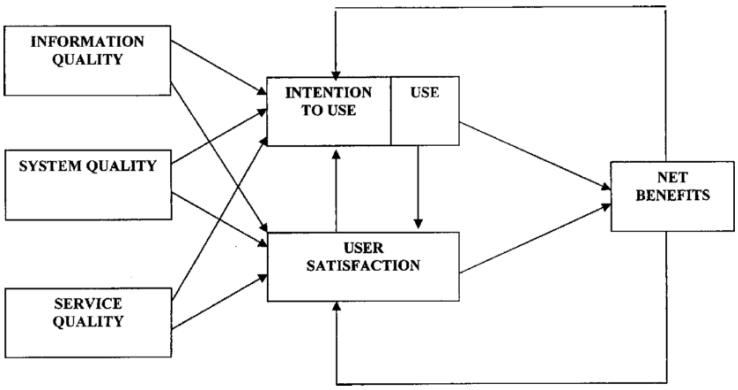

Figure 2.0. Updated D&M IS Success Mode (Delone and Mclean, 2003)

One of the strongest arguments presented in the updated model, was for the inclusion of service quality as an addition to the other quality dimensions. The updated IS Success model argued that service quality is an important measure of IS success. Pitt, Watson, and Kavan (1995) presented an augmented model that was adapted from the original model (Figure 2.3) but included service quality and validated the inclusion by showing there is a link between service quality, user satisfaction and use. The DeLone and Mclean (2003) paper emphasised that although service quality may not carry the same value as system and information quality, it is still applicable when measuring effectiveness of a system. Service Quality is also a dimension of IS and is one of the determinants of Intention to use, Use, and User Satisfaction. The inclusion of service quality is significant since the quality aspect of a system cannot be based alone on the system or the information it delivers - the service being provided is also a factor which is necessary to be aware of. This is especially prominent with systems that are highly utilised and dependent on the end user's input. Service quality is a construct of high importance in the context of Universities as the provision of high quality service is main principle of their business process model (Badwan et al., 2017). The service quality dimension of IS evaluation gained much prominence in the IS literature from the early 90's to the early 2000's (Kettinger and Lee, 1994; Kettinger and Lee, 1997;

Pitt et al., 1995; Watson Leyland and Kavan, 1998; Kettinger and Lee, 2005) particularly after the work of Parasuraman, Zeithaml and Berry (1985) on Service Quality in the marketing literature.

The second alteration to the model was the adaption of the impact components. In the original model, the influence section was composed of "Individual Impact" and "Organisation Impact" (Jiang, Klein, & Carr, 2002) in that order. The measurement of the two constructs are relevant in the assessment of determining IS success albeit they carry their own complications. DeLone and Mclean's (2003) explanation for the change was that the previous two dimensions using the word "impact" was not comprehensible enough and quite ambiguous as it did not define the direction of the impact; whether it be positive or negative. The authors intended for the model to be as simplistic as possible to avoid obstacles hence they came to the realisation that a single construct named "Net Benefits" which would encompass a positive result would suffice, but also avoid confusion. The model has thus become widely used in the literature which showcases its reliability (Alzahrani, Mahmud, Ramayah, Alfarraj, & Alalwan, 2019).

2.6.4. Model for managing information systems for service quality

The measurement and inclusion of service quality has become more and more popular since 1994 where the focus was highlighted by authors such Kettinger and Lee (1994, 1997) and Van Dyke, Kappelman, and Prybutok (1997, 1999) who added to, responded, commented and critiqued the SERVQUAL instrument developed by Parasuraman, Zeithaml, and Berry (1985, 1988). Bharati and Berg (2003) introduced their work denoting their attentiveness to IS success not being universal, and their understanding that the effect information systems have on service quality is a relationship to investigate. In particular, the study was based on the information systems department in electric utility organisations. The goal set out by their work was to address the gap in the literature regarding IS and service quality (Bharati & Berg, 2003). Figure 2.5 depicts the model they developed with service quality being the dependent variable and the results yielded from the regressions conducted. The model was tested for the relationships between independent variables and service quality, but also Cronbach's Alpha was used to test for reliability of each of the variables used.

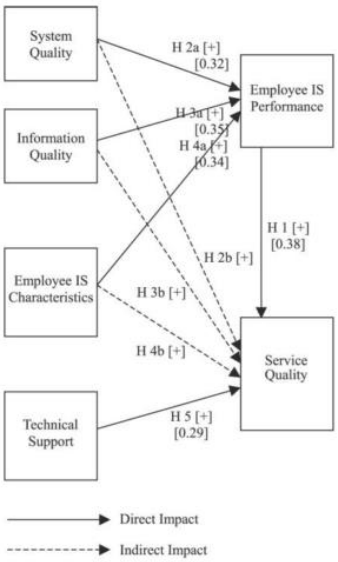

Figure 2.5: Model for managing information systems for service quality (with results), (Bharati and Berg, 2003)

The above model indicates that there are positive relationships between the independent variables (information quality, system quality, employee IS characteristics, technical support and employee IS performance) and Service Quality. There is also significant reliability in the variables used. Something important to note from the results is that system quality and information quality have an indirect positive relationship with service quality but a direct positive relationship with employee IS performance which has a positive direct relationship with service quality. Therefore, the link between information and system quality is relevant but even more relevant when analysing the relationship through employee IS performance. The model by Bharati and Berg (2003) has some identical and some similar variables in their model in comparison to DeLone and Mclean (1992, 2003). On the other hand, the perspective from which the authors look at evaluating the IS differs. For Bharati and Berg (2003), for instance, the focus is service quality and their model is derived from additional factors including user characteristics.

2.6.5. Content, Context, Process Framework

The evaluation process of any information system is not a task completed with ease. One of the key reasons in respect of complexity of the evaluation process can be drawn from the work of Edlund and Lövquist (2012) who explain that the older methods e.g. financial evaluation, lack the ability to adapt to the intricate nature of IS. The second reason why the evaluation of IS is complex, is based on the need for a good understanding of who the evaluation is being done for in terms of the specific stakeholders. The CCP framework addressed the foregoing critique. The content, context, process (CCP) framework (Figure 2.6), developed by Stockdale and Standing (2006) provides a broad

perspective of evaluation by encompassing dimensions on what is being measured, who is measuring and for what purpose. Due to the interaction between the three aspects of CPP with the content context and process aspects overlapping, it allows for the evaluation process to be more specific by answering the "Who, How and When" questions.

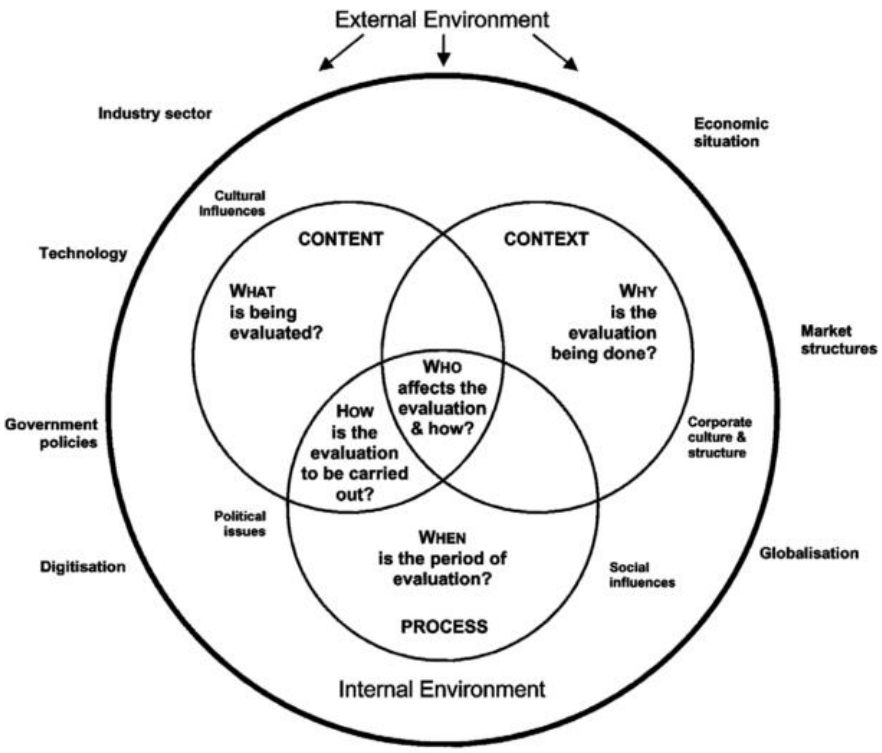

Figure 2.6: Content Context and Process Framework (Stockdale and Standing, 2006)

Evidently, the three main components of the framework are content, context and process – but there are also additional components that the framework consists of. The CCP categories are premised on the five questions of Who, What, Why, When and How. These are:

1. What is being evaluated?
2. Who affects the evaluation and how?
3. How is the evaluation to be carried out?
4. Why is the evaluation being carried out?
5. When is the period of evaluation? (Stockdale & Standing, 2006)

According to Stockdale and Standing's (2006) explanation, the content section is headlined by question 1, the context section by questions 2 and 4, and the process section is headlined by questions 3 and 5. The comprehensiveness of the CCP framework stems from the interactions between the key

components However, its usefulness in dealing with IS evaluation also stems from the inclusion of the internal and external environment. Factors in the internal and external environment also play a role because they have an impact on the system and its users. In the framework above, the internal environment is made up of the CPP components but is also used to encompass the subjects within the organisation such as politics and culture. On the outer ring, the factors outside the organisation also play a role e.g. globalisation, technology and the economic environment. The CCP framework takes on the evaluation process on a larger scale, looking at all areas that influence the information system to get a bigger picture and enable a more detailed and specific evaluation of the system in question. However, it may be quite complex, and costly to implement a full evaluation based on all components of the model.

Drawing inference from this model supports the premise of this study to determine relevant dimensions for an evaluation model that is relevant to a specific context. This model underscores how context is an integral component to evaluation. The context construct also links with the process and content construct which also refines the context looking further at who affects the evaluation process and how. This is especially relevant to this study as it specifically focuses on evaluating the system in an administrative context. The study is also conducted from the angle of the user perspective as their influence is vital in using user satisfaction as a gauge of system success.

2.6.6. Critiques of D&M IS Success Model

The general aim of evaluating information systems is to measure for IS success but regardless, it is far from a simplistic task. One of the best explanations as to why it is not so straightforward is because of the multifaceted relationships between variables that are interdependent of each other, as relations exist between IS, the users, environment and the organisation (Zviran and Erlich, 2003). Although the literature provides researchers with a wide variety of models, measurement tools and theories on IS success, there are also many discrepancies that have been identified. The D&M IS Success Model is a pivotal model with.in the extant literature. Majority of success models used the D&M models as a starting point and due to this it will be the focus of the critiques.

As discussed earlier the D&M 1992 model triggered some controversy soon after it was published. The discussion on the D&M model carried some positive responses and some critiques to the model (Muturi, Kiflemariam, & Acosta, 2018). One author who critiqued the model was Seddon (1997), who dedicated a paper to analyse DeLone and Mclean's model (DeLone and McLean, 1992). Something pointed out by Seddon, which was presented as a suggestion, was for the removal of "System Use" from the model.

Seddon's reasoning for this was merely due to the D&M model combining process and causal flows in the model and how it is arguable that "System Use" is applicable in a causal success model due to the dimension implying behavioural tendencies. Though, when talking about a process model, it defines the flow of the variables leading from one onto the other in a sequence (Wang, 2008). At the same time, in the same paths as the process flows, the D&M model represents causal flows as the variables are interrelated and can have specific effects on each other (Seddon,1997). An applied example could be an increase in the level of "service quality" will either increase or decrease the level of "user satisfaction". My interpretation of Seddon's criticism is that although "System Use" is a behaviour acted out by the users which can have varying outcomes, it still has a significant aspect of causality on the levels of the user satisfaction and individual impact constructs.

Another thought-provoking example from the updated seminal D&M Model (Delone and Mclean, 2003) refers to the understanding of the dimensions used. The 2003 paper does give a clear definition of the service quality dimension, even to an extent of explaining who the quality of service could be expected from. Yet in 2011, after numerous models had been created following input from the D&M model, Mclean explained that there are numerous meanings to the term "Service Quality" and that it came to his attention that the intended definitions have been lost over the years by numerous authors (Tate et al., 2014). Another example of a misunderstanding of definitions within the model was explained by Garrity and Sanders (2003) in relation to "System Quality". They argued that it was unclear whether the construct was referring to the technical side of the system, the user interface, or the work system. However I believe the authors of the IS Success Model DeLone and McLean (1992) made it clear with their referral to the system quality construct which is included in the technical level which is defined as the precision and proficiency of the system (Shannon & Weaver, 1948). It was later reiterated that intended sense of "System Quality" construct identifies with necessary features of the IS such as ease of use, system reliability, appropriate response times (Petter et al., 2008) to name a few.

In recent years the discussion on the D&M IS Success Model still continues. Mardiana et al. (2015) importantly critiqued the 2003 model and called for separation of the "Use" and "Intention to use" dimensions. The authors of the model wrote that increased "User Satisfaction" creates higher "Intention To Use" which leads to increased "Use" (DeLone and Mclean, 2003). The idea being presented against this is that based on the explanation given, it becomes unclear since the model links "Intention to use" and "Use" together. As a result, they posited an improved model (Figure 2.7), which displays a clearer representation of what DeLone, and Mclean explained. Furthermore, a general critique of the updated model based on insight from the work of Yakubu & Dasuki (2018) who applied the D&M IS Success Model to assess e-learning systems, communicates that although the D&M model was developed for

the context of e-commerce, researchers have used the model for many other context which noticeably results in varying results and opinions on the model.

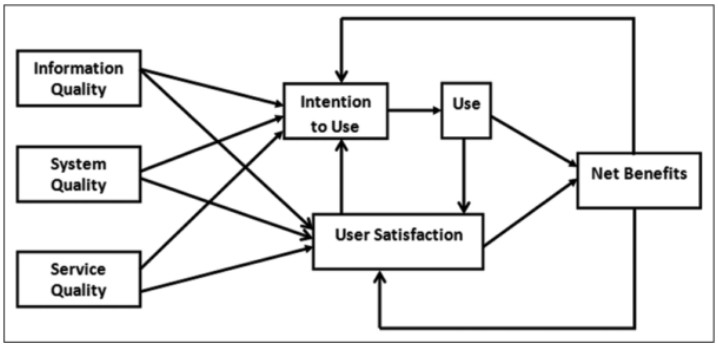

Figure 2.7: The separation of Intention to Use and Use of DeLone– McLean model (Mardiana et al.,2015)

2.7. Overview of Seminal Models

Of the research summarized and described in the previous section, it reveals merely a portion of the existing models and theories in the IS evaluation literature. There are many similar ideologies behind the models and if researchers are to combine the frameworks with the more current theoretical literature on IS evaluation, it may lead to development of more robust evaluation models.

In line with all the models discussed, the context is the determining factor that defines the model being presented. The evaluation process will alter in relation to the type of organisation, industry, perspective of evaluator and who the evaluation is being done for. It has been documented by authors in the past and present that the measurement of IS success varies in terms of the environment it is being measured under (Van Dyke et al., 1997; Tate et al., 2014). The context of a model carries a lot of significance for a study. Further, ensuring the model is comprehensible is also a big task. What is being explained here aligns closely with the theory of the CCP model by Stockdale and Standing (2006). The contribution from authors responding, giving critiques and insight on the IS Success Model is a sign of understanding which led to advances to the model being offered. For instance, Platisa and Balaban (2009) identified that the D&M model tends to focus on the systematic features of IS success and not so much on the human intervention. The human intervention role needs to be addressed when evaluating IS (Muda & Ade Afrina, 2018), as explored in the model developed by Bharati and Berg (2003). On the other hand, the critiques can also portray a level of misunderstanding which leads to intuitive questions being raised which can strengthen follow-up studies.

Based on the review of the seminal models, one can define that understanding of the evaluation approach and context play a big role in the development of a model. Furthermore, appropriateness of dimensions becomes an authoritative factor and authors need to ensure that variables are being used properly to assure correct use in the future. A lesson to be learnt is to ensure that all variables are clearly defined, and limitations are attached to definitions given, especially in the case of multiple contexts in which specific variables can be used.

An analysis of some informative models in the literature from the time of the D&M model up to recent studies, present some common variables that are used across board. Variables which are commonly found in several IS studies are usually centred around the quality constructs (Information Quality, System Quality and Service Quality) which have been used by many IS researchers (Bharati and Berg, 2003; DeLone and Mclean, 2003; Jingjun, Benbasat, and Cenfetelli, 2013). Work on the integration of service quality with system and information quality indicates the influences among the quality constructs. Jingjun et al. (2013) proposed hypotheses indicating that a user's perception of information quality is based on their perception of the systems quality and the users' perception of service quality will be based on their perception of both system and information quality. Determining the success of a system is essential and the determination of success in most cases is prominently derived from the users' perception, as they are the systems operators who can give their observations on their interactions with the system (Bokhari, 2005). The users experience is just as valuable as other measurable indicators of success (Cha & Park, 2018) thus, user Satisfaction is an important factor in IS evaluation.

2.8. User Satisfaction

The quality of an information system portrays a wide outlook that includes the technology but also the users that utilise the systems (Andersson and Von Hellens, 1997). Therefore, assessing IS quality presumes the analysis of the three quality dimensions (information, system and service quality) in terms of the users' perception of the system. Service quality and system quality are that which consist of overlapping interests, as they both have an impact on customer (user) satisfaction. Abrego Almazán, Tovar & Quintero (2017) validate the connection of the quality dimensions and User Satisfaction in their conceptual model and hypothesis shows links between the quality dimensions and User Satisfaction. Additionally in a study by Ojo (2017),which sought to validate the D&M IS Success model, it was also identified that the quality dimensions do in fact influence the users satisfaction with the system in question. According to Akter, Ray, and D'Ambra (2011), systems should be observed as services and is relevant in relation to the technology business alignment in the service field research. In the context of higher educational institutions, the system which facilitates university operations,

provides a service to the users. This section introspects the user satisfaction (US) construct as the construct has been classed as one of the prominent influencers of the success of an IS (Alzahrani et al., 2019).

The measurement of the construct user satisfaction (US) in accordance with the D&M IS Success Model was simply explained as the operational interaction a user had with an information system (DeLone and McLean, 1992). US measures the users perception while utilising the system (Mamma, 2010). An analysis of the multiple definitions provided by Vaezi (2013) has led to an informative definition of US which links the construct with the other dimension that affect its outcome. Thus, for the purpose of this study one can define US as a summary of the users experience of the information output, system quality, system-based and external support to users and the associated service by the IS or IT function. User satisfaction is a construct that is extensively used in the evaluation of organisational success due to the connection between US and overall performance (Qureshi and Qazi Abro, 2016).

The relevance of US in the evaluation process is that users can be symbolized as a medium of judgement on the evaluation of information systems. Thus, US serves as a proxy measure of the IS. However, the issue of social desirability may need close attention when using user satisfaction as a variable (Gelderman, 1998). Reasoning for this stems from the uncertainty in the surety of users remaining unbiased with their judgement in order to produce reliable findings to form a credible conclusion. The results Gelderman (1998) yielded from the relation US has with usage of IS and performance underscores that there is a valid argument in using US as a measure for IS Success.

Initially the application of US was that it is a good proxy for IS Success (Kassim, Jailani, Hairuddin, and Zamzuri, 2012). However Melone (1990) argues that there are barely any strong enough arguments that have been made verifying that US alone is a key indication of IS success. The same authors (Kassim et al., 2012) described the construct as a users' valuation which could range from positive to negative regarding the attributes of an information system. The underlying factor is that the construct is open ended, meaning that the satisfaction experienced can have different effects on the outcome of the determination of IS success. Melone (1990) supported this by explaining the varying ends of the satisfaction spectrum and signifying that both successful and unsuccessful IS could be associated with satisfied users and vice versa with dissatisfied users.

It is not surprising that the US construct implies a level of ambiguity as it can be classed as an attitude or subjective feeling. Similar to most other constructs used to measure IS Success, US also has faced criticisms such as the usage of the construct, miscomprehension of the construct and the misuse of the

developed US models (Thong and Yap, 1996). Additionally, the use of US created two main queries for Garrity & Sanders (2003). Firstly, the authors noted the absence of definition for the system boundary - that is, what exactly are the users assessing their satisfaction of, the systems output, associated services etc. Secondly, US measures lack context and do not relate to overall goals of the system (Garrity & Sanders, 1998). However, despite the problematic side of measuring US, it still represents a measure of importance when allocating factors to evaluate an IS and it carries strong links with other commonly used dimensions of IS success (Garrity and Sanders,2003).

Referring to the D&M models, user satisfaction has links with multiple variables which demonstrates the weight and significance it carries in determining IS success. It has been established that information quality is linked as a component of the US construct (Petter et al., 2008) and shortly after the D&M model was released, Seddon, Patry and Kiew (1994) tested and confirmed that both information and system quality account for a significant amount of variance in US. The three quality dimensions should be controlled for, or measured separately because singularly or jointly they will affect subsequent US (DeLone and McLean, 2002). Similarly, Hussein (2009) investigated the factors affecting IS success and found that the three quality dimensions among other dimensions were the main factors that influenced US which was also supported by the findings of Roky & Meriouh (2015).

In summary, the relevance of the US dimension in determining system success has been expressed by multiple authors and in various models as mentioned above. The users are a pertinent factor in the measurement of success because they are the primary point of contact with system usage hence the US construct is commonly used in IS evaluation (Karlinsky-Shichor & Zviran, 2016). It is a positive point that US has proven links with other measurable dimensions of system success making it easier to adopt the US dimension in the context of this study. It is therefore prudent that this study positions user satisfaction as the dependent variable given the prominence of context in the research problem domain viz. the environment of IS evaluation in this study being a university, the users are an integral part of the systems usage. The users are of relevance with administrative systems as they have the best understanding of the system and therefore their experiences and satisfaction with the system can be used as an indicator of IS success.

2.9. Determinants of User Satisfaction

This section identifies the determinants of US used in IS evaluation models to generate a broad understanding of what shapes the construct (Table 2.5). Of the User Satisfaction determinants that are

listed in Table 2.5, some determinants were not used in the final models of each study, however they were all taken into consideration for this review and will be used to guide this discussion.

Table 2.5: User Satisfaction Items

Determinants of US	Study	Authors
Accuracy Reliability Timeliness Relevancy Confidence in system	Development of a Tool for Measuring and Analyzing Computer User Satisfaction	(Bailey and Pearson, 1983) (Putra, Subiyakto, Yunita, Gunawan, & Durachman, 2018)
Satisfaction with specifics Overall satisfaction Information Satisfaction: difference between information needed and received Enjoyment Software satisfaction Decision making satisfaction	Information Systems Success: The Quest for the Dependent Variable	(DeLone and McLean, 1992)
Content Accuracy Format Timeliness Ease of use	A Confirmatory Factor Analysis of the End-User Computing Satisfaction Instrument	(Doll, Xia, and Torkzadeh, 1994)
Understanding Overall Perception Provided Services Quality: content, accuracy, format, ease of use, product timeliness	Quality and Evaluation of Information Systems in Institutional Organizations	(Mamma, 2010)
System Satisfaction Information Satisfaction Service Satisfaction	User Satisfaction with Information Systems: A Comprehensive Model of Attribute Satisfaction	(Vaezi, 2013)
Satisfaction with CIS components Current CIS vs. Paper Perceived time spent on computer	Determinants of User Satisfaction with a Clinical Information System	(Palm, Colombet, Sicotte, & Degoulet, 2006)
User Expectations Ease of Use Perceived Usefulness User Attitude Towards Information System Organizational Support Perceived Attitude of Top Management User Involvement in System Development User Skills User Experience	Variables affecting information technology end-user satisfaction: a meta-analysis of the empirical literature	(Mahmood, Burn, Gemoets, Jacque,2000)

Technical resources Knowledge management level Systems linkages Knowledge quality User IS competence Organizational attitude to knowledge management	Factors Influencing Perceived Benefits and User Satisfaction in Knowledge Management Systems	(Karlinsky-Shichor & Zviran, 2016)

The authors listed above in Table 2.5 have operationalised US in their studies whether it be as the dependent variable (Vaezi, 2013) or a contributing dimension in the process of information systems evaluation like Mamma (2010). Of all the determinants listed above, the common ones are accuracy, content, information satisfaction and other user characteristics. The determinants fall in line with the frequently used dimensions that are utilized in the evaluation of information systems. To be specific, reliability and timeliness used by Bailey and Pearson (1983) and Putra, Subiyakto, Yunita, Gunawan, & Durachman (2018) aligns well with the quality constructs (Information Quality, System Quality and Service Quality). The next section offers a summary of the analysed literature on IS evaluation therefore producing a set of proposed dimensions that can be used to measure IS User Satisfaction in a university administrative context.

2.10. Dimensions for evaluating a Higher Education University Administration System

The literature review has provided insight into the possible dimensions that are important in undertaking an evaluation of an administrative IS in a university. These are depicted in the following figure (Figure 2.6) and discussed further thereafter. The study aims to investigate and verify the evaluation dimensions for the context of a university administration system. This study will not seek to test the relationships between the dimensions, and this can be undertaken as a further study.

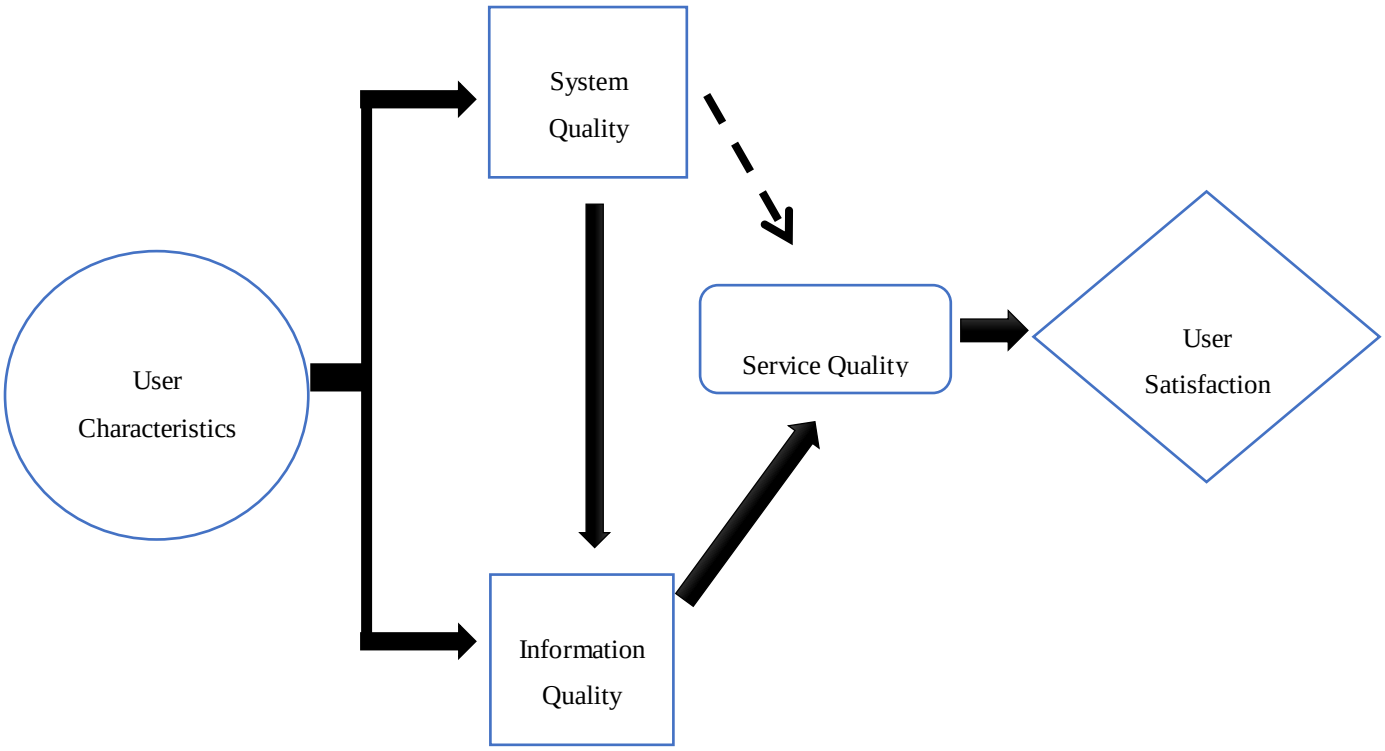

Figure 2.8: US Framework for Evaluation of IS success in Higher Education

The foregoing review has already underscored that when organisations adopt information technology to aid business functions, a measure of assessment is needed to ensure success and that the system is supporting organisational quality. As demonstrated in this literature review and in the conceptual framework (Figure 2.8), widely used measures of IS success are system quality, service quality and information quality. Many models measuring IS Success have included the three quality dimensions which could be classed as the standard set of dimensions, among others, to understand how the organisational needs are being met using information systems. In the DeLone and Mclean model (2003) System Quality, service quality and Information Quality are factors which have been determined to have influential power on the User Satisfaction construct (Muda & Ade Afrina, 2018).

Based on the extensive review of literature, it has become apparent that there are several suitable dimensions that can be used in the evaluation of administrative information systems in higher education. The dimensions show the logic as to how I have come to understand how user satisfaction is generated from an administrative system within a university setting in order to evaluate the IS. I therefore argue that the focal point of this study is that user satisfaction is a main determinant of IS Success and that the evaluation of the system should be based on the perception of users. Therefore, the characteristics

of the users, which was also used in a study by Venkatesh, Morris, Davis (2003), are important to get a better understanding of their perceptions for analysis.

User characteristics can be used as moderating variables in getting a more profound understanding of the US construct in this case. The characteristics of the user such as age, gender and experience with information systems will help in the analysis of their perception of the quality of the system. System Quality and Information Quality are the first of the relevant dimensions for determining US. When assessing the quality of a system, system quality and information quality are important considerations. DeLone & McLean (2002) confirmed that when evaluating a single system, system and information quality are likely to be among the most important variables. Xu, Benbasat, & Cenfetelli (2013) argue that perceived System quality influences perceived Information quality positively and perceived information quality influences perceived service quality which leads to the notion that System Quality and Service Quality are indirectly linked. System quality is a well-recognised dimension in IS Success research and has a strong link with information quality in the determination of IS success (Gorla, Somers, & Wong, 2010; Habib & Govindaraju, 2018). Returning to the research context, the overarching idea of a high level of service quality can be assumed to lead to high user satisfaction as it is presented in the D&M Model. This can be translated into benefits which can be seen through the improvement of the university administration function.

2.11. Conclusion

The goal of the literature review was to conduct thorough research into the topic of IS evaluation to attain knowledge on what has been done over the past couple of decades. The purpose of this was to get a deeper understanding of the topic and how the literature can help in guiding research towards providing a solution to the research problem. In light of the literature analysis, a vast amount of literature covers the assessment of IT departments which can be used as a reflection of the systems being used (Gorla et al., 2010; Hussein, 2009; Jiang et al., 2002; Kettinger & Lee, 2005; Watson, Pitt, Cunningham, & Nel, 1993). The issue of evaluation of IS departments usually pertains to the measurement of service quality. The volume of such a broad evaluation of the IS departments brings about the prospect for researchers in the IS field to develop contextualized but general methods to evaluate success of specific IS (Tate et al., 2014). The lack of this specific context in the literature shows that the issue of massification which has been around for over 2 decades has not been examined to find a solution to assess the success of university IS. Therefore, to bridge the gap, models should be devised and where applicable altered from an existing model to measure the success of actual information systems.

As per the 3 sub-research questions 1A, 1B and 1C (see table 1.1) the literature has shown that there are models and theories to measure the success of IS and the most prevalent one is the D&M success model. The common dimensions found in the literature which are also present in the D&M model are also well suited for this context of evaluating user satisfaction. Based on this, a set of proposed evaluation dimensions to determine IS success in the context of university administration systems have been established, with US being the dependant variable. The literature has given a substantial direction towards variables that would be appropriate to gauge the effectiveness of an IS from the perspective of the user. The evaluation dimensions which will form the basis of the investigation (described in Chapter 3) are IS User Characteristics, and three quality dimensions (Systems, information and service quality) on which US is dependant.

Chapter 3: Research Design & Methodology

3.1. Introduction

This chapter explores the research design that was used to achieve the outcome of determining the dimensions to assess the user satisfaction of administrative IS. As discussed in depth in chapter 2, past research on IS evaluation leans towards dimensions such as quality aspects (IQ, SysQ and SQ) among other variables such as user characteristics and usage. Then, in terms of user satisfaction, common variables are accuracy, timeliness, information satisfaction and understanding (DeLone & McLean, 1992; Doll et al., 1994; Vaezi, 2013). Both the literature on IS evaluation and User Satisfaction in an IS context have been used in the development of an initial conceptual framework that guided this research. Throughout the chapter, the design of the study and unit of analysis for the study will be discussed, followed by the methods used to execute the collection of data.

3.2. Research Design

The overarching design for this study is based on a Case Study design, incorporating a mixed method approach. One of the foremost authors on case study research defines case study research as "as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (Yin, 1984 p.24). Case study research design can be described as dissimilar from other qualitative methods mainly due to the fact that it is based solely on one or a few contextual circumstances (Gentles, Charles, Ploeg, & Mckibbon, 2015) which suits the nature of this research being centred around a contextual circumstance. Further reasoning for why a Case Study was used is supported by the research being conducted at a university using a unique administrative system utilized only by this specific institution. Case study research design has its challenges such as being described as a weak research tool especially in this instance of the research being single case which implies a lack of generalizability (Zainal, 2007). Although the research conducted may not be widely generalisable, within the context of evaluation of administrative IS, the outcome would still be beneficial in guiding future research in the same context.

A mixed method approach entails conducting a study where there is use of both qualitative and quantitative methods of research (Onwuegbuzie, 2007).The motivation for a mixed method approach is based on the theory that a surplus of information and even more valuable information can be attained by using the outcomes of both qualitative and quantitative methods as opposed to just one method

(Creswell, 1999). The first phase of this study was a qualitative phase which comprised of one-on-one interviews with users which was executed after identifying an initial set of evaluation dimensions from the literature. Thereafter, a survey was implemented in the second phase of the study during which quantitative data was collected.

3.3. Overview of the selected case: University of the Western Cape Marks Administration System (MAS)

The University of the Western Cape (UWC), was established in 1959 as an institution for coloured people during the apartheid era (Nyahodza & Higgs, 2017). Since then, as the nation overcame the struggles of apartheid, the university began to welcome students of all races. Over the past few years between 2016 and 2019 the university of the Western Cape has seen growth in the number of African, Coloured and Indian students. In addition, overall the number of students enrolled has seen yearly increases from 2016 where the number of students enrolled was 22906 Compared to 2019 where 25313 students enrolled at the university (Table 3.1).

Table 3.1: Enrolment statistics of the University of the Western Cape

	2016		**Total**	**2017**			**Total**	**2018**			**Total**	**2019**			**Total**
Row Labels	Female	Male		N/A	Female	Male		N/A	Female	Male		N/A	Female	Male	
African	5579	4304	9883	1	6249	4696	10946	1	6410	4551	10962	1	7002	4934	11937
Asian	65	59	124		65	58	123		55	44	99		42	48	90
Coloured	6545	3943	10488		6490	4004	10494		6624	4021	10645		6933	4096	11029
Indian	486	318	804		475	332	807		465	325	790		484	341	825
Other	134	124	258		146	110	256		144	119	263		143	110	253
White	818	531	1349		811	470	1281		787	430	1217		766	413	1179
Grand Total	13627	9279	22906	1	14236	9670	23907	1	14485	9490	23976	1	15370	9942	25313

The selected case for investigation was the Marks Administration System (MAS) at the University of the Western Cape (UWC). The Marks Administration System (MAS) is a subset of the universities main administration system, the Student Administration Systems Integration (SASI). The purpose of the SASI revolves around the functionality being a student database. SASI contains student information including their demographics, high school grades, up to date university module grades and any degrees attained(Mthimunye, Daniels, & Pedro, 2017). The SASI system is used in various aspects of university

administration tasks from the moment a student starts an enrolment application until their graduation. SASI also deals with masses of student information along with associated external vendor information. Therefore, the system needed to be functioning efficiently and effectively to support the university's related systems and daily functions while maintaining positive user satisfaction and minimal fault.

The MAS system is also an administrative system but holding student information regarding their modules and the grades achieved within each of their modules. The MAS is a database holding students' grades for assignments, tests and exams to create a final grade for each student for each module they are enrolled in. The link between the MAS and SASI is that MAS pulls student information pertaining to the degree and modules they are enrolled for. These two systems are linked together by student identification which would be their student numbers which is what lecturers and administrators use to input students marks into MAS. The Marks administration system is used by 1563 staff members and the system contains marks of 25313 students.

3.4. Unit of analysis

According to Babbie (2001), the unit of analysis refers to the "who" or "what" which is being studied. With this in mind, and based on the problem and main research question, the unit of analysis for this study was the users of the selected administrative system in a Higher Education institute viz. the University of the Western Cape. Further motivation of the selection of the unit of analysis is borne out by the literature which indicates that perceptions of users comprise an important data source with regard to the evaluation of IS (Kelly, 2009). The users are essentially the individuals using the system who have a better understanding of the functionalities and capabilities of the system. Thus, this study focused on the lecturers and administrative staff of the University of the Western Cape who comprise the users of the administrative Information System MAS.

3.5. Data Sources

MAS has a large group of users from all faculties and other university departments which includes lecturers, administrators, faculty officers and technical support staff. This large population was beneficial to get a large enough sample size to conduct the study and gather enough valuable information. The data sources in both phases contained feedback from the users of MAS at the University of the Western Cape who are the unit of analysis in this case study.

3.6. Ethical Considerations

Research ethics can be defined as what is necessary in the research process to ensure the preservation of the dignity of any involved entities or entities that can be affected by the research being publicised (Fouka and Mantzorou, 2011). To comply with this, throughout the research process the participants of both the interview process and survey were kept anonymous. Moreover, this research to be conducted in an ethical manner, ethical clearance was sought and granted by the UWC research office. Furthermore, for the ethical execution of the one-on-one interviews with the universities staff members, before commencing the recorded interviews, a consent form was provided along with an information sheet (see appendix 3.1 and 3.2).

3.7. Phase 1: Qualitative Methods using Interviews

The research methods carried out in this study as mentioned earlier were mixed methods which entailed two phases. The first phase was a qualitative method employing one-on-one interviews which was followed by the second phase that was quantitative method that involved a survey. Qualitative methods can be classified as a researcher's revelatory method towards an investigation which uses data to ask and solve questions (Kaplan & Duchon, 1988). Qualitative methods provide results which are usually relayed in a textual manner (Garbarino & Holland, 2009). The qualitative method used was one-on-one interviews which was informed by a literature review. Interviews are a popular method to collect data in qualitative research and can used as useful tool to obtain first hand user experiences (Ryan, Coughlan, & Cronin, 2014). There are three main interview types utilized during qualitative research viz. structured, semi-structured and unstructured interviews (Gill, Stewart, Treasure, & Chadwick, 2008). The variations in types of interviews all serve different purposes therefore the chosen interview procedure needs to be suitable for the nature of the study. This study made use of semi-structured interviews also known as "in-depth" interviews that allow the interviewer to have an agile style of questioning to allow participants to share opinions and experiences (Esterberg, 2002).

The semi-structured interview approach was chosen to be able to get detailed comprehendible and credible information from the primary stakeholders who are the users. The specific type of interview approach is widely used due to the flexible nature meaning questions could be adapted to assist the participants comprehension (Qu & Dumay, 2011). The qualitative data collection method was beneficial for this study as the interview process allowed for open ended dialogue which allowed one to probe deeper into ambiguous responses.

3.7.1. Implementation

During Phase 1, one-on-one interviews were held after a small-scale test run was held with 3 randomly chosen users. The test run was conducted to ensure that the questions meanings were understood correctly and to ensure clarity in the wording of the questions. After the test run, the formal interviews were conducted in the period of 29th March to 25th April 2018. Participants were from different faculties and departments within the university while supporting the condition that part of their role involves interaction with the Marks Administration System (MAS). The purpose of interviews was to engage in a semi-structured discussion and gain knowledge from the relevant staff members on their usage of the system. The interviewer facilitated the discussions enabling the participants to engage and interact and give their opinion on the various aspects of the MAS.

3.7.2. Instrument development

The interview instrument (see appendix 4.1) served the purpose of identifying user perceptions about what is important to them regarding the system (MAS). The interview questions were indirectly used to guide the interviewee responses to address constructs that determine a users' satisfaction. At a high-level, the discussion was led by the objectives and the main research question. Additionally, the discussion was also supported by the relevant literature which provided established IS evaluation dimensions to guide the interview questioning to provide relevant feedback. However, due to the interview being categorised as semi-structured, the questions were sometimes altered or continued with a follow-up question for a deeper response. A literature review led to the focus of the interviews on the three quality dimensions; Service Quality, System Quality and Information Quality as used in the DeLone and Mclean (2003) success model. The interview questions were aligned with potential administrative IS evaluation dimensions and were open ended but with direction towards understanding the system and its operability.

3.7.3. Qualitative Sampling

Over a 4-week period the interviews were conducted with users of the system MAS. In total 20 interviews were conducted. Interviews ceased once a point of theoretical saturation was reached as stated in literature by authors such as Glaser & Strauss (1967) and (Guest et al., 2006). Guest, Bunce and Johnson (2006) correctly discovered that there is a high frequency of theoretical saturation being observed in the research where purposive sampling has been used as the sampling method for data collection. This was to be expected, as the users who were interviewed are mainly using the system for

similar purposes such as uploading, vetting and publishing marks–therefore they were bound to have similar experiences and responses.

The sampling method was purposive sampling, as the interviews required responses from specific types of users which consisted of staff who utilised the system as part of their administrative duties. The users of MAS that participated in the interviews were also users of the main administration system SASI. The interviewees are all systems users who are required to use both systems in their job operations. Purposive sampling is one of the more common sampling strategies when dealing with qualitative methods of (Gentles et al., 2015). Purposive sampling is a method where the sample population is carefully and intentionally selected in relation to the characteristics of the ideal participants, they also have a higher likelihood of being able to contribute to the research (Etikan, 2016), and is ideal for qualitative studies (Palys, 2008).

The individuals who were selected were restricted to users of the system who use the system as a part of fulfilling their job description i.e. system use is mandatory for these users. The selected staff members needed to meet some criteria to determine their suitability to participate which was easily determined by screening potential participants before commencing. One requirement was that they needed to have experience working with the system in question. This was to ensure that the data collected from the staff was reliable. A second requirement was supported by the purpose of getting the most valuable information from the staff and that they needed to understand the systems' overall purpose, the main functions and have perceptual awareness of its strengths and weaknesses. Thirdly, in terms of the amount of experience they have, any experience was deemed to be enough. The rationale behind this is that having data collected from people of different experience levels would provide well rounded responses. For example, people with more experience will have an in-depth understanding. However, even people with little experience would be responsive and informative in what they could expect from the system in comparison to what they have experienced.

Regarding the size of the sample that was used for the interviews, the interviews came to an end after reaching a point of theoretical saturation. Theoretical saturation was reached after 20 interviews had taken place. Theoretical saturation is where the researcher begins to identify alike occurrences repetitively during the analysis process (Glaser & Strauss, 1967). Furthermore, Guest, Bunce & Johnson (2006) describe theoretical saturation as the point where all key ideas have been established. The same authors also conducted a review of literature and identified that where purposive sampling is involved, the sampling process only ceases upon reaching theoretical saturation. Therefore, the process of interviews continued until it came to a stage where the responses to questions were producing similar

answers or in other words, when interviews were no longer giving new information. Theoretical saturation was expected as some of the users being interviewed had identical roles.

3.7.4. Qualitative Data Analysis

Qualitative data analysis is the analysis of data that was collected using qualitative techniques (Babbie, 2001). The analysis was based on the data gathered during the interviews. The responses from the interview were analysed using definitions of system elements from the literature as a basis to derive context-based descriptions of the selected case. As such the emerging qualitative findings helped to revise the initial conceptual framework which was derived from the literature. According to Levy and Ellis (2006), the reason why a literature review is an effective foundation for the development of an instrument is because it aids the process in the case of gaining a firm base of theory to move into a new study.

The interviews were voice recorded and transcribed for ease of analysis. Once the transcripts were readily available, a software called ATLAS t.i was used to aid the analysis process. The ATLAS t.i software is a research tool that aids qualitative data analysis (Friese, 2014). This software enables researchers to be able to organize, structure and be systematic with the collected data (Konopásek, 2016). It was used to analyse the discussions and group together the answers to find trends, similarities and differences within the responses.

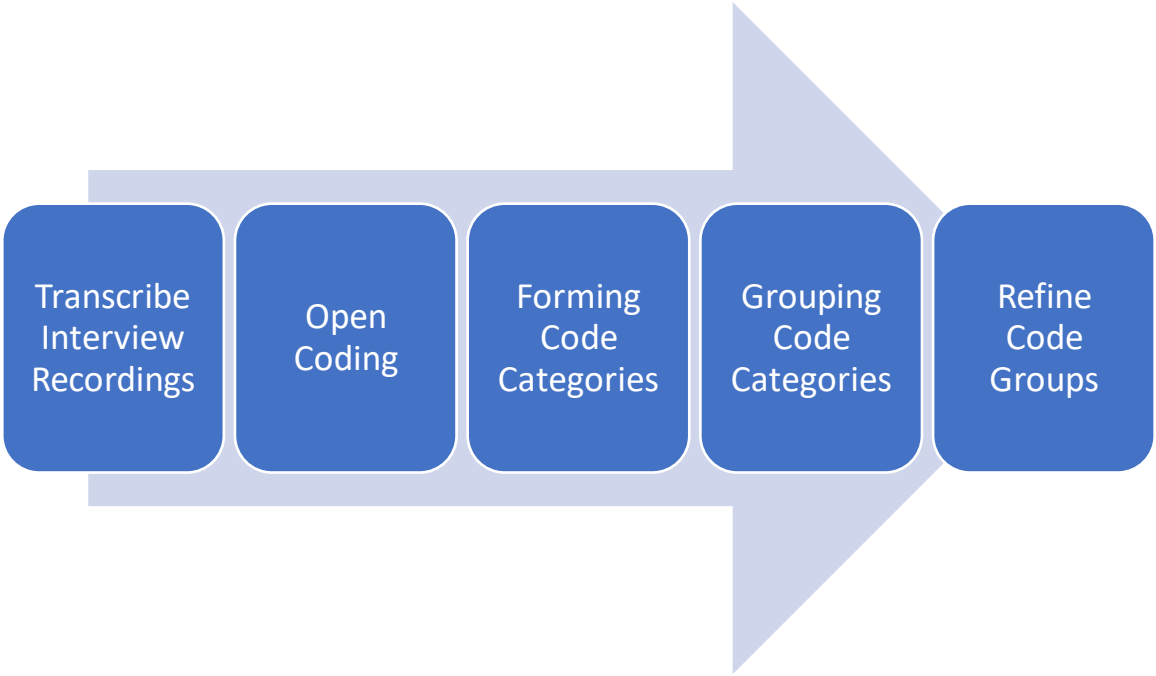

Figure 3.1: Qualitative Analysis Process

The analysis process (Figure 3.1) was based on authors such as Elo & Kyngas (2008) who explain the processes of inductive content analysis in their work. This inductive content analysis approach stems from what Basit (2003) describes as the "Ground" approach that was advocated by Glaser & Strauss (1967). Basically, this process of analysis involves using qualitative data, which in this case were the interview transcripts (See appendix 4.2 for interview transcript example). All 20 interview transcripts that were uploaded to Atlas t.i (Figure .3.2).

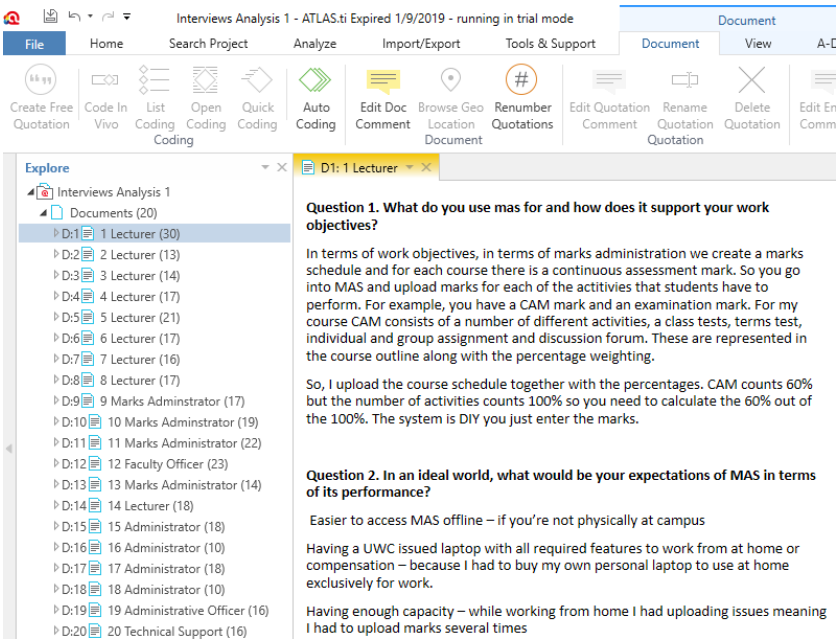

Figure 3.2: Uploaded documents in Atlas t.i

The type of coding that was conducted is referred to as *open coding*. Open coding is where comments were made on each of the individual interview transcripts and this was executed while reviewing and analysing the data (Elo & Kyngas, 2008). The transcripts were used to create codes (Figure 5.3) which formed code categories that were subsequently organised to represent themes in the data. The codes were named and described based on the interview response data (Table 4.7 for full list of codes with descriptions).

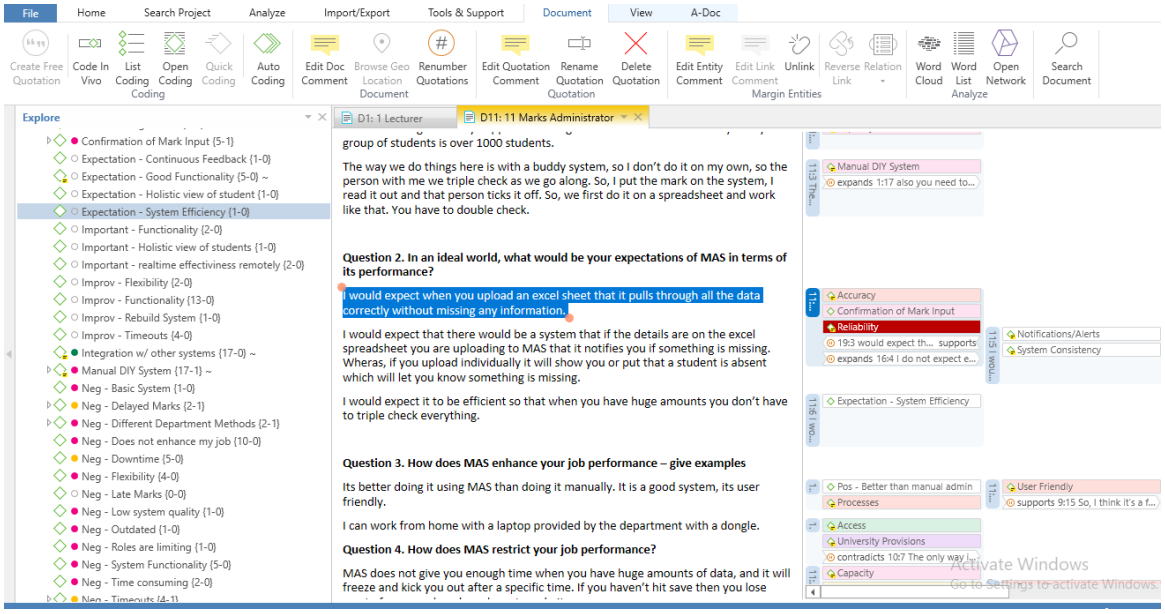

Figure 3.3: Codes and the associated quotes from interview transcripts

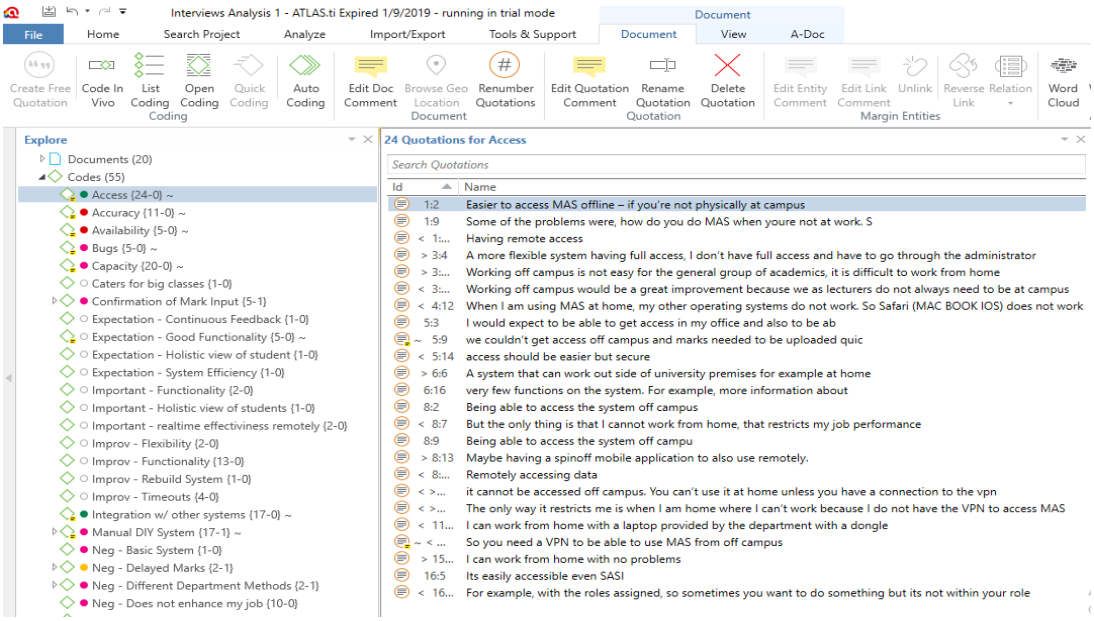

Figure 3.4: Codes and associated interview quotes

Following this the codes were grouped into code categories; Figure 3.4 shows an example for the highlighted code on the left named "Access" and on the right side a list of all the quotes from different interviews associated with the code. The codes which became the items were then grouped to collect similar themes amongst the items (Burnard, 1991). The code groups now representing dimensions, were also defined by using the literature as a starting point and the data to provide clear context. This phase of grouping codes and forming dimensions was assisted by a tool within the Atlas t.i software which

allowed for “Network Diagrams” to be created for a visual display of quotes, items and dimensions. Figure 3.5 shows the network diagram for the service quality dimension showing a graphic display of the item codes, quotes from the interviews that represent this code and possible links between the quotes.

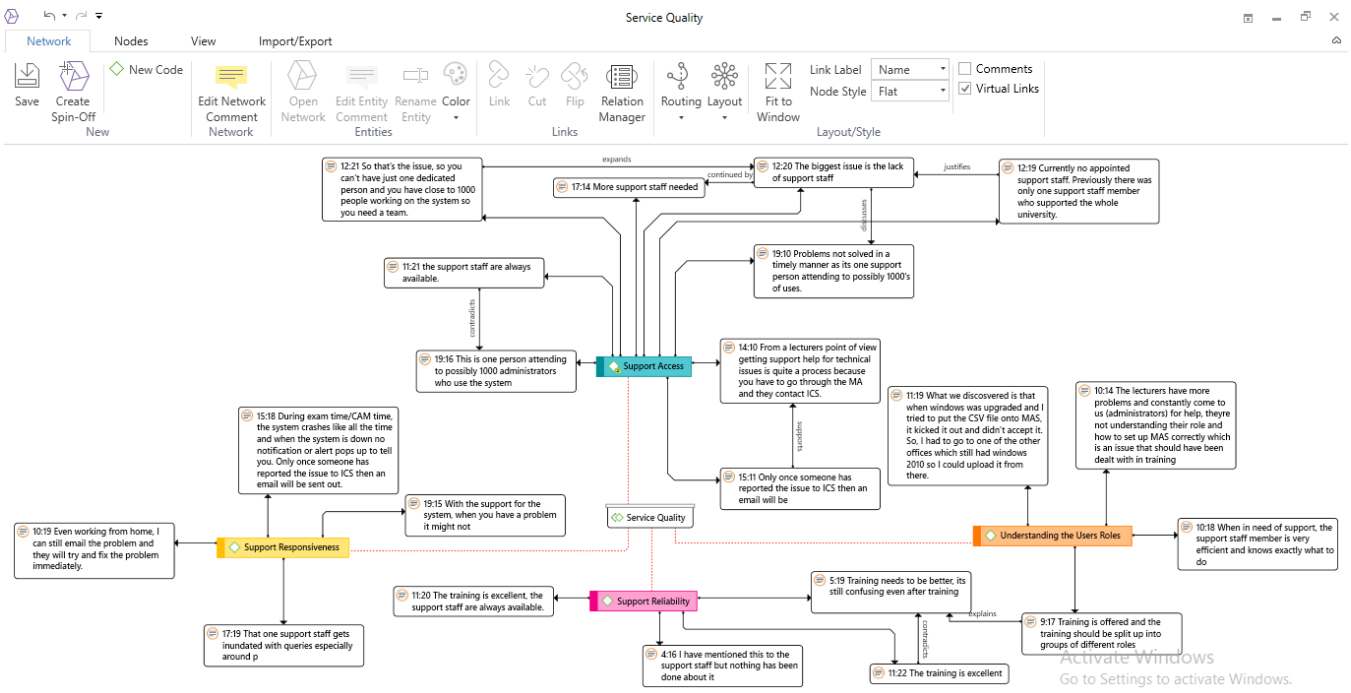

Figure 3.5 Service Quality Network Diagram

Each of the dimensions were further analysed against the dimensions presented in chapter 2. Where necessary, certain groups were broken down further into smaller, more distinct groups and those groups which do not fit within the dimensions were reviewed to be included. During analysis, the responses were used to strengthen and alter the initial conceptual framework (Chapter 2) for user satisfaction. The qualitative analysis resulted in an updated set of dimensions being established based on the literature and the qualitative data. The updated dimensions represent the outcome of the qualitative methods and analysis as an update to the conceptual framework presented in the conclusion of Chapter 2.

3.8. Phase 2: Quantitative Methods using a Survey

Quantitative methods have deeps roots in research literature in comparison to the evolving qualitative methods. Quantitative studies involve research in the form of collection of numerical values which can be reused for statistical analysis (Yilmaz, 2013). This study used a Likert-Scale survey as the quantitative method of data collection for phase 2. Two benefits of quantitative research is that the data

collection process and the responses can be dealt with in a time-efficient manner (Choy, 2014). Validity and reliability are of importance for this study to ensure that the most appropriate dimensions and descriptor items are brought together to accurately answer the main research question. Quantitative methods highly suit the importance of validity as they can ensure a higher level of validity. How this surety can be achieved is through different possible measures that can be used such as pilot studies and statistical tests which can be used to strengthen quantitative methods or instruments (Atieno, 2009).

The survey sent from the university registrar's office (appendix 5.1) was administered over a period of 3 weeks and comprised of 36 statements that were distributed to the entire population of MAS users. The structure of the survey was made up of 8 main sections which started with a section asking for users consent to participate (Refer to Appendix 5.2 User Satisfaction Instrument). This was followed by a section asking general questions pertaining to the demographics of the respondents. The remainder of the survey sections commenced with a heading for each of the dimensions and a description of the dimension. This description was provided to give the users an understanding of each dimension and the statements which followed. The statements for each of the dimensions were all positively scaled and were presented in the form of a 5-point Likert Scale ranging from 1, strongly agree to 5, and strongly disagree. The reason for choosing a 5-point Likert scale is because Leung (2011) states that the most popular scales are between 4-7 but there is no agreement in the literature as to which scale is best. At the end of each section, the users were provided with an opportunity to offer additional comments pertaining to each section

3.8.1. Survey implementation

The quantitative aspect of this research was conducted by the means of a Survey which was launched on 25th September 2018 and closed on 31st October 2018. A survey is a data collection tool and the results can be used for determining relationships or validity of variables (Glasow, 2005). The survey was administered to users of MAS. The necessity and usefulness of a survey is supported by Babbie (2001), who explains that surveys are primarily used in research where the unit of analysis are individual people (system users in the case of this study). In addition, the survey design helped specifically in determining descriptor items for the evaluation dimensions. The method of execution to implement the survey was via email (Appendix 5.1) which was sent out from the University Registrar's office to all MAS users. The completed surveys responses were automatically saved as soon as they were submitted.

3.8.2. Instrument development

The survey was implemented using an online survey platform software viz Google Forms. The motivation for this was to simplify the participation process for both the researcher and participants. From the researcher's perspective, the distribution of the survey, monitoring of how many people have participated and analysis of results were made simpler through the use of an online survey platform. From the participants perspective, it meant that they would not have to flip through multiple pages marking in multiple choice circles and easily correct any mistakes.

For the survey, the statements were based on insight from the interview analysis and synthesis of existing literature on the topic. The creation of a survey needed deep insight in order to formulate relevant statements to aid the data collection and effective analysis. The 7 main sections that comprised the survey were:

1. User Demographics
2. Business Process Quality
3. System Functionality
4. Information Quality
5. Systems Quality
6. Service Quality
7. User Satisfaction

The survey statements were grouped around each of the dimensions and definitions of the evaluation dimensions were provided in each section. The definitions enabled users to fully comprehend the context of the statements to ensure accurate responses. The statements used in the survey were positively scaled where the participants responded in the form of a 5-point Likert Scale. A number of statements used in the survey were duplicated from similar studies of information system evaluation (Armstrong, Fogarty, Dingsdag, & Dimbleby, 2005; Doumpa, 2009; P. Seddon et al., 1994; M. M. Visser, 2011; M. Visser et al., 2013). The authors used some similar and identical dimensions and their work was used to guide the process of structuring and wording of the survey items.

3.8.3. Sampling approach (Survey)

The survey targeted the entire population of MAS users at the university. This included departmental administrative staff, general administrative staff of the university and lecturers. Information about the objective of the research were provided in the survey invitation email to the users. Respondents to the survey were therefore versed with the reasons for evaluation of the system. Respondents were expected to have at least a basic understanding of the system. The survey questions probed users' expectations of how the system should function compared with how it functions and system improvements which they deemed were necessary.

The determination of what an appropriate sample size should be was determined using the Qualtrics sample size calculator. The components needed to be able to get a sample size were the confidence level, population size and margin of error. The confidence level represents the level where the sample is a true representation of the population (Israel, 1992). For the survey a 95% confidence level was used, reasoning it was a safe assumption to make that for every 100 responses, 5 have the potential to stray from the mean values. The next factor for calculating sample size was the population size, which in this case was 1563 total users of the MAS. Lastly, the margin of error refers to the level of error that the researcher is willing to accept Cochran(1977) and this study used a 7% margin of error. In this case, an acceptable minimum sample size was determined by the statistical analysis approach that was to be used., viz factor analysis. Therefore, a response of at least 150, which is a small proportion of the population was required but still suitable for a 7% margin of error.

After doing the calculation using the Qualtrics calculator using a population size of 1563, confidence level of 95% and margin of error of 7% respectively, the ideal sample was a total of 175. The survey was distributed to the entire population. Unfortunately, the number of respondents to the survey was only 102, even after a second call for responses was made to the MAS user population. Consequently, this is a limitation of the study which is discussed in subsequent chapters. A possible explanation for the response rate falling short is due to the time of year the survey was distributed being close to end of the semester meaning it was a peak time for the users of the MAS.

3.8.4. Quantitative Data Analysis

Quantitative analysis falls under the quantitative paradigm which relates to the quantitative measurement that is allocating numerical values to determine the perceived quality (Babbie, 2001). After the survey data was collected, a preliminary analysis was conducted before any statistical tests were executed. The preliminary analysis involved going through all the survey responses (see appendix

5.3). The purpose of this was to ensure that all compulsory sections were answered, any extra comments were noted, and any major data outliers were identified. For example, before the survey was launched, two test runs were conducted to ensure the survey did not have any faults – so these responses needed to be removed from the collective of responses. Post preliminary analysis, the survey analysis involved using the SPSS software to examine survey responses to determine the survey statements, referred to as items to be grouped to describe the variables for the evaluation instrument.

The information was analysed using factor analysis. By following the works of Kettinger and Lee (2005), the quantitative analysis was conducted through exploratory factor analysis. Exploratory Factor Analysis involves investigating a number of factors which can affect a variable and the variables that complement each other (Yong & Pearce, 2013). The motivation behind using factor analysis is to test and ensure that the specified descriptor items (determined through analysis of the interview transcriptions and further analysis using Atlas t.i) correspond to the associated independent variables which were Business Process Quality, System Functionality, Information Quality, System Quality and Service Quality. Gorsuch (1997) explains that item analysis serves the purpose of selecting the items that are closely matched with the construct, which in this case would be the independent variables. For this study, factor and item analysis were used to confirm the use of the suggested items for each of the independent variables. Within this process, the analysis helped to identify the best suiting and weaker items. The outcome for the factor analysis refined the 5 independent variables down to two which were renamed System Process Satisfaction and System and Service Quality Satisfaction.

3.9. Conclusion

This chapter described the research design and different methods that was used to conduct this study. To summarise the main areas the study was a single case study design following a mixed method approach. The qualitative aspect of the study was the initial phase where interviews were the data collection tool. The quantitative element of the study made use of a survey to collect data from a sample of MAS users. The next two chapters will explore the results of the qualitative and quantitative phases.

Chapter 4: Qualitative Findings & Analysis

4.1 Introduction

As per chapter 3, the first phase of the research sought to verify evaluation items that were identified in the literature. This first phase was undertaken by collecting data in the form of interviews from users of the administrative system. The interviews were focused on user experiences, based on their interaction with the system which enables them to fulfil administrative duties of their job.

The chapter is organised as follows: the first part of this chapter will discuss the responses provided from the MAS users in the interviews and the codes that were determined based on the responses. Subsequently, the second part of the chapter provides a deeper qualitative analysis of the responses from the interviews that explored using output derived from a qualitative analysis software, Atlas t.i This chapter presents the outcome of the analysis process (described in Chapter 3) which results in an updated set of evaluation dimensions. The chapter presents a synthesis of the qualitative data (post-categorisation of open codes) which represents the dominant themes presented in the findings. The different categories of data are then synthesised into dimensions for evaluating a university based administrative IS, then refined, and finally are compared to the literature and the initial conceptual framework (as per Chapter 2).

4.2 Overview of interview respondents

The different groups of staff interviewed included lecturers, administrative staff (which included marks administrators and administrative officers), faculty officers and support staff. Many of the interviews were conducted with Marks Administrators and lecturer. The last two interviews were interviews with users who work on the system from a support perspective with different roles viz. faculty officer and support staff. The users were based in different departments and faculties as shown in the table (Table 4.1). Overall there is a fair spread of staff members from various departments across the university.

Table 4.1: Demographics of Interview Participants

Staff Role	Frequency	Department	Faculty
Lecturer	6	Information Systems	Economics and Management Sciences
Lecturer	1	Extended Curriculum Program (ECP)	
Marks Administrator	1	Academic Development	
Marks Administrator	1	Information Systems	
Marks Administrator	2	Economics	

Marks Administrator	1	Finance	
Marks Administrator	1	Political Studies	
Administrative Officer	1	Accounting	
Faculty Officer	1	Administration	
Marks Administrator	1	Social Sciences	Arts
Administrative Officer	1		
Lecturer	2	Psychology	Education
Technical Support	1	Information & Communication Services (ICS)	All Faculties

The six interview questions were based around user experiences (see Appendix 4.1 for the interview schedule) to obtain a general sense of user satisfaction. Below I will briefly discuss each question and the objective behind each question to further discuss the general trend of responses given. Tables showing the frequency of responses are provided where appropriate. The tables also highlight the responses with the highest occurrences.

4.3 Support of MAS in users' work objectives

This question was designed to develop an understanding of the users' role, and what functions they use on the system. The uses of the system were similar, and only differing depending on the allocated roles of staff members. All users responded that the system supports their work objectives as it enables them to carry out their administrative tasks. The users' main uses of the system were for the capturing, vetting, confirming and publishing of students' marks. A prerequisite of this was a task of the lecturer to create a mark schedule, which would set up the structure of a module in terms of the assessments involved and the weighting the assessment carries regarding students' continuous assessment mark (CAM). Considering this, I concluded that the system supports their needs in completing those tasks to fulfil their duties. These responses are indicative that the systems high level functions are in line with the users' needs. Ultimately this explains that the system does its intended job.

4.4 Enhancing and restricting job performance

Questions 2 and 3 examined how the system affects users' performance in both a positive and negative way and how they would describe the enhancements or restrictions if any. This was used with intention to comprehend various aspects of (system) quality experienced from the system.

Table 4.2: Interview Question 2

3. How does MAS enhance your job performance?		

Response	Total	Total %
Aids processes, makes things easier & quicker	9	45%
Allows me to access student data	4	20%
Remote Access	1	5%
Does not enhance my performance	9	45%

45% of users stated that the system does not enhance their performance within their job as shown in Table 4.2. On the other hand, 33% of lecturers and more than half of the administrators felt that the system enhances their performance in the sense that it helps them by making tasks easier and being able to get the job done quicker. Overall, 45% of the interviewees stated that the system does not do anything for users to believe that the system is enhancing their performance in any way. One user (a lecturer) verifies this by concluding "*It doesn't do anything better than a spread sheet can do. But other than that, it is not a complicated system, it is not sophisticated it is just very basic*"

Table 4.3: Interview Question 3

4. How does MAS restrict your job performance?		
Response	**Total**	**Total %**
Manual DIY System	3	15%
University Provisions	1	5%
Remote Access	6	30%
Capacity	6	30%
Integration w/ other system	2	10%
Flexibility	3	15%
Reliability	1	5%
Processes	6	30%
Consistency	1	5%
University Provisions	1	5%
Downtime	4	20%
System Functionality (e.g. time outs)	4	20%
Speed	5	25%
System Support	3	15%
Doesn't restrict my job performance	2	10%
Time Consuming	2	10%
Outdated System	1	5%

Question 4 which examined the ways in which the system restricts users' performance raised a few issues (Table 4.3). The most frequent themes discussed were, remote access, capacity, integration with other systems, flexibility, processes and speed. The issue of speed is interlinked with capacity, which results in downtime. The users noted that the system tends to normally experience slow speed and

downtime when the system is in high demand, which usually occurs around peak times close to the end of the semester. In discussions about remote access, it has been established that the remote access is available; the problem is the provisions by the university for staff to gain access. For users to be able to access the system remotely, a university laptop/device needs to be used to connect to the virtual private network (VPN). In addition, while some departments have been provided the necessary resources such as laptops and dongles for data usage, most users have not, which essentially restricts them from having remote access.

The evidence also reveals that the system is very much out-dated. It is a system that was developed in 2009, making it close to 10 years old. It was noted by a couple users that the software is running on an out-dated operating system. Moreover, MAS is out-dated in the sense that is not compatible with the current version of windows. Only 5% of the users stated that the system does not restrict their job performance compared to the 95% that identified several restricting factors.

4.5 Expectations of an ideal administrative system

The fourth question was to gauge users' expectations of an ideal administrative system and what would increase their satisfaction as user. For a system to live up to an adequate level of user satisfaction, the users' expectations should be met. A gap between what the user expects and what the system provides can determine whether a user is truly satisfied with the system or not. The users of the system responded with various expectations of an ideal administrative system and the qualities it should have as shown below (table 4.4).

Table 4.4: Interview Question 4

4. In an ideal world what would be your expectations from a system like MAS?		
Response	Total	Total %
Good Speed	10	50%
User Friendly (Simple Processes, modern interface)	9	45%
Capacity	3	15%
Remote Access	4	20%
Good Functionality (e.g. Gives Notifications / Alerts)	7	35%
Continuous Feedback on modules	1	5%
Holistic view of students	1	5%
Flexibility/Access	1	5%
Integration w/ other systems	1	5%
Security	2	10%
Accurate & Reliable	6	30%

Informative	1	5%
Availability	2	10%
Minimal Manual Work	2	10%
System Consistency	2	10%
Good Processes (e.g. confirmation of mark input)	1	5%

The responses show that the lecturers' *main* expectations of an administrative system would be that the system is user friendly (44%), works with an appropriate level of speed (56%) and provides remote access. Remote access can be explained by the users being able to gain access to the system from environments outside of the University for example, working from home. The administrators also expressed the same expectations. In addition, administrators expected user friendliness (44%), good functionality, accuracy and reliability. These 3 out of the 5 main characteristics (User friendliness, speed and good functionality) denoted by the lecturers and administrators were also supported by the faculty officer and technical support as general expectations of an ideal administrative system.

4.6 Possible improvements to be made to the system

The fifth question examined the systems flaws and investigated what the major areas of improvement could be, based on users' expectations. It would indirectly answer the question of how the system is currently not providing user satisfaction. This question was one of the most important questions to get a clear understanding of users' expectations and what could potentially lead to higher levels of user satisfaction. Therefore, every response was carefully introspected, regardless of whether it was in a high or low response statistic (Table 4.5). When it comes to functionality, the users expressed improvements to be made in the way the system works such as giving notifications when deadlines for marks to be uploaded or published. Another example of a functionality improvement was to change the timeouts, so users' sessions are terminated while they are in the middle of uploading marks, sometimes it can occur without warning and marks captured might not be saved. On the other hand, some of the other themes have associations with the functionality of the system for example, general access and the system to require less human interaction. A more specific example from of the administrators is that for some system functions you need to click multiple times on a button for a response instead of just the one click.

Table 4.5: Interview Question 5

5. If you could make changes to the system what would they be and why?		
Response	**Total**	**Total%**
System Update	4	20%

5. If you could make changes to the system what would they be and why?		
Response	**Total**	**Total%**
Integration w/ other systems	6	30%
Good Speed	6	30%
Remote Access	6	30%
Security	2	10%
User Friendly (Modern Interface)	4	20%
Functionality (Gives Notifications / Alerts, Timeouts)	14	70%
Capacity	4	20%
Flexibility	2	10%
Accuracy	1	5%
General Access	1	5%
Capacity	1	5%
Processes	7	35%
Training	3	15%
System Consistency	2	10%
Less of A Manual DIY System	6	30%
Accuracy	2	10%
System Support	4	20%
Rebuild System	1	5%

The student information presented on the system is supposed to be a replica of what is on the main student admin system SASI. Majority of the users commented on the lack of integration or communication between linked systems and how it should be improved. Users have found that the two systems do not communicate with each other effectively in the sense that there may be information missing from MAS and the information is not updated in a timely manner. The resultant effects of the two systems not being in sync causes complications when trying to upload marks for students who are registered but somehow are not being reflected on the class list. MAS is highly dependent on SASI for accurate student information. This relates to another point of improvement viz. accuracy, which was raised by a small number of respondents (20%) but is still a significant matter.

The responses suggest that from a user perspective, there are numerous improvements and enhancements that can be made to the system. These improvements would alter the user experience and possibly ensure user satisfaction.

4.7 Users' final remarks

The last question was aimed to be a concluding question to gather any final remarks from the users on important issues about the system, whether they be positive comments or stressing further on problematic areas or potential areas of improvement. This gave the users an opportunity to make comments about system related issues they valued as the most important (Table 4.6). In this regard 35% of the users discussed training being of high importance whereas a small number of users mentioned positive comments about training provided. Several administrators stressed the fact that some users were not attending training, which leads to lecturers coming to ask for assistance from administrators around peak periods as they are unsure of what to do. Moreover, some users mentioned that it is not mandatory for users to attend the training. Another common comment about training is that users felt that the training was not effective as users would still find difficulty using the system. In line with Stelzer, Englert, Horold, & Mayas, (2015) and Qureshi & Qazi Abro, (2016) user friendliness is a vital trait that any system should possess. Thus, with users feeling that the system is not very user friendly even after gaining the necessary skills through training, this highlights flaws in both the training and the system itself.

Table 4.6: Question 6

6. What would you say are the most important issues you would like to express about the system?		
Response	**Total**	**Total%**
Capacity	4	20%
Availability	2	10%
Holistic view of students	1	5%
Processes	2	10%
User Friendly	4	20%
Training	7	35%
Speed	3	15%
Integration with other systems	4	20%
Access	1	5%
Functionality (Notifications/alerts)	4	20%
User Interface	1	5%
System Consistency	2	10%
Remote Access	0	0%
Realtime Effectiveness	1	5%
System Support	2	10%
Accuracy	1	5%
Security	1	5%

6. What would you say are the most important issues you would like to express about the system?		
Response	**Total**	**Total%**
System Update	1	5%

Using the Atlas t.i software was beneficial in being able to code specific comments made by users to later group them into categories. The codes provide quick access to quotes relating to specific theme that users discussed. The next section will explore the method of how codes were used to form categories which will later be used as evaluative dimensions for determining information systems success through user satisfaction.

4.8 Qualitative Analysis Process

A qualitative data analysis and research software named ATLAS t.i was utilised to study the data in depth after the interview recordings were transcribed. Documents which were the 20 individually transcribed interview discussions were uploaded onto the software. The documents were all structured identically and organised with numbered questions followed by the users' responses. The software provides a function allowing codes to be created and assigned to word, sentences or paragraphs. The codes were useful for the development of themes in relation user satisfaction of the system. The functionality of Atlas t.i made it easier to group and reference individual quotes during the analysis process. An additional feature of Atlas t.i used to help create visuals for the analysis was network diagrams. Network diagrams showcase the codes and quotes that were linked to that code. The network diagrams were also used to show the relationships between quotes that in some cases strengthen the quotes by giving support or in some cases contradict the quote.

For the responses given by users, a range of 27 codes were assigned (See Table 4.7). Initially, for the first few documents, it was a process of creating new codes also known as open coding (Elo and Kyngas, 2008). Once the codes were created and assigned to responses, it resulted in a process of grouping codes together to form code groups (Burnard, 1991). The code groups were formulated based on the inferred similarity of their meaning. Some codes may be found in more than one category.

Table 4.7: List of codes

Code	Description	Comments
Availability	The time that the systems uptime with full functionality	This code was found in questions discussing: Expectations of an ideal system Important issues
Confirmation of mark input	The system giving confirmation that a spreadsheet or mark has	This code was found in questions discussing: How the system restricts users (Negative)

Code	Description	Comments
	been successfully uploaded and saved	Improvements to be made
Flexibility	The adaptability of the system, the willingness of the systems processes to be modified	This code was found in questions discussing: How the system restricts users (negative comments) Improvements to be made
System Consistency/Reliability	The dependability of the system, does the system responds in the way it should and how it should have some consistency with its functions and processes	This code was found in questions discussing: Expectations of an ideal system How the system restricts user's performance (Negative comments) Improvements to be made Important Issues
Timeouts	This refers to the system having time limits for activities and kicking users out while uploading marks	This code was found in questions discussing: How the system restricts user's performance (Negative comments) Improvements to be made
University Provisions	This code can be explained by the university making the appropriate provisions for resources needs for staff to be able to successfully fulfil their duties, in particular while for duties that may need to be fulfilled outside of campus premises.	This code was found in questions discussing: How the system restricts user's performance (Negative comments) Improvements to be made
System Support	The staff or team employed to provide help with technical issues relating to the system	This code was found in questions discussing: How the system restricts user's performance (Negative comments) Improvements to be made Important Issues
Security	The safety of the system in terms of security of the data, access to the system and records of who users' logins with timestamps, credentials used to log in both at campus and remotely and the security of the networks being used.	This code was found in questions discussing: Expectations of an ideal system How the system restricts user's performance (Negative comments) Improvements to be made Important Issues
Accuracy	This code refers to how precise the system is in terms of the information it produces, this could be in terms of the students' information it provides, the calculation of marks or with the reports it creates.	This code was found in questions discussing: Expectations of an ideal system Improvements to be made Important Issues
Notifications/Alerts	The system providing notifications or alerts as reminders to users. This could be for purposes such as Mark deadlines Password updates System downtime Help functions	This code was found in questions discussing: Expectations of an idea system How the system restricts user's performance (Negative comments) Improvements to be made Important Issues

Code	Description	Comments
Training	End user training to fully prepare uses on how to use the system and all its functionality.	This code was found in questions discussing: How the system restricts user's performance (Negative comments) Improvements to be made Important Issues
Manual DIY System	The functionality of the system being highly dependent on user interaction and manual work.	This code was found in questions discussing: Expectations of an ideal system How the system restricts user's performance (Negative comments) Improvements to be made
Integration w/ other systems	The systems interaction, communication and syncing with other associated systems.	This code was found in questions discussing: Expectations of an ideal system How the system restricts user's performance (Negative comments) Improvements to be made Important Issues
User Friendly	How easy the system is to use.	This code was found in questions discussing: Expectations of an ideal system How the system enhances user's performance (Positive comments) How the system restricts user's performance (Negative comments) Improvements to be made Important Issues
Capacity	The number of users the system can handle at a time without malfunctioning or the amount of pressure the system can handle from a user's input/usage.	This code was found in questions discussing: Expectations of an ideal system How the system restricts user's performance (Negative comments) Improvements to be made Important Issues
Processes	The procedures users have to go through to complete tasks e.g. Setting up or changing the mark schedule, uploading marks, changing marks.	This code was found in questions discussing: Expectations of an ideal system How the system enhances user's performance How the system restricts user's performance (Negative comments) Improvements to be made Important Issues
Access	The ease of access of the system while at campus and remotely.	This code was found in questions discussing: Expectations of an ideal system How the system restricts user's performance (Negative comments) How the system enhances user's performance (positive comments) Improvements to be made Important Issues
Speed	How fast the system responds	This code was found in questions discussing: Expectations of an ideal system How the system restricts user's performance (Negative comments) Improvements to be made Important Issues
System Functionality	How the system works, what the system should be doing, what it is capable of doing and what the system actually does.	This code was found in questions discussing: Expectations of an ideal system How the systems restrict user's performance (Negative comments)

Code	Description	Comments
		How the system enhances user's performance (positive comments) Improvements to be made Important Issues
Positive Comments	General positive comments made about the system	
Negative Comments	General negative comments made about the system	

The first step in this analysis process was to use the initial conceptual framework created at the end of the literature review (Chapter 2), to align codes together that would fit the dimensions that lead to User Satisfaction (US). These initial dimensions were: Information Quality (IQ), System Quality (SysQ) and Service Quality (SQ). A high-level table of code groups will be shown in the section to follow but appendix 4.3 shows an example of a code table created for Service quality, it contains examples from the interviews which pertain to each code. Codes were assigned into groups based on the predetermined dimension as per the conceptual framework developed in chapter 2. However, there were some codes where there was no fit and due to this new code groups were developed.

Post forming code groups and network diagrams for the quality aspects, there were some codes which could be grouped together to form new groups. These were different from what was found in the literature on the topic of information systems evaluation. The context of university administrative systems differs from most of the studies and dimensions used in other studies of information systems evaluation may not be applicable. This means the existing models can be adapted from traditional dimensions, to dimensions which are complementary to the context of this study.

The new dimensions which were identified were business process quality (BPQ) and system functionality (SF) In the following section the 5 US dimensions are discussed in detail.

4.9 Dimensions of User Satisfaction for the Evaluation of MAS

The qualitative analysis process led us to the previously mentioned 5 dimensions of user satisfaction. This section will provide information on each of the individual dimensions and their relevance to the research of user satisfaction of university administration systems. Each dimension will be explored through a definition provided by the literature, and in some cases a definition based on the literature but altered for the context of the research. Thereafter, all the codes pertaining to each dimension are presented with descriptions.

4.9.1 Information Quality

Information quality relates to the value that is created with the information output that the system produces (DeLone & McLean, 1992; Iivari, 2005). With the MAS system primarily dealing with the information that is recorded by users and stored on the system, this dimension plays a key role in the evaluation of the information system. The quality of information produced is of substantial value to the users as the information, which is the students' marks, makes up the main output of the work the users see while interacting with the system. Students' marks are entered on to the system manually, entering marks one by one or, by uploading a spread sheet with the marks. Table 4.8 shows the codes that align with the Information Quality Dimension and a description of each code.

Table 4.8: Code Group - Information Quality

Code	Description
Accuracy	This code refers to how precise the system is in terms of the information it produces, this could be in terms of the students' information it provides, the calculation of marks or with the reports it creates.
Integration w/ other systems	The systems interaction, communication and syncing with other associated systems.
Security	The safety of the system in terms of security of the data, access to the system and records of who users' logins with timestamps, credentials used to log in both at campus and remotely and the security of the networks being used.

Information Quality from a user perspective, based on data from user responses show there are various expectations of the quality of information the system supports and produces. Accuracy is one of the highest priorities when evaluating information quality. In this case, the system deals with students' academic marks which will later be used for the purpose of creating an academic report in the form of a transcript. The marks processed via this system need to be as accurate as possible. There are also other factors which can affect the accuracy of the information produced by a system, this being the systems dependency and integration with other systems.

The information quality of some administrative systems is dependent on the integration with other systems. The users expect the related systems to be linked to ease the process of transferring information from one system to another. In line with this, users also expect the system to automatically gathering information from the linked systems regularly enough to not lead to discrepancies. One example from this case would be the integration with Microsoft Excel, which needs the system to be competent and compatible enough with excel. This is imperative so that when spread sheets from excel are uploaded the information is shown on the system correctly. A second example, the integration between MAS and SASI needs to be functional without error so that it eliminates the problems associated with student details being presented on MAS incorrectly. The systems need to be able to communicate with one

another effectively to reduce errors. All mentioned problems present problems for the users who then produce information outputs which aren't correct – thus this mitigates against user satisfaction.

User satisfaction is also derived from the user knowing how secure the system is. Security is the third code derived from user responses which is an informative measure of information quality. The security of a system needs to be enough to protect that data on the system. The users mentioned that the system has a protocol where passwords need to be changed after a certain period. On the other hand, the procedures involved are not so secure. Likely reasoning for this is that there are no notifications for when the password needs to be changed and regaining access requires the support staff to change the password and then pass the password on to the user. This raises too much of a security risk as it means the support staff now have access to the user's personal passwords and the systems information.

In summary, the input and output of information from administrative systems must produce and maintain the utmost level of quality. Such information contributes to the students' academic position and in turn serves as a representation of the university administrative structure and the university.

4.9.2 System Quality

System Quality and its definition has produced some debate over what exactly the term system quality refers to. In particular Garrity and Sanders (2003) addressed the use of System Quality in the D&M Model, pointing out that their definition of system quality is unclear. For the purpose of this study the term system quality will look directly at the attributes of the system as it turns inputs into outputs. This definition is in line with the definition used by Nelson, Todd and Wixom (2005) which describes system quality as the functions of the system responsible for production of output. The relevance of system quality looks at the system itself and how the system provides value in relation to its purpose and usability. The context of system quality links back to a definition provided in chapter 2 by Petter, DeLone and McLean (2008) which discusses system quality referring to the necessary attributes of the system. The dimension is required as it plays a role in the satisfaction users perceive of the system. This dimension also enables us to depict a relationship between information quality and system quality from the perspective of the user as hypothesised by (Xu et al., 2013).

Table 4.9: Code Group: System Quality

Code	Description
Access	The ease of access of the system while at campus and remotely.
Availability	The time that the systems uptime with full functionality

Reliability	The dependability of the system, does the system responds in the way it should and how it should have some consistency with its functions and processes
Security	The safety of the system in terms of security of the data, access to the system and records of who users' logins with timestamps, credentials used to log in both at campus and remotely and the security of the networks being used
Speed	How fast the system responds to user commands
User Friendly	How easy the system is to use.

From a user perspective the responses from the interview implied that a satisfactory level of satisfaction can be achieved through maintaining various attributes. These attributes discussed as System Quality codes (Table 4.9) were having access to the system remotely as well as on site, the system being both available and reliable, flexibility, no issues with user capacity, quick system response and being user friendly. The interview allowed users to discuss their expectations of an ideal administrative system and most users mentioned the attributes above. They would expect the system to be available almost 100% of the time, with room for downtime during periods of maintenance. The system would also need to be fast and able to handle a large volume of users without decreasing functionality or system response time. Users also stated that for the system to meet their needs as lecturers and administrative staff, who sometimes do not need to be present within the campus environment, the system would need to be easily accessible remotely. Linked with this, a small number of users extended this but suggesting the system could have a spin off app which would have limited functionality but would still allow users to use the system remotely and with ease.

Although system quality and its technicality can refer to the functionality of the system, I concluded that due to functionality being a vital part of users' satisfaction, it could be a dimension of its own. This will be addressed towards the end of the section.

4.9.3 Service Quality

As defined by DeLone and Mclean, service quality is the "quality of the support that system users receive from the information systems organisation and IT support personnel"(DeLone and Mclean, 2016, p.11). Service quality is a strong dimension to capture in the context of user satisfaction as both service quality and user satisfaction deals with an aspect of user's perceptions and fulfilment of user goals. The 4 codes derived from the interviews that make up the service quality dimension were system update, university provisions, training and support staff. However, after analysing the literature on information systems service quality, these can be translated into the dimension listed in Table 4.10

Table 4.10: Code Group: Service Quality

Code	Description

Support Access	Convenient access to staff or team employed to provide help with technical issues relating to the system. Also including end user training to fully prepare users on how to use the system and all its functionality.
Support Reliability	How effective is the service provided by support staff and the university regarding MAS.
Support Responsiveness	How receptive are providers of service in dealing with users' problems in a timely manner.
Understanding/Knowing the user	Comprehending the users' role and their functions on the system to be able to help when assistance is needed.

With any system, users of the system are dependent on training provided and assistance given when problems arise which matches with the support access code. Some users felt that training provided was enough and there were more pressing issues, while others felt that the training did not help their understanding on how to use the system. If users are still unable to fully understand how to use the system after training, this queries the reliability of the quality of service. Nonetheless, training is important as it can enhance the usability of the system which can affect user satisfaction. It is quite apparent that in this case, the support is not adequate for the job of attending to a campus with thousands of users thus resulting in low levels of responsiveness. The provision of a quality service is vital when dealing with large numbers of users as in this study. Furthermore, having a clear understanding of the user's needs and functions on the system is necessary.

4.9.4 Business Process Quality

Business processes can be defined as a "set of logically related tasks performed to achieve a defined business outcome" (Davenport & Short, 1990, p.12). The users of the MAS are assigned roles which are linked to the business process of administrating students' marks which is the business outcome in this scenario. Business process quality can be linked to system quality or be a subset of system quality. The processes involved with tasks users can facilitate on the system, need to be evaluated along with the nature of the task being considered, when assigning the process of how the task is done. Lastly, the process of how the task is to be executed should be assessed against the simplicity of the methods the user has to take in order to complete the task and processes need to be consistent for similar tasks. For example, the process of inputting a mark for a term test or assignment, should be similar if not identical for inputting a mark for an exam or supplementary exam.

Table 4.11: Code Group: Business Process Quality

Code	Description
Integration with other systems (programs)	The systems interaction, communication and syncing with other associated systems or programs.
Manual DIY System	The functionality of the system being highly dependent on user interaction and manual work.
Processes	The procedures users must go through to complete tasks e.g. Setting up or changing the mark schedule, uploading marks, changing marks.

The codes representing this dimension (Table 4.11) relate to the integration with other systems, the system needing too much human intervention and the processes themselves. Users explained that some processes for tasks require too many unnecessary steps for example double or triple clicking for the system to accept a command. Another example given was that before entering a mark the input field already has an absent sign which must be deleted before entering a mark. These are examples of processes which make the process more time consuming that it needs to be.

4.9.5 System Functionality

System Functionality is a dimension that was formed considering the relationship between the systems functions and the systems purpose. The systems purpose should be supported by the business processes of the system. In addition, system functionality is dependent on the business processes. Without the business processes and system functionality being aligned, there is a mismatch which can downgrade the quality of the overall system and user expectations. The codes that determine the dimension System Functionality are listed in table 4.12.

Table 4.12: Code Group – System Functionality

Code	Description
General Functionality	How the system works, what the system should be doing, what it can do and what the system does.
User Input Confirmation	The system giving confirmation that a spreadsheet or mark has been successfully uploaded and saved
Notifications/Alerts	The system providing notifications or alerts as reminders to users. This could be for purposes such as Mark deadlines Password updates System downtime Help functions
System Timeouts	This refers to the system having time limits for activities and kicking users out while uploading marks

The users' perception of the system is also based on how the system works, what it can do, what users can do and how this enhances their job performance and experience. The dimension is complex and needed to be separated from the way the system quality dimension is being addressed in this context.

In this regard, system quality is addressing attributes of the quality the system delivers while system functionality relates specifically to the functionality of the system which should be aligned to business processes. The codes created that are categorised under system functionality are applicable in this context however, they can be generalised for universal administrative systems.

4.10 Dimensions of evaluation

In summary, based on review of the literature, and the subsequent qualitative findings presented in this chapter, I arrived at a revised set of dimensions for evaluating a system (Table 4.13). The table contains codes that were verified from the responses given by users and some which were taken from the literature and contextualised to fit the framework of university administrative systems. The description given is therefore an updated combination of contextual descriptions given from the code table (table 4.7) and definitions established in the existing literature on the topic. These are the following items that appear to be relevant for system evaluation in a university administrative context:

Table 4.13: User Satisfaction Dimensions

Evaluation Item	Sub Items
Information Quality	Accuracy Integration with other systems Security
System Quality	Access Availability Reliability Speed User Friendliness Flexibility Capacity
Service Quality	Support Access Support Responsiveness Support Reliability Understanding the User
Business Process Quality	Integration with other systems Manual DIY System Processes
System Functionality	User input confirmation Notifications/ Alerts System Timeouts General Functionality Accessing external information from linked systems Being able to do multiple things at once Help functions

4.11 Updated Conceptual Framework

The main outcome of the qualitative analysis is pictured in Figure 4.1, which is based on updated set of dimensions and their associated codes. The coding process yielded two new code groups which were different from what was revealed in the literature review. Interpretation of the existing literature and the data collection and analysis presented an opportunity to review and update the initial conceptual model. The new dimensions which were identified were *business process quality* and *system functionality*.

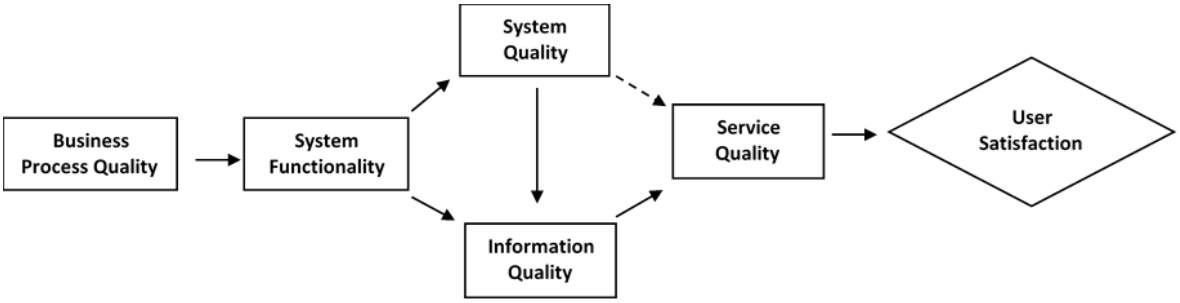

Figure 4.1: Updated user satisfaction model: University administration information system

In light of the review of the literature, and the subsequent qualitative findings an updated set of IS evaluation dimensions for a university administrative system were arrived at (Figure 4.1). To conclude and address the new conceptual framework for the chapters to follow, the 5 dimensions and descriptions and relationships need to be explained.

Business Process Quality pertains to the way in which the system aligns to the processes the users have to undertake to complete mark administrative tasks. The latter is associated with *System Functionality* which is related to how the system functions in relation to users' interaction with the system. The next three dimensions leading on from System Functionality are the three main quality dimensions. The *Information Quality* dimension represents the quality of information provided by the system such as the accuracy of the information. *System Quality* represents the quality of the attributes of the system, such as how secure the system is. Lastly, we posit that *Service Quality* is determined by the latter two constructs, and it represents the provision of services to users in terms of attributes such as responsiveness and assurance. All these dimensions can be assessed and analysed from a user perspective to derive a level of user satisfaction, which in essence represents the level of IS success.

Chapter 5: Quantitative Findings & Analysis

5.1. Introduction

This study on determining dimensions for evaluating university administrative systems, has been explored through answering research sub-questions that support specific objectives of the research. The research question that is addressed in this Chapter is: What items best describe each dimension? This research question supported the third research objective viz. "*To develop and validate dimensions to measure the success of university administration information systems".* As per the quantitative element of the mixed methods approach, this phase entailed the online distribution of a survey to the users of the administrative system (MAS) through use of the google forms platform. The chapter will explore the nature and purpose of the survey, describe the deployment of survey, present statistical results and finally discuss and reflect on the quantitative analysis.

The qualitative analysis presented in the previous chapter, provided multiple descriptor items for each of the proposed 5 dimensions to measure user satisfaction. The dimensions in the updated conceptual framework (see Chapter 4) were used in the survey and each section had its own set of statements which represent the descriptor items for each dimension. To be able to answer the research question mentioned above, the descriptor items needed to be tested.

5.2. Evaluation of the MAS System: Descriptive Results

The purpose of the survey was to obtain information directly from the users based on their perspective on the evaluative dimensions in relation to MAS. This section provides an overview of the responses the users provided in the survey in the form of descriptive statistics.

5.2.1. Participants consent and demographics

Of the users who participated, there was at least one user from each of the 7 faculties and they were based in over 30 different departments. The ages of the users varied as shown in Figure 5.1 with over 70% of users being in the range of 30 to over 50 years of age. Additionally, 85% of all users rated their expertise of computer-based systems as intermediate or advanced (Figure 5.2) and 66% have had 4 or more years of experience using the system (Figure 5.3). This evidence of users experience with the system is an indication of the confidence in the responses in terms of its evaluation.

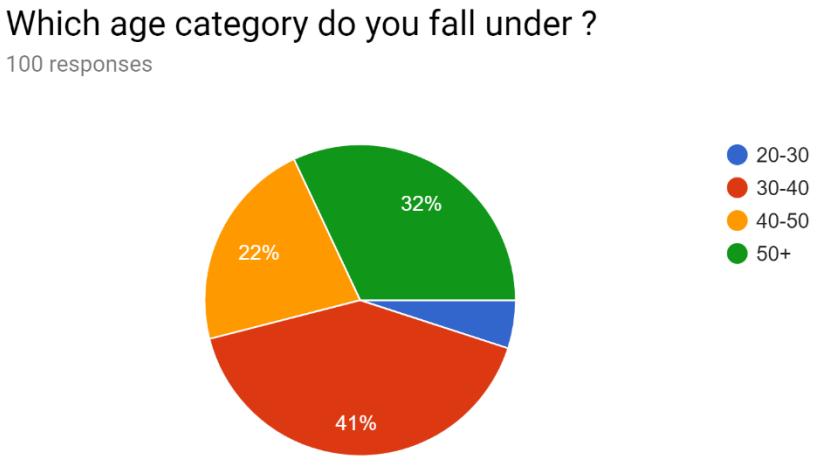

Figure 5.1: Age Categories

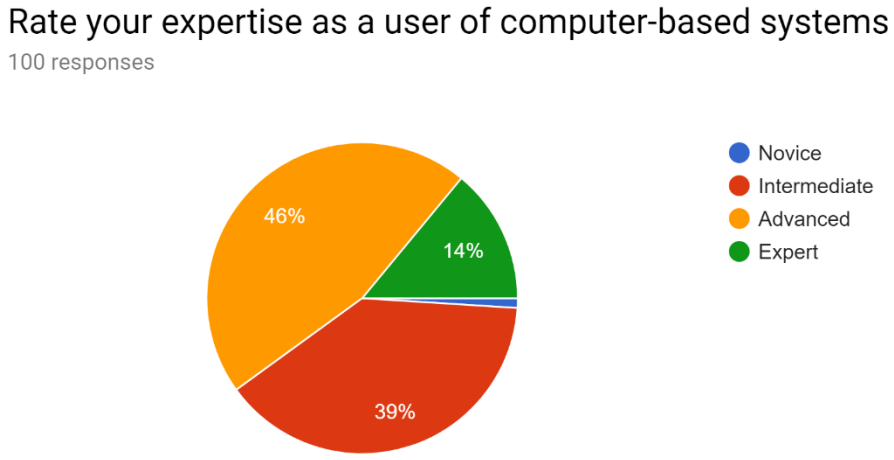

Figure 5.2: Expertise in using computer-based systems

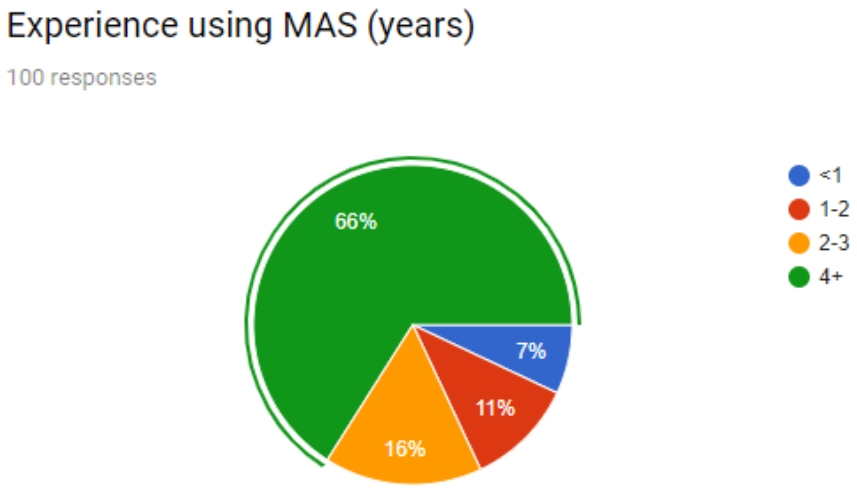

Figure 5.3: Experience using MAS

5.2.2. Business Process Quality

Business process quality was one of the dimensions not identified in the literature but was derived through the qualitative analysis was integrated into the conceptual framework. As per the literature this dimension is not one which was identified in key literature. The

uniqueness of this dimension makes the findings informative to understanding the user's perspective of this system aspect. The responses to the questions pertaining to this dimension are presented in Table 5.1.

Table 5.1: Business Process Quality Descriptive Statistics

Likert Scale Response Rate (%)					
1 Strongly Agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree	Item Mode
P1A: I am satisfied with the number of steps I must take to complete a task					2
11,8	40,2	17,6	22,5	7,8	
P1B: The processes to perform tasks are simple					2
16,7	38,2	18,6	19,6	6,9	
P1C: The system's process for uploading marks manually is easy					2
13,7	40,2	21,6	18,6	5,9	
P1D: The system's process for uploading marks via spread sheet is easy					2
17,6	32,4	265	14,7	8,	
P1E: It is easy to undertake changes to marks					2
12,7	30,4	13,7	30,4	12,7	
P1F: It is easy to make changes to a mark schedule					2
11,8	27,5	21,6	26,5	12,7	

The responses given about the business process quality show that in general, the users are satisfied with the business process quality of the system. An example of this, is that 52% of the users agreed or strongly agreed that they were satisfied with the number of steps users are required to undertake to complete a task (P1A). The responses also signify that users are satisfied with the simplicity of the process for inputting marks one by one (P1C) and uploading marks via an excel spreadsheet (P1D). On the other hand, when asked about the ease of making changes to marks (P1E), 43.1% agreed or strongly agreed that the process is simple and 43.1% who disagreed or strongly disagreed that it was not simple enough. This presents a balanced argument as to whether the process for changing marks is simple enough. On the topic of making alterations, 39.2% also disagreed or strongly disagreed, declaring the process for making changes to a mark schedule is not easy (P1F). The mode of each survey item pertaining to business process quality was 2. The results present an understanding that the business processes of the system are beneficial for the users' general functions but may need some adjustments. Based on the responses, the most vital improvement to the system would need to be made to accommodate users who need

to make changes to their mark schedule or students marks, which are both associated with the main function of the systems usage.

5.2.3. System Functionality

System functionality is another dimension which emerged as a finding from the qualitative data analysis. The survey response shown in table 5.2 in respect of the system functionality of the MAS showed that a majority of respondents agreed with all the statements apart from one.

Table 5.2: System Functionality Descriptive Statistics

Likert Scale Response Rate (%)					
1 Strongly Agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree	Item Mode
P2A: The functionality offered by the MAS system aligns well with my work processes					2
10,8	48,0	17,6	17,6	5,9	
P2B: The system responds quickly to commands					2
11,8	36.3	24.5	16.7	10,8	
P2C: The system currently offers all necessary functionality for my job role					2
10.8	52.9	19.6	9.8	6.9	
P2D: The system allows me to complete and save a task before timing out					2
15.7	36.3	24.5	18.6	4.9	
P2E: The system allows me to do multiple tasks simultaneously					4
2.0	9.8	22.5	46.1	19.6	

The results shown in Table 5.2 indicate the mode for each item was 2 apart from P2E where 65.7% of users disagreed or strongly disagreed with the statement “The system allows me to do multiple tasks simultaneously”. An overview on the findings from the system functionality section indicates that the system functions well and is aligned well with the users’ duties on the system. However, users are restricted to do one process at a time which could be an indicator that this aspect of the system does not enhance their work performance. This is an area where system functionality can be improved.

5.2.4. Information Quality

The section contained statements assessing the quality of the information output. Responses to statements in relation to the quality of the information output of MAS indicates a mode of 2. This indicates that in general respondents agreed with the statements. (Table 5.3).

Table 5.3: Information Quality Descriptive Statistics

Likert Scale Response Rate (%)					
1 Strongly Agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree	Item Mode
P3A: The information provided by MAS is always timely					2
13.7	49.0	24.5	11.8	1.0	
P3B: The information provided by MAS is always accurate					2
10.8	50.0	23.5	14.7	1.0	
P3C: The information that I source from MAS is reliable					2
16.7	53.9	18.6	8.8	2.0	
P3D: The system does accurate calculations of students' semester marks					2
22.5	53.9	11.8	9.8	2.0	
P3E: The data on MAS is accurately imported from SASI.					2
11.8	35.3	27.5	21.6	3.8	

To be more precise, over 50% of the respondents agreed or strongly agreed that in alignment with the MAS information quality, the information output was timely, accurate and reliable. Differently, the last statement (P3E) which addressed the accuracy of information that is provided from the parent system SASI, users were more diverse in their answers. Overall, in relation to P3E 47.1% strongly agreed or agreed, 27.5% who were neutral and only 25.4% who disagreed or strongly disagreed. Information from P3E leads to the explanation that there is no consensus among users regarding this statement or that users had differing experiences with the parent system SASI and the data feed it provides. The information quality of the system is at a satisfactory standard for the users besides the need for better alignment between the parent system SASI and MAS. In essence focus needs to be centred around ensuring real-time updating of information on both systems.

5.2.5. System Quality

System quality examined the quality of the system attributes of the MAS. The responses to questions in this section of the questionnaire are shown in table 5.4.

Table 5.4: System Quality Descriptive Statistics

Likert Scale Response Rate (%)					
1 Strongly Agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree	Item Mode
P4A: Only basic computer proficiency is needed to use the system					2
12.7	51.0	13.7	19.6	2.9	
P4B: The system is user friendly					2
10.8	33.3	19.6	22.5	13.7	
P4C: The system is easily accessible on university premises					2
26.5	56.9	13.7	2.0	1.0	
P4D: The system is easily accessible when I am not on campus					4
2.0	17.6	19.6	35.3	25.5	
P4E: The system is always available when I need to use it					4
6.9	30.4	24.5	34.3	3.9	
P4F: The system securely stores data					2
16.7	49.0	30.4	2.9	1.0	
P4G: The systems response to queries is quick					3
8.8	31.4	42.2	13.7	3.9	
P4H: The system's response time is not affected during times of peak use					4
2.9	13.7	24.5	43.1	15.7	

Over 60% of respondents agreed or strongly agreed that the system requires only basic computer proficiency (P4A), is easily accessible on university premises (P4C) and accurately stores data (P4F). On the other hand, in relation to the system being accessible outside of the university premises (P4D) and the systems response time remaining efficient during peak times (P4H) over 50% of users disagreed or strongly disagreed. This responses to this evaluation dimension also indicate some uncertainty regarding the systems having a quick response to queries (P4G) as 42.2% were neutral and 40.2% agreed or strongly agreed with the statement. Similarly, the user's responses regarding the system being available when they need to use it (P4E), the responses showed that 38.2% disagreed or strongly disagreed and 37.3% agreed or strongly agreed. This item resulted in a mode of

4. The results from this section exhibits less agreements on the satisfaction from the system quality when compared to the general trend of responses from the previous sections. From the users' responses it appears that that there are several areas for improvement for the quality of the systems attributes that could be considered. The improvements include the system being easily accessible outside of campus premises, the system always being available, the system response time to queries being quicker and the response times not being affected during peak times.

5.2.6. Service Quality

This section contained statements which focused on the service that is being provided to the users of the system by the Information and Communications Services support staff at the university. As argued in Chapter 2, this is also a relevant dimension of evaluation when analysing the effectiveness of a system and how the users perceive satisfaction with a system. The results relating to this dimension are a good indicator of improvements to the service quality aspect of the system, which supports the importance of the dimension as presented in the literature. Table 5.5 presents the responses to the Service Quality statements.

Table 5.5: Service Quality Descriptive Statistics

Likert Scale Response Rate (%)					
1 Strongly Agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree	Item Mode
P5A: When using the system, I do not experience problems which I cannot resolve alone					4
2.9	28.4	26.5	34.3	7.8	
P5B: When I encounter a problem, I know who to contact and the procedure to go through					2
19.6	30.4	15.7	24.5	9.8	
P5C: The procedure for acquiring technical support for the system is easy					4
11.8	20.6	22.5	36.3	8.8	
P5D: I believe that there is sufficient support staff available					4
8.8	22.5	25.5	25.5	14.7	
P5E: The technical support for MAS provides users with a fast service					3
12.7	14.7	30.4	27.5	14.7	
P5F: The support staff for the system are technically competent					2
13.7	39.2	39.2	4.9	2.9	

P5G: It is possible to use MAS without having been trained					4
4.9	30.4	15.7	33.3	15.7	
P5H: I am encouraged to attend training					2
21.6	37.3	28.4	8.8	3.9	

The users who disagreed or strongly disagreed (49%) were slightly more than the users who agreed (35.3%) with the statement that it is possible to use the system without being trained first (P5G). In the same regard, 45.1% disagreed or strongly disagreed with the statement claiming that the procedure for getting technical support is easy (P5C) which is more than the 12.7% who agreed. When the responsiveness of the support staff was questioned (P5E), users had to agree or disagree on whether technical support provide a fast service. The responses showed that 30.4% of users gave a neutral response but the users that disagreed were a greater percentage of 42.2% which includes those who merely disagreed (27.5%) and those who strongly disagreed (14.7%). This gives evidence that the technical support staff do not provide a fast service, and this is an area for improvement with regard to service quality.

Overall, the responses to the questions in this dimension indicates a lot of negative feedback. For example, P5B probed whether the users are aware of the people to contact when they need help and the mode for this item was 2 meaning most users agreed or strongly agreed (50%). However, in terms of the procedure for acquiring help being easy (P5C) the most common answer was 4 indicating the procedure isn't simple. In addition to this, 58.9% of the users responded that they are encouraged to attend the training (P5H), however 31.3% agreed they still come across problems which they cannot resolve without technical assistance (P5A). The interpretation of this is that there are problematic areas of the overall quality of service to the users of the system.

5.2.7. User Satisfaction

The last section of the instrument focused on the users' perceptions of their overall satisfaction with the MAS (Table 5.6).

Table 5.6: User Satisfaction Descriptive Statistics

Likert Scale Response Rate (%)	

1 Strongly Agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree	Item Mode
P6A: I enjoy using MAS					2
15.7	31.4	31.4	11.8	9.8	
P6B: I am satisfied with the systems user interface					2
10.8	35.3	23.5	20.6	9.8	
P6C: Using MAS makes my job easier					2
17.6	41.2	18.6	11.8	10.8	
P6D: Overall, I am satisfied with MAS					2
12.7	41.2	19.6	18.6	7.8	

The mode of each of the individual items was 2 showing that users agreed with the statements. For example, 47.1% of users agreed or strongly agreed that they enjoy using MAS (P6A) and 58.8% of users agreed that using MAS makes their job easier (P6C). In each of the statements within this section the users who agree are more than double the number of users who disagree which is shown in Figure 5.4. Figure 5.4 clearly demonstrates that the users are satisfied with the system overall. From the results from all the previous sections, one can infer that the users are in fact satisfied with the system as it aids their duties and make their job easier. Nonetheless, there are some improvements that can be made to enhance the level of satisfaction being attained from the MAS, mainly in the area of system and service quality.

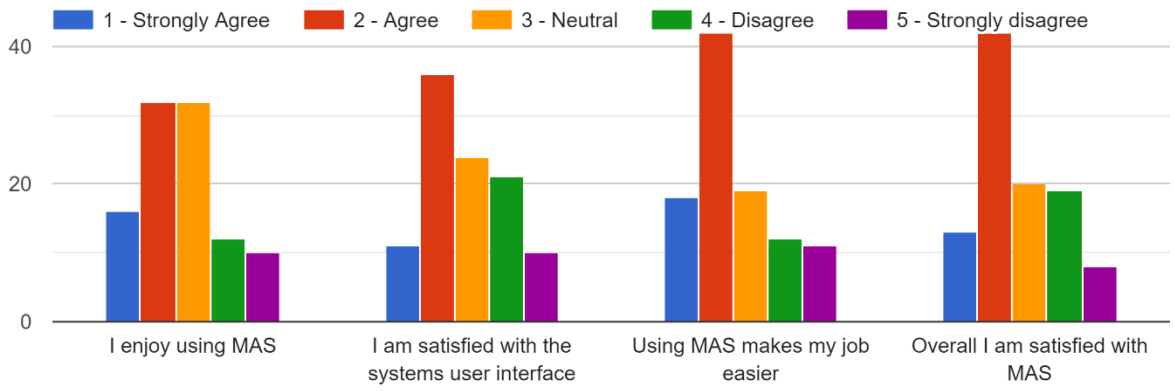

Figure 5.4 Users reflection on their satisfaction with MAS

5.3. An assessment of the system evaluation dimensions

The underlying objective of this study was to determine dimensions for the evaluation of a Marks Administration System. This goal entailed developing the evaluation criteria which would be the items that would describe each of the individual dimensions. These dimensions were developed through qualitative procedures discussed in Chapter 4. Overall, the findings presented a useful array of results, the users responses provided insight on their experience with the system. The next step was to then test that the dimensions and their associated items were appropriate to measure the effectiveness of the system in question. The main method of analysis for the quantitative phase was factor analysis which is within the family of factor analytic techniques with several uses. Factor analysis allows the researcher to condense a large set of variables or scale items down to a smaller, more manageable number of dimensions or factors (Reio & Shuck, 2015). How this is achieved is through searching for groups and summarising the underlying patterns of correlation (Pallant, 2013). It is not designed to test hypotheses or to assess whether one group is significantly different from another. It is used extensively by researchers involved in the development and evaluation of tests and scales (Osborne, 2015), which was the objective of this study

5.4. Factor Analysis Rationale

The term 'factor analysis' encompasses a variety of different, although related techniques. One of the main distinctions is between what is termed principal components analysis (PCA) and factor analysis (FA). These two sets of techniques are similar in many ways and are often used interchangeably by researchers (Abdelmoteleb & Higgs, 2010). Both techniques attempt to produce a smaller number of linear combinations of the original variables in a way that accounts for most of the variability in the pattern of correlations (MacGregor & Kourti, 1995; Tucker & MacCallum, 1997).

They do differ in a number of ways, as in principal components analysis the original variables are transformed into a smaller set of linear combinations which are easier to comprehend (Abdelmoteleb & Higgs, 2010). In factor analysis, however, factors are estimated using a mathematical model, where only the shared variance is analysed (Yong & Pearce, 2013). For this analysis, the Principal Components Analysis is used. Although

both approaches (PCA and FA) often produce similar results, books on the topic often differ in terms of which approach they recommend. Stevens (1996 pp. 362–363 cited in Pallant, 2013) agrees to having a preference for principal components analysis and advocates that it is psychometrically comprehensive, mathematically less challenging, and it avoids some of the potential factor analysis issues with 'factor indeterminacy'. While assessing both FA and PCA it was established that an experimental summary of the data set is better attained through PCA whereas an interest in a theoretical resolution that is undisturbed by unique and error variability is complemented by factor analysis (Tabachnick & Fidell, 2001).

There are two main approaches to factor analysis that are described in the literature—exploratory and confirmatory. Exploratory factor analysis is often used in the early stages of research to gather information and explore the interrelationships among a set of variables (Osborne, 2015). Confirmatory factor analysis, on the other hand, is a more complex and sophisticated set of techniques used later in the research process to test previously specified theories concerning the structure underlying a set of variables (Williams, Onsman, & Brown, 2010). Given that the research was an exploratory study to develop evaluation criteria for a university system, this study used confirmatory factor analysis.

5.5. Steps involved in factor analysis

This section will describe the four main steps that were followed in factor analysis as discussed in the SPSS manual (Pallant, 2013) and by Williams, Onsman and Brown (2010). The following assumptions are put forward as per the SPSS survival manual:

- ***Sample size***: Ideally the overall sample size should be 150 as mentioned earlier based on other researchers' recommendations. Moreover, there should be a ratio of at least five cases for each of the variables (Osborne & Costello, 2004).
- ***Linearity***: Due to factor analysis having strong links with correlation it is assumed that the relationship between the variables is linear.
- ***Outliers***: Factor analysis can be sensitive to outliers, so as part of the initial data screening process, outliers were checked for and none were found.

5.5.1. Step 1: Suitability of the data for factor analysis

One consideration when determining the suitability of the data factor analysis is the sample size. The literature presents little agreement among authors concerning how large a sample should be (Comrey & Lee, 1992; Hair, Anderson, Tatham, Black, & Hair Jr, J.F.; Anderson, R.E.; Tatham, R.L.; Black, 1995; Hogarty, Hines, Kromrey, Perron, & Mumford, 2005; Nunnally, 1979; Barbara G Tabachnick & Fidell, 2014). In small samples the correlation coefficients among the variables are less reliable and factors obtained from small data sets do not generalise as well as those derived from larger samples. Various authors have different opinions on the suggested sample sizes. Stevens (1996) suggests that the sample size requirements advocated by researchers have been reducing over the years as more research has been done on the topic. Nunnally (1979) suggests 10 cases for each item to be factor analysed which is a 10:1 ratio. Nevertheless Tabachnick and Fidell (2014) and Hair *et al* (1995) do acknowledge that smaller sample sizes such as 150 and 100 (respectively) can produce adequate outcomes if results show marker loadings that exceed 0.80 (Pallant, 2013).

Inter-correlations between the items are the second area of concern and can help guide the decision of the suitability of factor analysis. To determine the suitability, it is recommended that an analysis of the correlation matrix is executed and factor analysis would not be advised in cases where the majority of coefficients are below .3 (Barbara G Tabachnick & Fidell, 2014). The features of SPSS were also assisting in the preliminary procedures undertaken before factor extraction. These procedures consist of Bartlett's test (Bartlett, 1954) which is a method to produce a factor scores that are correlated with a specific factor (Yong & Pearce, 2013) and the Kaiser-Meyer Olkin (KMO) measures (Kaiser, 1970, 1974) which is used to determine the suitability of the data to conduct factor analysis (Treiblmaier & Filzmoser, 2009). With both tests there are certain results that need to be achieved for factor analysis to be utilised which are also some of the assumptions that are aligned with factor analysis. For example, for the Bartlett's test of sphericity a minimum of p =.05 is the standard (Williams, Brown, & Onsman, 2010) and a minimum KMO index of .6 (B. G. Tabachnick & Fidell, 2001)

In the **Correlation Matrix** table (Table 5.7), the results present correlation coefficients of .3 and above, which satisfies assumption 2. Therefore, our use of factor analysis for this

analysis is appropriate. Results show that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value is above .6. In-addition, the Bartlett's Test of Sphericity value is significant (i.e. the Sig. value should be .05 or smaller). In this analysis the KMO value is .874, and the Bartlett's test is significant (p=.000), therefore factor analysis is appropriate.

Table 5.7: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.874
Bartlett's Test of Sphericity	Approx. Chi-Square	2718.986
	Df	630
	Sig.	.000

5.5.2. Step 2: Factor extraction

Factor extraction is a process undertaken to detect common factors and to eliminate instances of common variance among the factors (Suhr, 2006). There are a variety of approaches that can be used to identify (extract) the number of underlying factors or dimensions. Although the most frequently used approach is principal components analysis (Reio Jr & Shuck, 2015), some other commonly available extraction techniques as documented by Costello and Osborne (2005) are:

- principal components;
- principal factors;
- image factoring;
- maximum likelihood factoring;
- alpha factoring;
- unweighted least squares; and
- generalized least squares.

When deciding on the number of factors that are considered to best describe the relationships between variables there are two conflicting needs that must be balanced. These needs are the need to find a simple solution with as few factors as possible and the need to explain as much of the variance in the original data set as possible. It has been suggested that the best method is through exploratory methods where the researcher would

experiment with differing numbers of factors to find a suitable solution (Tabachnick & Fidell, 2001).There are a number of techniques that can be used to assist in the decision concerning the number of factors to retain such as Kaiser's criterion, Scree test and Parallel analysis.

One of the most commonly used techniques is known as Kaiser's criterion, or the eigenvalue rule (Costello & Osborne, 2005; Taherdoost, Sahibuddin, & Jalaliyoon, 2014; Yong & Pearce, 2013). Through use of this rule, the factors referring to an eigenvalue of 1.0 or more should be the only factors that are utilised (Pallant, 2013). To determine how many components (factors) to extract, what was considered was a few pieces of information provided in the output. Using Kaiser's criterion as discussed above, the main interest was in components that have an eigenvalue of 1 or more. To determine how many components met this criterion, the Total Variance Explained Table (Table 5.8) was analysed. The eigenvalues for each component are listed. In the analysis only the first nine components recorded eigenvalues above 1 (14.513; 2688; 2.009;1.617; 1.456; 1.253; 1.247; 1.318; 1.012). These nine components explain 74.814 per cent of the variance (see Cumulative percent column).

Table 5.8: Total Variance Explained

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.513	40.314	40.314	14.513	40.314	40.314
2	2.688	7.468	47.782	2.688	7.468	47.782
3	2.009	5.579	53.362	2.009	5.579	53.362
4	1.617	4.491	57.853	1.617	4.491	57.853
5	1.456	4.046	61.899	1.456	4.046	61.899
6	1.253	3.480	65.379	1.253	3.480	65.379
7	1.247	3.463	68.842	1.247	3.463	68.842
8	1.138	3.162	72.004	1.138	3.162	72.004
9	1.012	2.811	74.814	1.012	2.811	74.814
10	.827	2.296	77.110			
11	.801	2.225	79.335			
12	.734	2.039	81.374			
13	.662	1.840	83.214			
14	.574	1.594	84.807			
15	.521	1.447	86.254			
16	.508	1.410	87.664			
17	.473	1.314	88.978			
18	.437	1.215	90.193			
19	.397	1.101	91.295			
20	.342	.949	92.243			
21	.314	.873	93.116			

22	.290	.807	93.923			
23	.264	.734	94.657			
24	.260	.722	95.379			
25	.238	.661	96.039			
26	.221	.613	96.652			
27	.199	.552	97.204			
28	.170	.472	97.676			
29	.165	.459	98.136			
30	.137	.380	98.515			
31	.131	.365	98.880			
32	.109	.304	99.184			
33	.104	.289	99.474			
34	.076	.211	99.684			
35	.067	.186	99.871			
36	.047	.129	100.000			
Extraction Method: Principal Component Analysis						

Often, using the Kaiser criterion, there are too many components that are extracted, so therefore, we use the scree-plot (Figure 5.5) provided in our results as a benchmark. What we look for is a change (or elbow) in the shape of the plot (Beavers et al., 2013). Only components above this point are retained. Nonetheless, there is quite a clear break between the first and the second components. Thus, Components 1 and 2 explain or capture much more of the variance than the remaining components. Factor analysis is used as a data exploration technique, so our choice of interpretation and use is based on our considered judgements and not on any hard and fast statistical rules. Because of our research context, we would limit ourselves to the components mentioned above.

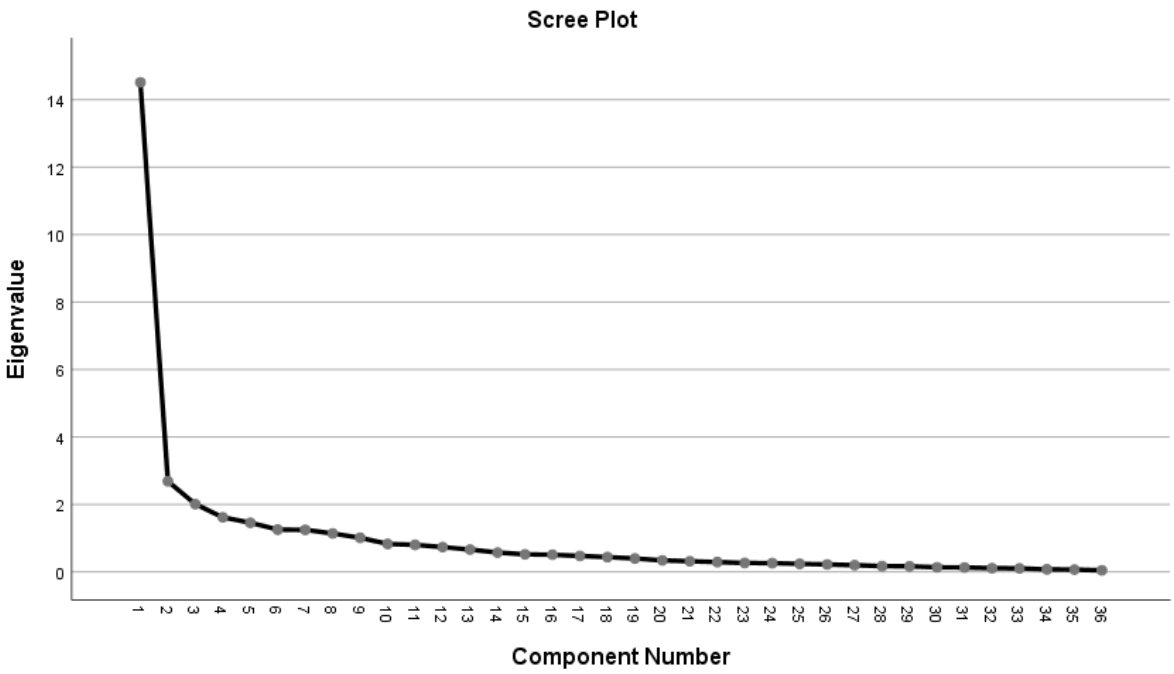

Figure 5.5 Scree Plot

The final element of analysis that must be examined is the Component Matrix (Table 5.9). This shows the loadings of each of the items on the nine components (as per Table 5.9). SPSS uses the Kaiser criterion (retain all components with eigenvalues above 1) as the default. The analysis suggests that most of the items load quite strongly (above .4) on the first component and to some extent, the second component. Very few items load on Components 3 to 9 and this supports the conclusion from the scree-plot to retain only two factors for further investigation. In this instance, the sample size was significantly less than what is advised in the literature as previously mentioned, the common standard is a ratio of 1:10 in respect of items to respondents. Therefore, an ideal number of surveys was not achieved as only 102 responses were obtained. This is the most probably explanation for the initial components being reduced to 2 components.

Table 5.9: Component Matrix

Component Matrix									
	Component								
	1	2	3	4	5	6	7	8	9
P6D	.872								

P4B	.801								
P6A	.800	-.345							
P6B	.794								
P1B	.790	-.473							
P6C	.766								
P5C	.759		.408						
P5E	.733						-.330		
P2A	.726	-.416							
P2C	.719								
P1E	.713								
P2B	.712								
P5D	.699		.416						
P5B	.678		.513						
P1A	.664	-.512							
P3C	.662	.396							
P1C	.659								
P2D	.634								
P5A	.623								
P4G	.599	.345	-.378						
P3A	.596		-.330						
P2E	.580				-.408	.302			
P5F	.559		.457						
P1D	.559						.373		
P4C	.559				.408				
P3E	.557	.336							.322
P3B	.543	.404				.305			
P4A	.535				.307		.475		
P4E	.532							.463	
P1F	.497			-.311		.370			
P5H	.469			-.319		-.319			
P4F	.452	.429				-.375	.402		
P3D	.422			-.578				.310	
P5G				.412	.558	.316			
P4H	.464	.359			-.509				
P4D	.335			.455				.510	

5.5.3. Step 3: Factor rotation and interpretation

The aim of factor rotation would be to assist the process of obtaining clear results from factor analysis. This procedure seeks to simplifying and clarifying the results for a better interpretation (Osborne, 2015). Factor rotation can be executed through different methods. The two main methods are oblique and orthogonal rotations. Of all the orthogonal rotation methods used, the most frequently used would be the Varimax method and in terms of the oblique method the most common is direct Oblimin (Taherdoost et al., 2014). There are some distinct differences between the two and different researchers have chosen to use

varying methods due to these differences. As an example, orthogonal rotations produce uncorrelated factors, maintain a 90 degree angle between the X and Y axis and use much simpler mathematical calculations with results that are easier to interpret (Osborne, 2015; Tabachnick & Fidell, 2001; Taherdoost et al., 2014). A study with a similar background to this research by Kassim, Jailani, Hairuddin and Zamzuri also used Varimax (Kassim et al., 2012). On the other hand, oblique factor rotation may be more complex but also produces a higher level of accuracy and results which are correlated (Taherdoost et al., 2014).

According to the Pallant (2013), both methods can produce similar results if the correlations are distinct. A number of researchers experiment with both methods to later decide which approach produces results which are more comprehendible (Pallant, 2013). After rotation, the results have to be interpreted and at this stage through use of SPSS, the software does not interpret the factors but it displays the grouped variables (Pallant, 2013). Through an in-depth understanding of the content of the variables (and underlying theory and past research), it is up to the researcher to propose possible interpretations of the newly grouped or clumped variables.

Once the number of factors was determined, the next step was to try to interpret them. To assist in this process the factors were rotated. This did not change the underlying solution—rather; it presented the pattern of loadings in a manner that was easier to interpret. In this analysis, two components were extracted and rotated. There are several different rotation techniques. For our analysis, Varimax and Oblimin rotation techniques were used due to their simplicity. The Oblimin option uses an oblique rotational technique (which does not assume that the factors are uncorrelated). The output from Oblimin rotation allowed us to determine how strongly inter-correlated the factors are, and therefore which of the rotational techniques was more appropriate.

Analysis

Table 5.10: Total Variance Explained – Principal Component Analysis

Total Variance Explained			
Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	9.182	25.504	25.504
2	8.020	22.278	47.782

Extraction Method: Principal Component Analysis.

At this point of the analysis only two components are listed in Table 5.10 (as compared with nine, in the previous un-rotated output). The SPSS software was manipulated to select only two components for rotation. The distribution of the variance explained was also been adjusted after rotation. Component 1 explains 25.504 per cent of the variance and Component 2 explains 22.278 per cent.

The Rotated Component Matrix (Table 5.11), presents the loadings of each of the variables on the two factors that were selected. The highest loading variables on each of the component were used to identify the nature of the underlying latent variable represented by each component.

Table 5.11: Rotated Component Matrix 3

	Component	
	1	2
P1B	.903	
P1A	.836	
P6A	.825	
P2A	.817	
P6D	.766	.453
P6B	.763	.340
P4B	.741	.374
P6C	.717	.349
P1E	.666	.327
P1C	.661	
P2C	.597	.412
P1F	.543	
P2B	.538	.466
P4A	.518	
P5H	.502	
P1D	.469	.315
P4D		
P3C		.738
P5D	.318	.689
P5E	.373	.680
P3B		.664
P4G		.657
P5C	.442	.643
P3E		.623
P4F		.622
P2D		.615
P3A		.582
P4H		.577
P5A	.338	.555
P5F		.547

P5B	.433	.531
P4C		.526
P3D		.498
P2E	.342	.487
P4E	.307	.454
P5G		

5.5.4. Analysis of Findings

The next step in a factor analysis process is to assess the outcomes of the factor loadings and to re-label the two newly grouped factors if necessary. However, before the analysis it is important to address the limitations to provide context for the findings and clarify how they shaped the outcome of the study.

The only key limitation of the study which had an impact on the results of the survey was the sample size. The sample size was below the recommended 150 respondents or having a 1:10 ratio of items to respondents. This study had a ratio of roughly 1:3 projecting a small sample size to work with. Consequently, the limited responses explain the factor analysis result which was not anticipated. Given the limitation, it is possible that a repeat study which yields a response of a minimum ratio of 1:10 or over 150 responses, would provide a better validation of whether the five dimensions identified in the study are a useful set of system evaluation criteria. Nonetheless, given the current factor analysis outcomes, the results were assessed and the two factors that have emerged from the factor analysis were labelled.

Labelling is an intuitive process in which the researchers examines the factor analysis outcomes to prove the best possible description of the component (or dimension). In this case, identification and labelling of the two components is not clear cut and easy given the large number of items which loaded onto each component. The predominant challenge with naming the two components was the result of having each component being a combination of items from two or three different original dimensions. The naming process had two main stages, the first being the identification of which previous dimensions are associated with the new dimensions and the second stage involved analysing the items to find similarities to form an appropriate name for the new dimension. After an introspection of the findings presented in the previous section the two components were labelled and the

next section will explore the re-naming of the 2 dimensions, presented by the findings and analysis to be used in the evaluation of Information Systems by measuring User Satisfaction.

5.6. Refined Evaluation Dimensions

Table 5.12 and 5.13 show the outcome of the factor analysis, which depicts that of the original proposed dimensions, the results of the analysis portray they can be narrowed down to just 2 dimensions previously mentioned as components.

5.6.1. Component 1: System Process Satisfaction

In this analysis, the main loadings on Component 1 (Table 5.13) are items ***P1B, P1A, P6A, P2A, P6D, P6B, P4B and P6C***.

System Process Satisfaction

Component 1 was renamed System Process Satisfaction because when referring to the actual items themselves, these are all descriptors items that fall under the dimensions named Business Process Quality, User Satisfaction, System Functionality and System Quality. A deeper analysis of the items that brought back the higher loadings all refer to satisfaction attained by the processes of the system. For example, P1A, P1B and P2A link directly to the users' perception of the functionality of the system and the procedures to assist the users in their tasks. The other items that make up this component relate to the overall satisfaction perceived from users' interaction with the system which also aligns well with the functionality and processes of the system and how well they help the users. This component forms part of the key criteria of analysis as the users need the systems functions and procedures to cater to the needs of the users' job role and aiding the users work performance.

Table 5.12: Component 1: System Process Satisfaction

COMPONENT 1: System Process Satisfaction			
Survey Statement	Code	Factor Loading	Code Name: Component Item
Business Process Quality			

I am satisfied with the number of steps I must take to complete a task.	P1A	.836	Manual DIY System & Processes
The processes to perform tasks are simple	P1B	.903	Processes
The system's process for uploading marks manually is easy	P1C	.661	Processes
The system's process for uploading marks via spread sheet is easy	P1D	.469	Integration with other systems (programs)
It is easy to undertake changes to marks	P1E	.666	Processes
It is easy to make changes to a mark schedule	P1F	.543	Processes & Manual DIY System
System Functionality			
The functionality offered by the MAS system aligns well with my work processes	P2A	.817	General Functionality & User input confirmation
The system responds quickly to commands	P2B	.538	General Functionality
The system currently offers all necessary functionality for my job role	P2C	.597	General Functionality & Notifications/Alerts
System Quality			
Only basic computer proficiency is needed to use the system	P4A	.518	User Friendly
The system is user friendly	P4B	.741	User Friendly
Service Quality			
I am encouraged to attend training	P5H	.502	Support Reliability
User Satisfaction			
I enjoy using MAS	P6A	.825	General User Satisfaction
I am satisfied with the systems user interface	P6B	.763	Satisfactory System Interface
Using MAS makes my job easier	P6C	.717	Easier Duties
Overall, I am satisfied with MAS	P6D	.766	General User Satisfaction

5.6.2. Component 2: System and Service Quality Satisfaction

The main items on Component 2 (Table 5.14) are ***P3C, P5D, P5E, P3B, P4G, P5C, P3E, P4F*** that are linked to the dimensions named Information Quality, System Quality and Service Quality.

System and Service Quality Satisfaction

Component 2 was renamed System and Service Quality and justification for this is based on items that presented high factor loadings. It is apparent that the component leans towards the attributes of the system and the support provided by the technical support staff. From the system and information quality dimensions, the dominant items refer to attributes

such as accuracy, speed and security and on the other hand the Service Quality items look at Support Access and Support Responsiveness.

Table 5.13: Component 2: System and Service Quality Satisfaction

COMPONENT 2			
Survey Statement	Code	Factor Loading	Code Name: Component Item
System Functionality			
The system allows me to complete and save a task before timing out	P2D	.615	System Timeouts & Notifications/Alerts
The system allows me to do multiple tasks simultaneously	P2E	.487	General Functionality
	Information Quality		
The information provided by MAS is always timely	P3A	.582	Integration with other systems
The information provided by MAS is always accurate	P3B	.664	Accuracy
The information that I source from MAS is reliable	P3C	.738	Security
The system does accurate calculations of students' semester marks	P3D	.498	Accuracy
The data on MAS is accurately imported from SASI.	P3E	.623	Integration with other systems
	System Quality		
The system is easily accessible on university premises	P4C	.526	Access
The system is always available when I need to use it	P4E	.454	Availability
The system securely stores data	P4F	.622	Security
The systems response to queries is quick	P4G	.657	Speed
The system's response time is not affected during times of peak use	P4H	.577	Reliability
	Service Quality		
When using the system, I do not experience problems which I cannot resolve alone	P5A	.555	Support Access
When I encounter a problem, I know who to contact and the procedure to go through	P5B	.531	Support Access
The procedure for acquiring technical support for the system is easy	P5C	.643	Support Access
I believe that there is sufficient support staff available	P5D	.689	Support Responsiveness
The technical support for MAS provides users with a fast service	P5E	.680	Support Responsiveness
The support staff for the system are technically competent	P5F	.547	Understanding/Knowing the users

5.7. Reliability and Validity

The reliability of the survey instrument was measured using Cronbach's alpha which measures for internal validity of an instrument (Bonett & Wright, 2015) and the literature has presented that a value of .7 to .8 is an adequate value for alpha (FIeld, 2009). In this case, it was found that based on the results the value for alpha for each of the dimensions and their statements are shown in Table 5.15. The values found for alpha are all within or close to the range deemed adequate by the literature which is an indication of the reliability in the relationship between items in each dimension.

Table 5.14: Survey reliability: Cronbach's Alpha

Dimension	Cronbach's Alpha
Business Process Quality	0.86
System Functionality	0.82
Information Quality	0.80
System Quality	0.78
Service Quality	0.87
User Satisfaction	0.93

5.8. Conclusion

This chapter dealt with the quantitative findings from conducting factor analysis on the results from the Likert-Scale Survey. The descriptive statistical results presented earlier in the chapter shed light on both the strengths and weaknesses of the system as perceived by the primary users. Overall the descriptive survey findings show that the main areas of improvement related to the System Quality and Service Quality dimensions.

Later in the chapter quantitative analysis took place through confirmatory factor analysis where the results varied from what was expected. The 35 items of the Information Systems User Satisfaction scale were subjected to principal components analysis (PCA) using SPSS Version 12. Prior to performing PCA the suitability of data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of .3 and above. The Kaiser-Meyer-Oklin value was .87, exceeding the recommended value of .6 (Kaiser 1970, 1974) and the Bartlett's Test of Sphericity (Bartlett, 1954) reached statistical significance, supporting the factorability of the correlation matrix. In view of that, the principal components analysis revealed the presence of nine components with eigenvalues exceeding 1, explaining 40.314 per cent, 47.782 per cent, 53.362 per

cent, 57.853 per cent, 61.899 per cent, 65.379 per cent, 68.842 per cent, 72.004 per cent and 74.814 per cent of the variance respectively. An inspection of the screen-plot revealed a clear break after the second component. Using Cattell's (1966) scree test, it was decided to retain two components for further investigation.

Unfortunately, the outcome did not produce a straightforward result. In this case, the variables load moderately on only two components, and the second component had fewer variables loading on the component. This suggests that a one component dimension is suitable for the instrument and at most a two-case scenario could be explored. This is not a satisfactory finding because evaluation cannot be based on only 2 dimensions especially when one is a dependent variable. It is concluded that because of the low sample and low ratio of items to survey responses there was insufficient data to conduct a satisfactory analysis. Therefore, the sample in this study did not provide enough data to verify the five dimensions. To extend these results further, other researchers may subject the proposed evaluation instrument in other university contexts in which a greater response rate may be forthcoming.

Chapter 6: Conclusion & Recommendations

6.1. Introduction

The apartheid era in South Africa placed restrictions on people of colour creating educational barriers included ensuring that the millions of black nationals have access to quality higher education (Gray & Czerniewicz. Laura, 2018). Post-apartheid the massification of students led to a count of almost 1 million public sector students which is double that of 1994 (Council for Higher Education South Africa., 2016). The massification of students created a problem for the education system as higher education institutions were not equipped to cope with such large numbers of students. The influx of students was not accommodated by the amount of staff, resources and structure of the institutions.

Given this scenario, the research that was undertaken for this study, was conducted to determine evaluation dimensions for the assessment of user satisfaction of university administration systems. Measurement of user satisfaction was to be used as a means to measure IS success. Considering the growing number of students and staff that such systems cater for, this study was necessary, particularly in the South African higher education context. University administration systems have numerous uses and deal with a significant amount of pressure during the academic year.

This chapter provides a summary of the study which commences by revisiting the research objectives and how they were achieved. The following section addresses the importance of this research from two perspectives, the IS practice perspective and from a literature perspective. Subsequently, recommendations will be given for IT managers at universities and other researchers on the topic of IS evaluation. The final section will provide directions for future research.

6.2. Overview of the attainment of the Research Objectives

The research process followed a mixed method approach that started with an extensive review of the literature on the topic of information systems evaluation. To mould the environment of the study, some background research was done to set the context of the higher education environment in South Africa. The literature review was imperative to get

a deep-rooted understanding of the existing literature but also to develop a starting point for established dimensions for the study. The next step was a qualitative process to acquire first-hand information from the users of the system in question. The qualitative analysis provided data to aid the construction of a survey which was distributed to the entire MAS user population. The findings from the survey and qualitative analysis resulted in the proposed variables to measure user satisfaction in order to determine IS Success being narrowed down from 5 variables to only 2 variables. The main research question for this study was supported by 6 sub questions and 3 research objectives (see Table 1.1). The remainder of this section will revisit the research objectives of this study.

Objective One: To determine which extant models of IS evaluation are applicable in this research context

This objective was achieved through use of a literature review by answering the sub research questions 1A,1B and 1C. A number of models and theories were uncovered from the literature and through deep synthesis, they were narrowed down to the relevant models and theories to fit the research question such as the Delone and Mclean IS Success model (DeLone & McLean, 1992, 2002). The literature analysis shed light on a number of different studies on the evaluation of IS and the various methods used to conduct evaluation. Within majority of the methods found, the authors had made use of similar dimensions measure the success of an IS. The common set of IS evaluation dimensions included System Quality, Information Quality, Service Quality as the independent variables (Bharati & Berg, 2003; DeLone & Mclean, 2003; DeLone & McLean, 1992; Gorla et al., 2010; Xu et al., 2013). Some studies used user satisfaction as one of the independent variables (Abdelgawad & Comes, 2019; Habib & Govindaraju, 2018; Helia et al., 2018; Jiang et al., 2002) and some used user satisfaction as the dependent variable (Ajoye, 2014; Gatian, 1994; Putra et al., 2018; Zviran & Erlich, 2003). This process allowed for the identification of specific suitable dimensions to investigate IS success in a university environment. In an alternative context for example IS in the banking or health environment, the outcome may have produced varying results. The dimensions that may be applicable for a banking information system might not be compatible with that of an information system in a university administration context. Within the university administrative environment, the focal dimensions that were identified were three quality dimensions, system quality, information quality and service quality.

Objective Two: To qualitatively assess the relevance of dimensions derived from the literature and to identify possible new ones (as related to university administrative IS)

The dimensions identified from the literature were tested through one on one interviews to determine the relevance of the dimensions in a university administrative setting. This was an effective step in the research process to qualitatively gather the user's opinions on the system and assess the aforementioned literature-derived dimensions in a university administrative context. The outcome of this objective was achieved in two ways. Firstly, by gaining validation on the three dimensions from the literature based on the findings from the interview. Secondly, through the qualitative analysis using Atlas t.i, the analysis process resulted in two more dimensions, viz. Business Process Quality and System Functionality. The addition of the two dimensions which were the result of analysing first-hand feedback from users of MAS which was pivotal to the study as it also assisted in identifying relationships between the dimensions. The key outcome of the qualitative research was being able to update the initial conceptual framework from the literature review in chapter 2. The update to the conceptual framework allowed for a visual representation of the change in results from the literature and revisions to framework to accommodate the qualitative findings from the interviews and analysis.

Objective Three: To develop a measuring instrument and to validate its associated dimensions to measure the success of University admin information systems

The final objective directly related to the main research question was the final step of the research in validate dimensions to measure the success of IS admin systems. This objective was achieved through a process of analysing the interview data and the dimensions attained from the qualitative methods to find which items would best describe each dimension. The descriptor items were used to develop statements pertaining to each dimension that was used constructed into a structured survey instrument. The final objective was achieved was by answering the last sub research question which stated: "*Which dimensions represent user satisfaction with respect to university administrative IS*". The survey results were analysed and used in a Confirmatory Factory Analysis process to determine which dimensions should be used to measure User Satisfaction. The results presented two new dimensions which were a combination of items from the original six

dimensions and were renamed System Process Satisfaction and System and Service Quality. As part of the reflection of the research conducted, it is important to highlight the limitations experienced which impacted the outcome of the research.

Limitations

- The given time period for which data could be collected limited the sample size
- The availability of system users confined the number of users that can participate in the data collection.
- Out of a large population of 1563 users not all users had the time to participate and not all users will be willing
- There was not a large amount of literature on IS Success for university administrative systems Literature from IS evaluation in other contexts were used and generalised where possible to suit the context of university administrative systems

6.3. Contribution to Knowledge and Practice

This study stemmed from the issue of post-apartheid massification in South Africa, which has had an impact on the administrative processes of higher education institutions. The impact of massification has spill-over effects into the administrative IS used by universities. Due to massification of higher education, the IS had to deal with an increase in the number of students who the systems cater for. Likewise, pressure was also put on the users of the systems as they also carry a major role in the administrative processes. The outcome of this research was determining evaluative dimensions to assess the satisfaction of users as a proxy for the effectiveness of these systems. The importance of this is to help universities to determine how effective their administrative systems are and whether the users are satisfied. Additionally, this research will help universities to assess their administrative IS to assess whether the systems are keeping up with the increasing number of students and staff it caters to. The value of this research can be analysed from two angles, one being the value added to IS practice and the second being literature on IS evaluation.

Value brought to IS practice is aligned with improvements to university administrative systems and their management. An example of one of the key findings of the interviews that would be helpful feedback to the IT department at UWC was in relation to service quality. A number of respondents raised a substantial amount of negative feedback regarding service quality. The users felt the support staff play a significant role in their user experience and that there should be enough system support staff to assist users in a timely manner. On a general note for all universities, IT managers as well as users need to be aware and involved of the investment in administrative systems. How this would benefit the success of the system in the long run is by users and IT managers being able to provide their input during the specification and development phases. This would allow them to offer their opinion on essential aspects of the system such as the user requirements based on the two evaluation dimensions found in this study. In essence this would create some leverage in the post-development evaluation where user satisfaction is used to measure the systems success.

The value of the research to literature in the field of IS evaluation is specific to context of university administrative systems. Although this was a case study research, it can act as a guide for other researchers to use as a starting point in their determination of dimensions for administrative IS in other universities. This study is an addition to the IS evaluation literature as it provides evaluation dimensions tailored to the administrative procedures of universities from the viewpoint of the users. Over the past few decades, the literature on IS evaluation has dispersed into research covering different industries IS e.g., banking (Daghouri et al., 2018; Hussein, 2009; Tam & Oliveira, 2017), health (Ammenwerth, Kaiser, Wilhelmy, & Höfer, 2003; Doumpa, 2009; Yu & Qian, 2018) and e-commerce (April, 2007; Wang, 2008). This study presents evaluation dimension in favour of the users how they perceive the system and how satisfied they are with the system to prove its success. Studies from other industries look at evaluating the system solely on its functionality and how well it meets organisational goals. How this study differs from the above-mentioned industries is that literature on evaluation of university administrative systems has few studies to refer from, therefore this research adds to the few studies investigating evaluation dimensions in this context. Alternatively, this study differs as it only uses the users of the system who are in-fact staff members, as opposed to the customers of the system who have no ties to the organisation the system is associated with. This distinction is valuable as the users of the system (staff members) have a broader

perspective of the system and benefit from being satisfied with the system in two ways whereas customers in this regard can only relate to the system working in their favour. For staff members it not only improves the administration of the university, but it also makes their job easier which makes the findings more informed.

The US construct has been adopted into studies focusing on information system evaluation. It has been established that effectiveness of organisations can be evaluated through use of determining user satisfaction. Authors have supported the US construct usage in IS evaluation and argued the construct as one of the most commonly used as well as most important variable (Melone, 1990; Ojo, 2017; Qureshi & Qazi Abro, 2016). Commonalities between this study and other studies would be the methods used which was a survey and the variables used (Abrego Almazán et al., 2017; Mamma, 2010; Ojo, 2017). Mamma (2010) and April (2007), conducted similar studies looking at dimensions or parameters for IS evaluation but in difference contexts namely institutional organisations and e-commerce. Regarding the dimensions used, (Abrego Almazán et al., 2017) used similar dimensions to the dimensions proposed in the initial conceptual framework (see Chapter 2). The authors also came to similar conclusions to the findings of the qualitative data collection and updated framework. The qualitative findings lead to an updated framework stating that the quality dimensions have an impact on US. (Abrego Almazán et al., 2017) findings presented that both IQ and SysQ have a positive effect on US but reiterating that IQ has the stronger link with US. On the other hand, (Ojo, 2017) found that SQ has the greatest influence on US. How both these studies are associated with the result of the outcome of the qualitative findings is by both authors finding positive relationships between the quality dimensions and US. The qualitative findings of this research led to an updated conceptual framework which presented that the quality dimensions lead to a positive outcome on US. The difference between this study and the literature is that through quantitative methods and analysis, the proposed 5 dimensions for US were narrowed down to 2 dimensions which encompass descriptor items from all three quality dimensions. The outcome of the study creates value to the literature as the 2 dimensions to measure user satisfaction is unique from other studies and leaves room for future research that will be discussed in section 6.5.

Recommendations

Through conducting this study, it became evident that there is a need for some recommendations going forward in this area of research. The recommendations are split in two sections, recommendations for University IT Managers and for Evaluation methods in general. The recommendations for university IT managers are focused on the findings from the data collected in this study which pertains to features, functions and support of the system. On the other hand, the recommendations towards the literature on evaluation methods focuses on the way forward when researching and conducting IS evaluation.

University IT Managers

Involve users in the design and development stages of IS implementation to guarantee the proposed system will meet their needs along with organisational needs and ensure user satisfaction.

In the design stage, align the systems functionality specifically to user roles and their intended usage of the system. This recommendation stems from the additional dimension 'Business Process Quality' which was established in the qualitative analysis (See section 4.12).

Ensure the systems response time is unaffected during peak-usage times as this will affect user's productivity and their satisfaction (See section 4.6)

Employ enough support staff to be able to support the number of users and decrease users time waiting on support (5.3.6).

Evaluation Methods

IS evaluation research needs to be specific and methods should be closely aligned with the context of the systems evaluation. Not all evaluation methods can be generalised for any information system in any environment.

Evaluation of IS needs to be holistic and take all relevant factors and stakeholders into consideration. For example, including the users and system developers input into consideration instead of looking exclusively at the IS.

When evaluating an IS it would be beneficial to evaluate the system at two different points in a period of time for e.g. at a peak usage time and a less peak time. This will enable a well-rounded understanding of the systems strengths and weaknesses.

6.4. Directions for Future Research

This study has created an avenue for future research in the area of information systems evaluation in the context of University administration systems. The findings presented by this study could direct a study to testing and verifying the two dimensions. Figure 6.1 presents the final conceptual framework for User Satisfaction as per the findings of the research.

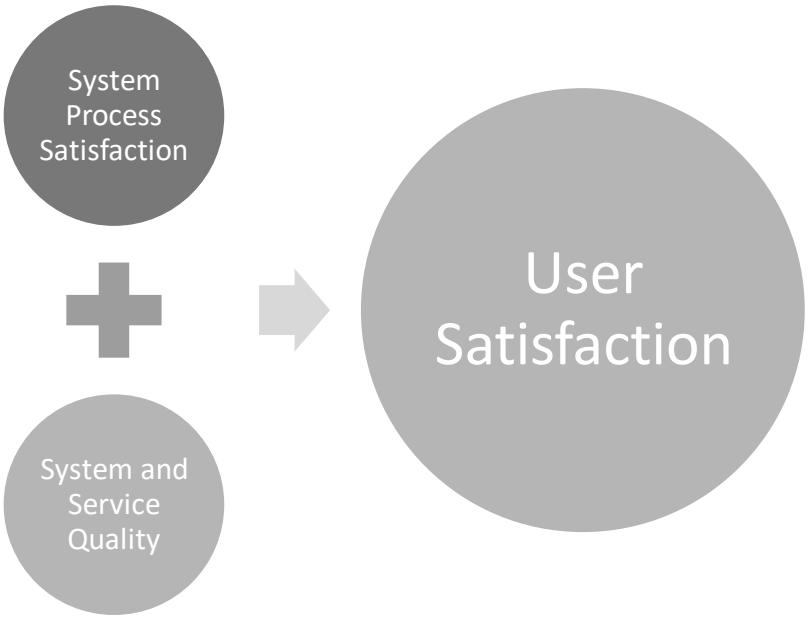

Figure 6.1: Final user satisfaction model: University administration information system

This framework could be used as a tool to measure user satisfaction and to determine IS success. This framework should be tested further in other university environments and used to evaluate user satisfaction and determine effectiveness of their administrative systems along with other supporting systems. Such a framework could be utilized by IT managers in universities across South Africa to assess areas of system success, system failure and areas of improvement for the system in question. The value of this proposed

research would assist the South African education system and universities in managing and updating their administrative systems to combat the continuing increase in student enrolment.

To conclude referring back to the crux of the research problem, an additional direction for future research could investigate the impact of the post-apartheid environment in South Africa. Follow up research could examine the influence post-apartheid South Africa has on user satisfaction of university administrative systems.

7. Reference List

Abdelgawad, A. A., & Comes, T. (2019). Evaluation Framework for the iTRACK Integrated System. In Z. Franco, J. Gonzalez, & J. Canos (Eds.), *Proceedings of the 16th International Conference on Information Systems for Crisis Response And Management (ISCRAM2019)*. Valencia.

Abdelmoteleb, S. A., & Higgs, M. (2010). Common Factor Analysis and Component Analysis: Are They Interchangeable? A Word of Caution. *Australian and New Zealand Academy of Management*, 1–14.

Abrego Almazán, D., Sánchez Tovar, Y., & Medina Quintero, J. M. (2017). Influence of information systems on organizational results. *Contaduria y Administracion*, *62*, 321–338. https://doi.org/10.1016/j.cya.2017.03.001

Agourram, H. (2009). International Journal of Information Management Defining information system success in Germany. *International Journal of Information Management*, *29*, 129–137. https://doi.org/10.1016/j.ijinfomgt.2008.05.007

Aithal, P. S. R. (2015). Quality Enhancement in Office Management of Higher Education Institutions through Innovations & Best Practices. *International Research Journal of Business & Management*, *8*(5), 16–27.

Ajoye, M. B. M. (2014). INFORMATION SYSTEMS USER SATISFACTION : A SURVEY OF THE POSTGRADUATE SCHOOL PORTAL. In *Library Philosophy and Practice*.

Akoojee, S., & Nkomo, M. (2007). Access and quality in South African higher education: the twin challenges of transformation. *South African Journal for Higher Education*, *21*(3), 385–399. https://doi.org/10.4314/sajhe.v21i3.25712

Akter, S., Ray, P., & D'Ambra, J. (2011). Viewing systems as services: the role of service quality. *International Con*, 1–18. Retrieved from http://ro.uow.edu.au/commpapers/3125/

Al-adaileh, R. M. (2009). An Evaluation of Information Systems Success : A User Perspective - the Case of Jordan Telecom Group. *European Journal of Scientific Research*, *37*(2), 226–239.

Al-ghamdi, A. A. (2017). Building a Framework for ICT Project Implementation and Evaluation. *Global Journal of Computer Science and Technology: G Interdisciplinary*, *17*(1).

Alzahrani, A. I., Mahmud, I., Ramayah, T., Alfarraj, O., & Alalwan, N. (2019). Modelling digital library success using the DeLone and McLean information system success

model. *Journal of Librarianship and Information Science*, *51*(2), 291–306. https://doi.org/10.1177/0961000617726123

Ammenwerth, E., Kaiser, F., Wilhelmy, I., & Höfer, S. (2003). *Evaluation of user acceptance of information systems in health care – the value of questionnaires -*. *95*(May), 643–648.

Andersson, T., & von Hellens, L. A. (1997). Information systems work quality. *Information and Software Technology*, *39*(12), 837–844. https://doi.org/10.1016/S0950-5849(97)00042-6

April, G. (2007). *Dimensions for evaluating Information Systems service quality expectations of e-Commerce SMMEs*.

Armstrong, B., Fogarty, G. J., Dingsdag, D., & Dimbleby, J. (2005). Validation of a computer user satisfaction questionnaire to measure IS success in small business. *Journal of Research and Practice in Information Technology*, *37*(1), 27–42.

Atieno, O. P. (2009). An Analysis of the Strengths and Limitation of Qualitative and Quantitative Research Paradigms. *Problems of Education in the 21st Century*, *13*, 13–18. https://doi.org/10.1073/pnas.0502680102

Avgerou, C. (1995). Evaluating Information Systems by Consultation and Negotiation. *International Journal of Information Management*, *15*(6), 427–436.

Babbie, E. (2001). The practice of social research (9th ed.). In *The practice of social research (9th ed.)*. Retrieved from http://ezproxy.lib.umb.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2001-06958-000&site=ehost-live

Badwan, J. J., Shobaki, M. J. Al, Naser, S. S. A., Abu, Y. M., Badwan, J. J., Shobaki, M. J. Al, … Adopting, A. (2017). Adopting Technology for Customer Relationship Management in Higher Educational Institutions To cite this version : HAL Id : hal-01500365 Adopting Technology for Customer Relationship Management in Higher Educational Institutions. *International Journal of Engineering and Information Systems*, *1*(1), 20–28.

Bailey, J. E., & Pearson, S. W. (1983). DEVELOPMENT OF A TOOL FOR MEASURING AND ANALYZING COMPUTER USER SATISACTION. *Management Science*, *29*(5), 530–546.

Bartlett, M. S. (1954). A Note on the Multiplying Factors for Various χ 2 Approximations . *Journal of the Royal Statistical Society: Series B (Methodological)*. https://doi.org/10.1111/j.2517-6161.1954.tb00174.x

Basit, T. (2003). Manual or electronic ? The role of coding in qualitative data analysis.

Educational Research, *45*(2), 143–154. https://doi.org/10.1080/0013188032000133548

Beavers, A. S., Lounsbury, J. W., Richards, J. K., Huck, S. W., Skolits, G. J., & Esquivel, S. L. (2013). Practical Considerations for Using Exploratory Factor Analysis in Educational Research - Practical Assessment, Research & Evaluation. *Practical Assessment, Research & Evaluation*, *18*(6), 1–13. Retrieved from http://www.pareonline.net/getvn.asp?v=18&n=6

Beinart, W., Dubow, S., Histories, R., & Censer, J. R. (1995). *SEGREGATION TWENTIETH-CENTURY SOUTH AFRICA*.

Beynon-Davies, P., Owens, I., & Williams, M. D. (2004). Information systems evaluation and the information systems development process. *Journal of Enterprise Information Management*, *17*(4), 276–282. https://doi.org/10.1108/17410390410548689

Bharati, P., & Berg, D. (2003). Managing information systems for service quality: a study from the other side. *Information Technology & People*, *16*(2), 183–202. https://doi.org/10.1108/09593840310478685

Bokhari, R. H. (2005). The relationship between system usage and user satisfaction : a meta-analysis. *Journal of Enterprise Information Management*, *18*(2), 211–234. https://doi.org/10.1108/17410390510579927

Bonett, D. G., & Wright, T. A. (2015). Cronbach ' s alpha reliability : Interval estimation , hypothesis testing , and sample size planning. *Journal of Organisational Behavior*, *36*, 3–15. https://doi.org/10.1002/job

Brown, A. (2005). IS evaluation in practice. *The Electronic Journal of Information Systems Evaluation*, *8*(3), 169–178.

Bunting, I. (2006). The Higher Education Landscape. In *Transformation in Higher Education*. Retrieved from http://www.mfri.purdue.edu/content/Higher Education Landscape_web.pdf

Burnard, P. (1991). *Searching for meaning : a method of analysing interview transcripts with a personal computer*. (1967).

Carlsson, S. A. (2003). Advancing Information Systems Evaluation (Research): A Critical Realist Approach. *Electronic Journal of Information Systems Evaluation*, *6*(2), 11–20.

Cattell, R. B. (1966). The Scree Test For The Number Of Factors. *Multivariate Behavioral Research*. https://doi.org/10.1207/s15327906mbr0102_10

Cha, Y. U., & Park, M. J. (2018). Evaluating and planning information systems in the

public sector: The case of Korea. *Information Development*, *35*(4), 655–665. https://doi.org/10.1177/0266666918780956

Chen, S., Osman, N., Nunes, M., & Peng, G. (2011). Information systems evaluation methodologies. *INFORMATION SYSTEMS EVALUATION METHODOLOGIES*, 23–32. Retrieved from http://eprints.whiterose.ac.uk/74740

Choy, L. T. (2014). The Strengths and Weakness of Research Methodology : Comparison and Complimentary between Qualitative and Quantitative Approaches. *Journal of Humanities and Social Science*, *19*(4), 99–104. https://doi.org/10.9790/0837-194399104

Cochran, W. G. (1977). *Sampling Techniques* (3rd ed.). John Wiley & Sons.

Comrey, A. L., & Lee, H. B. (1992). A first course in factor analysis, 2nd ed. In *A first course in factor analysis, 2nd ed.* https://doi.org/10.1037/0011756

Costello, A. B., & Osborne, J. W. (2005). Best Practices in Exploratory Factor Analysis : Four Recommendations for Getting the Most From Your Analysis. *Practical Assessment Research and Evaluation*, *10*(7), 1–8.

Council for Higher Education South Africa. (2016). *South African Higher Education Reviewed Two Decades Of Democracy*. Retrieved from www.che.ac.za

Creswell, J. W. (1999). Mixed-Method Research: Introduction and Application. In *Handbook of Educational Policy* (pp. 455–560).

Cronholm, S., & Goldkuhl, G. (2003). Strategies for Information Systems Evaluation- Six Generic Types. *Electronic Journal of Information Systems Evaluation*, *6*(2), 65–74.

Daghouri, A., Mansouri, K., & Qbadou, M. (2018). Information system evaluation based on multi-criteria decision making: A comparison of two sectors. *International Journal of Advanced Computer Science and Applications*, *9*(6), 291–297. https://doi.org/10.14569/IJACSA.2018.090642

Davenport, T. H., & Short, J. E. (1990). The new industrial engineering : information technology and business process redesign. *Sloan Management Review*, *31*(4), 11–27.

Davies, B., Baron, S., Gear, T., & Read, M. (1999). Measuring and managing service quality. *Marketing Intelligence & Planning*, *17*(1), 33–40. https://doi.org/10.1108/02634509910253795

DeLone, W. H., & Mclean, E. R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems / Spring*, *19*(4), 9–30. https://doi.org/10.1073/pnas.0914199107

DeLone, W. H., & Mclean, E. R. (2016). Information Systems Success Measurement. *Foundations and Trends in Information Systems*, *2*(1), 1–116.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60–95. https://doi.org/10.1287/isre.3.1.60

DeLone, W. H., & McLean, E. R. (2002). Information systems success revisited. *Proceedings of the 35th Hawaii International Conference on System Sciences (HICSS)*, *00*(c), 238–249. https://doi.org/10.1109/HICSS.2002.994345

Department of Education. (1997). *Education White Paper 3: A Programme for the tranformation of Higher Education*.

Department of Higher Education. (2013). *White Paper for Post-School Education and Training*. https://doi.org/10.5663/aps.v1i1.10138

Doll, W. J., Xia, W., & Torkzadeh, G. (1994). A Confirmatory Factor Analysis of the End-User Computing Satisfaction Instrument. *Management Information Systems Research Center*, *18*(4), 453–461.

Doumpa, T. (2009). *Hospital Information System Evaluation*.

Dyke, T. P., Prybutok, V. R., & Kappelman, L. A. (1999). Cautions on the Use of the SERVQUAL Measure to Assess the Quality of Information Systems Services. *Decision Sciences*, *30*(3), 877–891. https://doi.org/10.1111/j.1540-5915.1999.tb00911.x

Dyke, T. Van, Kappelman, L., & Prybutok, V. (1997). Measuring information systems service quality: concerns on the use of the SERVQUAL questionnaire. *MIS Quarterly*, *21*(June), 195-. https://doi.org/10.2307/249419

Edlund, S., & Lövquist, A. (2012). *The Role of System Administrators in Information Systems Success*. Retrieved from http://uu.diva-portal.org/smash/record.jsf?pid=diva2:534363

Elo, S., & Kyngas, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107–115. https://doi.org/10.1111/j.1365-2648.2007.04569.x

Esterberg, K. G. (2002). *Qualitative Methods in Social Research*. Boston: McGraw-Hill.

Etikan, I. (2016). Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*, *5*(1), 1. https://doi.org/10.11648/j.ajtas.20160501.11

Farbey, B., Land, F., & Targett, D. (1993). How to assess your IT investment: a study of methods and practice. In *MANAGEMENT TODAY-LONDON*. https://doi.org/10.1007/s00198-016-3769-2

Farbey, B., Land, F., & Targett, D. (1999). Moving IS evaluation forward : learning themes and research issues. *Journal of Strategic Information Systems*, *8*, 189–207.

FIeld, A. (2009). Discovering Statistics Using SPSS. In *The Joint Commission journal on quality improvement* (3rd Editio, Vol. 21). https://doi.org/10.1016/S1070-3241(16)30130-4

Friese, S. (2014). *Qualitative Data Analysis with ATLAS.ti* (2nd ed.). Retrieved from https://books.google.co.za/books?id=-YhIAwAAQBAJ

Fouka, G., & Mantzorou, M. (2011). What are the major ethical issues in conducting research? Is there a conflict between the research ethics and the nature of nursing?. *Health science journal*, *5*(1), 3.

Garbarino, S., & Holland, J. (2009). *Quantitative and qualitative methods in impact evaluation and measuring results*.

Garrity, E. J., & Sanders, G. L. (1998). Introduction to Information Systems Success Measurement. In *Dimensions of Information Systems Success* (pp. 1–45). Idea Group.

Garrity, E. J., & Sanders, G. L. (2003). System Quality and Information Quality : Do They Really Reflect Information System Success ? *Proceedings of the Information Resources Management Association Conference*, 158–162.

Gatian, A. G. (1994). Is user satisfaction a valid measure of systems effectiveness? *Information & Management*, *26*(3), 119–131. Retrieved from http://dx.doi.org/10.1016/0378-7206(94)90036-1

Gelderman, M. (1998). The relation between user satisfaction , usage of information systems and performance. *Information & Management*, *34*, 11–18.

Gentles, S. J., Charles, C., Ploeg, J., & Mckibbon, K. A. (2015). Sampling in Qualitative Research : Insights from an Overview of the Methods Literature. *The Qualitative Report*, *20*(11), 1772–1789.

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: Interviews and focus groups. *British Dental Journal*, *204*(6), 291–295. https://doi.org/10.1038/bdj.2008.192

Glaser, B. G., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*.

Glasow, P. A. (2005). Fundamentals of survey research methodology. *Retrieved September*, pp. 1–28. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Fundamentals+of+Survey+Research+Methodology#1

Gorla, N., Somers, T. M., & Wong, B. (2010). Organizational impact of system quality, information quality, and service quality. *Journal of Strategic Information Systems*, *19*(3), 207–228. https://doi.org/10.1016/j.jsis.2010.05.001

Gorsuch, R. (1997). Exploratory Factor Analysis : Its role in Item Analysis. *Journal of Personality Assessment*, *68*(3), 532–560. https://doi.org/10.1207/s15327752jpa6803

Gray, E., & Czerniewicz. Laura. (2018). Access to Learning Resources in Post-apartheid South Africa. In J. Karaganis (Ed.), *Shadow Libraries: Access to Knowledge in Global Higher Education* (pp. 107–157). https://doi.org/10.1192/bjp.111.479.1009-a

Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough ? An Experiment with Data Saturation and Variability. *Field Methods*, *18*(1), 59–82. https://doi.org/10.1177/1525822X05279903

Habib, A. A., & Govindaraju, R. (2018). Success Measures Evaluation for Mobile Commerce Using Text Mining based on Customer Tweets. *IOP Conference Series: Materials Science and Engineering*, *319*(1). https://doi.org/10.1088/1757-899X/319/1/012009

Hair, J. F., Anderson, R. E., Tatham, R. L., Black, W. C., & Hair Jr, J.F.; Anderson, R.E.; Tatham, R.L.; Black, W. C. (1995). Multivariate data analysis: with readings. In *International Journal of Pharmaceutics*. https://doi.org/10.1016/j.ijpharm.2011.02.019

Hall, M., & Symes, A. (2005). South African higher education in the first decade of democracy: From cooperative governance to conditional autonomy. *Studies in Higher Education*, *30*(2), 199–212. https://doi.org/10.1080/03075070500043317

Helia, V. N., Asri, V. I., Kusrini, E., & Miranda, S. (2018). Modified technology acceptance model for hospital information system evaluation - A case study. *MATEC Web of Conferences*, *154*, 0–4. https://doi.org/10.1051/matecconf/201815401101

Higher Edcuation South Africa. (2014). *Strategic framework, 2015 – 2019*.

Hogarty, K. Y., Hines, C. V., Kromrey, J. D., Perron, J. M., & Mumford, A. K. R. (2005). The quality of factor solutions in exploratory factor analysis: The influence of sample size, communality, and overdetermination. *Educational and Psychological Measurement*. https://doi.org/10.1177/0013164404267287

Hussein, S. A. (2009). *An Empirical Investigation of Information System Success: An Analysis of the Factors Affecting Banking Information Systems Success in Egypt*. University of Bradford.

Iivari, J. (2005). An Empirical Test of the DeLone-McLean Model of Information System Success. *The Database for Advances in Information Systems*, *36*(2), 8–27.

Irani, Z. (2002). Information systems evaluation: Navigating through the problem domain. *Information and Management*, *40*(1), 11–24. https://doi.org/10.1016/S0378-7206(01)00128-8

Jaleel, M. A. (2014). *Administration of Information in Higher Education-Role of ICT*. *3*(2), 935–938.

Jiang, J., Klein, G., & Carr, C. (2002). Measuring Information System Service Quality: SERVQUAL from the Other Side. *MIS Quarterly*, *26*(1), 145–166. https://doi.org/10.2307/4132321

Juma, K. S., Raihan, A., & Clement, C. K. (2016). Role of ICT in Higher Educational Administration in Uganda. *World Journal of Educational Research*, *3*(1), 1–10. https://doi.org/10.22158/wjer.v3n1p1

Jumare, M. A., Tahir, S. M., & Hamid, A. T. (2017). The use of ICT in Nigerian universities: A study of Kaduna State University, Kaduna. *International Journal of Advanced Research in IT and Engineering*, *6*(7), 1–12.

Kaisara, G., & Pather, S. (2011). The e-Government evaluation challenge: A South African Batho Pele-aligned service quality approach. *Government Information Quarterly*, *28*(2), 211–221. https://doi.org/10.1016/j.giq.2010.07.008

Kaiser, H. F. (1970). A second generation little jiffy. *Psychometrika*. https://doi.org/10.1007/bf02291817

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*. https://doi.org/10.1007/BF02291575

Kaplan, B., & Duchon, D. (1988). Combining Qualitative and Quantitative Methods in Information Systems Research: A case study. *MIS Quarterly*, *12*(4), 571–586.

Karlinsky-Shichor, Y., & Zviran, M. (2016). Factors Influencing Perceived Benefits and User Satisfaction in Knowledge Management Systems. *Information Systems Management*, *33*(1), 55–73. https://doi.org/10.1080/10580530.2016.1117873

Kassim, E. S., Jailani, S. F. A. K., Hairuddin, H., & Zamzuri, N. H. (2012). Information system acceptance and user satisfaction : The mediating role of trust. *Procedia-Social and Behavioral Sciences*, *57*, 412–418.

https://doi.org/10.1016/j.sbspro.2012.09.1205

Kelly, D. (2009). Methods for Evaluating Interactive Information Retrieval Systems with Users. *Foundations and Trends in Information Retrieval*, *3*(1–2), 1–224. https://doi.org/10.1561/1500000012

Kettinger, W. J., & Lee, C. C. (1994). Perceived Service Quality and User Satisfaction with the Information Services Function. *Decision Sciences*, *25*(5–6), 737–766. https://doi.org/10.1111/j.1540-5915.1994.tb01868.x

Kettinger, W. J., & Lee, C. C. (1997). "Zoning-In" on Information Systems Service Quality: Continuous Refinement of the SERVQUAL Measurement. *ICIS '97 Proceedings of the 18th International Conference on Information Systems*, (1993), 197–203. Retrieved from http://dl.acm.org/citation.cfm?id=353120

Kettinger, W. J., & Lee, C. C. (2005). Zones of Tolerance : Alternative Scales for Measuring Information Systems Service Quality. *MIS Quarterly*, *29*(4), 607–623.

Klein, H. K., Myers, M. D., Quarterly, S. M. I. S., & Mar, N. (2017). A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems Stable URL : http://www.jstor.org/stable/249410 A SET OF PRINCIPLES FOR CONDUCTING AND EVALUATING INTERPRETIVE FIELD STUDIES IN INFORMATION SYSTEMS1. *MIS Quarterly*, *23*(1), 67–93.

Konopásek, Z. (2016). *Making Thinking Visible with Atlas . ti : Computer Assisted Qualitative Analysis as Textual Practices Author (s): Zdeněk Konopásek Source : Historical Social Research / Historische Sozialforschung . Supplement , No . 19 , Grounded Theory Reader (2007)*. (19), 276–298. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Fundamentals+of+Survey+Research+Methodology#1

Krishnaveni, R., & Meenakumari, J. (2010). Usage of ICT for Information Administration in Higher education Institutions – A study. *International Journal of Environmental Science and Development*, *1*(3), 282–286. https://doi.org/10.7763/IJESD.2010.V1.55

Kumar, K. (1990). Post Implementation Evaluation of Computer- Based Information - Systems : Current Practices. *Communications of the ACM*, *33*(2), 203–212.

Le Grange, L. (2016). Decolonising the university curriculum: leading article. *South African Journal of Higher Education*, *30*(2), 1–12.

Le Grange, Lesley. (2011). (Re)thinking (trans)formation in South African (higher) education. *Perspectives in Education*, *29*(2), 1–9.

Shing-On Leung (2011) A Comparison of Psychometric Properties and Normality in 4-,

5-, 6-, and 11-Point Likert Scales, Journal of Social Service Research, 37:4, 412-421, DOI: 10.1080/01488376.2011.580697

Levy, Y., & Ellis, T. J. (2006). A systems approach to conduct an effective literature review in support of information systems research. *Informing Science: International Journal of an …*, *9*, 181–212. Retrieved from http://www.scs.ryerson.ca/aferworn/courses/CP8101/CLASSES/ConductingLiteratureReview.pdf

Li, M. (2019). *An Analysis on the Effectiveness of Ideological and Political Education in Improving the Administration Performance of Applied University*. *329*(Iccessh), 314–317. https://doi.org/10.2991/iccessh-19.2019.71

MacGregor, J. F., & Kourti, T. (1995). STATISTICAL PROCESS CONTROL OF MULTIVARIATE PROCESSES. *Control Engineering Practice*, *3*(3), 403–414.

Machingambi, S. (2011). Is Access to Higher Education a Sufficient Condition for Social Equity in South Africa? A Critical Analysis. *J Soc Sci*, *28*(1), 13–20. Retrieved from http://www.krepublishers.com/02-Journals/JSS/JSS-28-0-000-11-Web/JSS-28-1-000-2011-Abst-PDF/JSS-28-1-013-11-1221-Machingambi-S/JSS-28-1-013-11-1221-Machingambi-S-Tt.pdf

Mahmood, M. A., Burn, J., Gemoets, L. A., & Jacquez, C. (2000). Variables affecting information technology end-user satisfaction : a meta-analysis of the empirical literature. *International Journal of Human-Computer Studies*, *52*, 751–771. https://doi.org/10.1006/ijhc.1999.0353

Mamma, E. (2010). Quality and Evaluation of Information Systems in Institutional Organizations. *International Conference on Qualitative and Quantitative Methods In Libraries*, 1–8.

Mardiana, S., Tjakraatmadja, J. H., & Aprianingsih, A. (2015). International Journal of Economics and Financial Issues DeLone–McLean Information System Success Model Revisited: The Separation of Intention to Use -Use and the Integration of Technology Acceptance Models. *International Journal of Economics and Financial Issues*, *5*(5), 172–182. https://doi.org/10.1016/j.procs.2015.12.150

Mason, R. O. (1978). Measuring information output: A communication systems approach. *Information and Management*, *1*, 219–234. https://doi.org/http://dx.doi.org/10.1016/0378-7206(78)90028-9

McKeever, M. (2017). Educational Inequality in Apartheid South Africa. *American Behavioral Scientist*, *61*(1), 114–131. https://doi.org/10.1177/0002764216682988

Melone, N. P. (1990). A Theoretical Assessment of the User-Satisfaction Construct in Information Systems Research. *Management Science*, *36*(1), 76–91.

Ministry of Education. (2001). *National Plan for Higher Education*. Retrieved from http://www.justice.gov.za/commissions/FeesHET/docs/2001-NationalPlanForHigherEducation.pdf

Mohamedbhai, G. (2014). Massification in Higher Education Institutions in Africa: Causes, Consequences, and Responses. *International Journal of African Higher Education*, *1*(1), 60–83. https://doi.org/10.6017/ijahe.v1i1.5644

Msila, V. (2007). From Apartheid Education to the Revised National Curriculum Statement : Pedagogy for Identity Formation and Nation Building in South Africa. *Nordic Journal of African Studies*, *16*(2), 146–160. https://doi.org/10.3167/jrs.2012.120307

Mthimunye, K. D. T., Daniels, F. M., & Pedro, A. (2017). Predictors of academic performance among second-year nursing students at a university in the Western Cape. *South African Journal of Higher Education*, *32*(1), 192–215. https://doi.org/10.20853/32-1-693

Muda, I., & Ade Afrina, E. (2018). Influence of human resources to the effect of system quality and information quality on the user satisfaction of accrual-based accounting system. *Contaduria y Administracion*, *64*(2), 1–25. https://doi.org/10.22201/fca.24488410e.2019.1667

Muturi, B., Kiflemariam, A., & Acosta, F. (2018). Towards a Robust Human Resource Information Systemâ□™s Success Measurement Model. *International Journal of Academic Research in Business and Social Sciences*, *8*(3), 1–14. https://doi.org/10.6007/ijarbss/v8-i3/3895

Nelson, R. R., Todd, P. A., & Wixom, B. H. (2005). Antecedents of Information and System Quality : An Empirical Examination Within the Context of Data Warehousing. *Journal of Management Information Systems*, *21*(4), 199–235.

Nunnally, J. C. (1979). Psychometric Theory. In *Applied Psychological Measurement*. https://doi.org/10.1177/014662167900300216

Nyahodza, L., & Higgs, R. (2017). Towards bridging the digital divide in post-apartheid South Africa: a case of a historically disadvantaged university in Cape Town. *South African Journal of Libraries and Information Science*, *83*(1), 39–48. https://doi.org/10.7553/83-1-1645

Ojo, A. I. (2017). Validation of the DeLone and McLean Information Systems Success Model. *Healthcare Informatics Research*, *23*(2), 60–66. https://doi.org/10.1016/0048-9697(79)90065-2

Onwuegbuzie, A. J. (2007). A Typology of Mixed Methods Sampling Designs in Social Science Research. *The Qualitative Report*, *12*(2), 281–316.

Osborne, J. W. (2015). What is Rotating in Exploratory Factor Analysis ? *Practical Assessment, Research and Evaluation*, *20*(2), 1–7.

Osborne, J. W., & Costello, A. B. (2004). Sample size and subject to item ratio in principal components analysis. *Practical Assessment, Research & Evaluation*, *9*(11), 1–9.

Pallant, J. (2013a). *SPSS survival manual: a step by step guide to data analysis using IBM SPSS* (5th ed.). Open University Press.

Pallant, J. (2013b). *SPSS survival manual*. McGraw-Hill Education (UK).

Palm, J., Colombet, I., Sicotte, C., & Degoulet, P. (2006). Determinants of User Satisfaction with a Clinical Information System. *AMIA Symposium*, 614–618.

Palys, T. (2008). Purposive sampling.In L.; M. Given (Ed.). *The Sage Encyclopedia of Qualitative Research Methods*, *2*, 697-8.

Parasuraman, A., Zeithaml, V. A., & Berry, L. . L. (1985a). A Conceptual Model of Service Quality and Its Implications for Future Research. *Journal of Marketing*, *49*(4), 41–50. https://doi.org/10.1016/S0148-2963(99)00084-3

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). Consumer Perceptions of Service Quality. *Journal of Retailing*, *64*(1).

Parasuraman, A., Zeithaml, V., & Berry, L. (1985b). A Conceptual Model of Service Quality and Its Implications For Future Research. *Journal of Marketing*, *49*(fall 1985), 41–50. https://doi.org/10.1016/S0148-2963(99)00084-3

Pather, S. (2017). Contextualising Information Systems Evaluation Research : Towards a Classification of Approaches. *The European Conference on Information Systems Management*, 252–261.

Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: models, dimensions, measures, and interrelationships. *European Journal of Information Systems*, *17*, 236–263. https://doi.org/10.1057/ejis.2008.15

Pitt, L. F., Watson, R. T., & Kavan, C. B. (1995). Service Quality: A Measure of Information Systems Effectiveness. *MIS Quarterly*, *19*(2), 173–187. https://doi.org/10.2307/249687

Platisa, G., & Balaban, N. (2009). Methodological Approaches to Evaluation of Information System Functionality Performances and Importance of Successfulness Factors Analysis. *Management Information Systems*, *4*(2), 011–017.

Popovič, A., Puklavec, B., & Oliveira, T. (2019). Justifying business intelligence systems adoption in SMEs: Impact of systems use on firm performance. *Industrial*

Management and Data Systems, *119*(1), 210–228. https://doi.org/10.1108/IMDS-02-2018-0085

Putra, S. J., Subiyakto, A., Yunita, I., Gunawan, M. N., & Durachman, Y. (2018). Assessing the user satisfaction perspectives of information system: A library case study in Indonesia. *Indonesian Journal of Electrical Engineering and Computer Science*, *12*(1), 95–101. https://doi.org/10.11591/ijeecs.v12.i1.pp95-101

Qu, S. Q., & Dumay, J. (2011). The qualitative research interview. *Qualitative Research in Accounting and Management*, *8*(3), 238–264. https://doi.org/10.1108/11766091111162070

Qureshi, Z. H., & Qazi Abro, M. M. (2016). EFFICIENT USE OF ICT IN ADMINISTRATION. *International Journal of Economics, Commerce and Management*, *IV*(10), 540–550.

Reio Jr, T. G., & Shuck, B. (2015). Exploratory Factor Analysis : Implications for Theory, Research, and Practice. *Advances in Developing Human Resources*, *17*(1), 12–25. https://doi.org/10.1177/1523422314559804

Roky, H., & Meriouh, Y. Al. (2015). Evaluation by users of an industrial information system (XPPS) based on the DeLone and McLean model for IS success. *Procedia Economics And Finance*, *26*(0), 903–913. https://doi.org/10.1016/S2212-5671(15)00903-X

Ryan, F., Coughlan, M., & Cronin, P. (2014). Interviewing in qualitative research: The one-to-one interview. *International Journal of Therapy and Rehabilitation*, *16*(6), 309–314. https://doi.org/10.12968/ijtr.2009.16.6.42433

Seddon, P. B. (1997). A respecification of the DeLone and McLean model of IS Success. *Information Systems Research*, *8*(3), 240–253. https://doi.org/10.1287/isre.8.3.240

Seddon, P., Patry, M., & Kiew, M. (1994). A Partial Test and Development of the DeLone and McLean Model of IS Success. *International Conference On Information Systems (ICIS)*, 99–110.

Selwyn, N., Henderson, M., & Chao, S. (2018). ‘ You need a system ’: exploring the role of data in the administration of university students and courses administration of university students and courses. *Journal of Further and Higher Education*, *42*(1), 46–56. https://doi.org/10.1080/0309877X.2016.1206852

Shannon, C. E., & Weaver, W. (1948). A Mathematical Theory of Communication. *The Bell System Technical Journal*, *27*(July), 1–54. https://doi.org/10.1145/584091.584093

Smithson, S., & Hirschheim, R. (1998). Analysing information systems evaluation :

another look at an old problem. *European Journal of Information Systems*, *7*, 158–174.

Song, J., Kim, J., Jones, D. R., Baker, J., & Chin, W. W. (2014). Application discoverability and user satisfaction in mobile application stores: An environmental psychology perspective. *Decision Support Systems*, *59*(1), 37–51. https://doi.org/10.1016/j.dss.2013.10.004

Song, X., & Letch, N. (2012). Research on IT/IS Evaluation: A 25 Year Review. *Electronic Journal of Information Systems Evaluation*, *15*(3), 276–287. Retrieved from http://www.ejise.com/issue/download.html?idArticle=826

Stelzer, A., Englert, F., Horold, S., & Mayas, C. (2015). Improving service quality in public transportation systems using automated customer feedback. *Transportation Research Part E: Logistics and Transportation Review*, *89*, 259–271. https://doi.org/10.1016/j.tre.2015.05.010

Stevens, J. (1996). *Applied multivariate statistics for the social sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Stockdale, R., & Standing, C. (2006). An interpretive approach to evaluating information systems : A content , context , process framework. *European Journal Of Operational Research*, *173*, 1090–1102. https://doi.org/10.1016/j.ejor.2005.07.006

Struwig, F. W., & Smith, E. E. (2009). ORGANISATIONAL NORMS OF ACADEMIC ADMINISTRATION AT A HIGHER EDUCATION INSTITUTION. *Acta Commercii*, *9*(1), 60–77.

Suhr, D. D. (2006). Exploratory or Confirmatory Factor Analysis ? *SUGI 31*, 1–17.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using Multivariate Statistics* (4th ed.). Boston: Allyn & Bacon.

Tabachnick, Barbara G, & Fidell, L. S. (2014). Using multivariate statistics (6th ed.). In *Using multivariate statistics 5th ed*. https://doi.org/10.1037/022267

Taherdoost, H., Sahibuddin, S., & Jalaliyoon, N. (2014). Exploratory Factor Analysis; Concepts and Theory. *Advances in Applied and Pure Mathematics*, 375–382. https://doi.org/10.1017/CBO9781107415324.004

Tam, C., & Oliveira, T. (2017). Understanding mobile banking individual performance: The DeLone & McLean model and the moderating effects of individual culture. *Internet Research*, *27*(3), 538–562. https://doi.org/10.1108/IntR-05-2016-0117

Tate, M., Sedera, D., Mclean, E., & Burton-Jones, A. (2014). Information Systems Success Research : the " Twenty Year Update ?" Panel report from PACIS, 2011.

Communications of the Association for Information Systems, *34*(64), 1235–1246.

Teeger, C. (2015). “Both Sides of the Story”: History Education in Post-Apartheid South Africa. *American Sociological Review*, *80*(6), 1175–1200. https://doi.org/10.1177/0003122415613078

Thong, J. Y. ., & Yap, C.-S. (1996). Information Systems Effectiveness : A User Satisfaction Approach. *Information Processing Management*, *32*(5), 601–610.

Treiblmaier, H., & Filzmoser, P. (2009). *Exploratory factor analysis revisited : How robust methods support the detection of hidden multivariate data structures in IS research*.

Tucker, L., & MacCallum, R. (1997). *Exploratory Factor Analysis*.

Vaezi, R. (2013). *User Satisfaction with Information Systems : A Comprehensive Model of Attribute Satisfaction*.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). USER ACCEPTANCE OF INFORMATION TECHNOLOGY: TOWARD A UNIFIED VIEW. *MIS Quarterly*, *27*(3), 425–478.

Visser, M. M. (2011). *TOWARDS DEVELOPING AN EVALUATION TOOL FOR BUSINESS MANAGEMENT INFORMATION SYSTEMS ' SUCCESS AT PUBLIC FURTHER EDUCATION AND TRAINING (FET) COLLEGES IN SOUTH AFRICA*.

Visser, M., Van Biljon, J., & Herselman, M. (2013). Evaluation of management information systems : A study at a further education and training college. *SA Journal of Information Management*, *15*(1), 1–8. https://doi.org/10.4102/sajim.v15i1.531

Wang, Y. S. (2008). Assessing e-commerce systems success: A respecification and validation of the DeLone and McLean model of IS success. *Information Systems Journal*, *18*(5), 529–557. https://doi.org/10.1111/j.1365-2575.2007.00268.x

Watson, R. T., Leyland, F. P., & Kavan, C. B. (1998). Measuring Information Systems Service Quality: Lessons from Two Longitudinal Case Studies. *MIS Quarterly*, *22*(1), 61–79. https://doi.org/10.2307/249678

Watson, R. T., Pitt, L. F., Cunningham, C. J., & Nel, D. (1993). User satisfaction and service quality of the IS department: Closing the gaps. *Journal of Information Technology*, *8*(4), 257–265. https://doi.org/10.1057/jit.1993.36

Williams, B., Brown, T., & Onsman, A. (2010). Exploratory factor analysis: A five-step guide for novices. *This Journal Article Is Posted at Research Online*, *8*(3), 1–13. Retrieved from

http://ro.ecu.edu.au/jephc/vol8/iss3/1Availableat:http://ro.ecu.edu.au/jephc/vol8/iss3/1

Williams, B., Onsman, A., & Brown, T. (2010). Exploratory Factor Analysis : A five-step guide for novices. *Journal of Emergency Primary Health Care*, *8*(3), 1–13. https://doi.org/10.1080/09585190701763982

Wixom, B. H., & Todd, P. a. (2005). A Theoretical Integration of User Satisfaction and Technology Acceptance. *Information Systems Research*, *16*(1), 85–102. https://doi.org/10.1287/isre.l050.0042

Xu, J., Benbasat, I., & Cenfetelli, R. T. (2013). Integrating Service Quality with System and Information Quality: An Empirical Test in the E-Service Context. *Mis Quarterly*, *37*(3), 777–794.

Yakubu, M. N., & Dasuki, S. I. (2018). Assessing eLearning systems success In Nigeria: An application of the Delone And Mclean information systems success model. *Journal of Information Technology Education: Research*, *17*, 183–203. https://doi.org/10.28945/4077

Yilmaz, K. (2013). Comparison of Quantitative and Qualitative Research Traditions: epistemological, theoretical, and methodological differences. *European Journal of Education*, *48*(2), 311–326. https://doi.org/10.1111/jppi.12086

Yong, A. G., & Pearce, S. (2013). A Beginner's Guide to Factor Analysis: Focusing on Exploratory Factor Analysis. *Tutorials in Quantitative Methods for Psychology*, *9*(2), 79–94. https://doi.org/10.20982/tqmp.09.2.p079

Yu, P., & Qian, S. (2018). *Developing a theoretical model and questionnaire survey instrument to measure the success of electronic health records in residential aged care*. 1–18.

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*, *5*(1).

Zviran, M., & Erlich, Z. (2003). Measuring IS User Satisfaction : Review and Implications. *Communications of the Association for Information Systems*, *12*(1), 81–103. Retrieved from https://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=11386555&lang=fr&site=ehost-live

Appendix 3.1: Interview Consent Form

Consent Form: Interview

University of the Western Cape

Title of Project:

Evaluation of Information Systems in a University administration context: Measurement of User Satisfaction

By checking the box,		☐
a	I agree to participate in this research project.	
b	I have read this consent form and the information it contains and had the opportunity to ask questions about them.	
c	I understand that I was selected to participate in this study due to my expertise and/or position	
d	I understand that my responses are being used solely for research, and that my privacy is respected at all times.	
	I understand that my responses will be used in aggregate form only, so that I will not be personally identifiable.	
e	I understand that I am under no mandatory obligation to take part in this project, and I have the right to withdraw my participation at any stage.	

g	I understand that this research might be published in a research journal, policy brief or book. In the case of dissertation research, the document will be available to readers in a university library in printed form, and possibly in electronic form as well.	

_____ _____ _____

Name of Participant Date Signature

(*or legal representative*)

_____ _____ _____

Lead Researcher Date Signature

(*To be signed and dated in presence of the participant*)

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.

Appendix 3.2: Information Sheet

Interview Discussion – Information Systems Evaluation

Project Title: Evaluation of Information Systems in a University administration context: Measurement of User Satisfaction

What is this study about?

My name is Tatenda Watungwa, a student at the University of the Western Cape (South Africa) pursuing a Masters programme in Information Systems. I am conducting a study to measure Information systems (IS) success of higher education administrative systems. I am investigating how to evaluate Information Systems from a user satisfaction perspective. By gathering this information, I aim to develop an instrument to measure IS success. This study is solely for academic purposes. Your personal details shall remain strictly confidential and anonymous, and the study does not intend to harm you in any way. I thank you in advance for your participation.

What will I be asked to do if I agree to participate?

The interview will be a chance to get a general idea of the administrative systems to get a first-hand understanding from practical system stakeholders. If you agree to participate in this research project, you will be asked to participate in an interview discussion which aims to gather more information regarding MAS and your experience with usage of the system. The duration of the interview will be between 20-30 minutes and will be held at a mutually benefitting venue (UWC campus). The proceedings will be audio recorded.

Would my participation in this study be kept confidential?

At no stage will any personal information be collected. This includes your name, staff number etc. We will only collect broad information such as faculty, department. The audio recording will not be shared with any other parties and will be taken for the sole purpose of transcribing the discussion for research analysis purposes.

What are the risks of this research?

There are no known risks associated with participating in this research process.

What are the benefits of this research?
The benefits of research are that it will provide a measurement tool for evaluating the success of administrative systems of higher education institutions. The findings will be shared with relevant stakeholders, and can potentially be used to identify and remedy problematic areas from the perspective of the users of the administrative systems.

Is it compulsory to participate in this research and may I stop participating at any time?

Your participation in this research is completely and entirely voluntary and you may choose not to take part at all. By choosing to participate, you will have the option to withdraw from the process at any time without any negative implications. Should you have any questions regarding this study and your rights as a research participant or if you

wish to report any problems you have experienced related to the study, please contact my supervisor:

Prof. Shaun Pather

Email: spather@uwc.ac.za

Tel. **021 959 3248**

Information Systems Dept. Coordinator of Post Graduate Studies

University of the Western Cape

Private Bag X17

Bellville 7535

South Africa

Appendix 4.1: Interview Schedule

Title of Study: Evaluation of Information Systems in a University administration context: Measurement of User Satisfaction

Welcome and thank you for taking the time to participate and help me with my study. The purpose of this interview is to get your feedback on the usage of MAS, how you would describe the experience and what aspects are to be improved. Specifically, to understand what works for you and what doesn't work in light of determining whether the system denotes information systems effectiveness.

Let me introduce myself. I am **Tatenda Watungwa** and I will be the interviewer in today's interview. I will guide the conversation by asking questions for you to respond to. There are no right or wrong answers to these questions. I may probe deeper into your answer to get a better understanding. This interview is anonymous and confidential. As you can see, we will be voice recording this interview. The recording will only be used to create a written record of today's discussion.

Question	Objective: What do I want to gain from this response?
1. How does the system support your work objectives?	(Understanding their user role): To understand what they are using the system for and what functionality they have access to
2. How does MAS enhance your job performance? Give examples	(Possibly answers relating to system/information quality): Looking to see what the users can identify to describe the systems quality
3. Does MAS restrict your job performance in any way? Give examples	
4. If we were in an ideal world, what would be your top FIVE expectations from a system like MAS?	What would increase their satisfaction as a user

5. If you could make changes to the system what would they be and why?	What are the major areas of improvement, leading on from their expectations, how is the system not meeting their expectations
6. Of all the things we've discussed today, what would you say are the most important issues you would like to express about the system?	Just general comments that may come to mind about MAS

Conclusion: Thank you for participating I would like to remind you that any comments featuring in this report will be anonymous and your opinions will be a valuable asset to the study.

Appendix 4.2: Example of Interview Transcript

Interview 1.

Job title: IS Department Lecturer (256 students)

Question 1. What do you use mas for and how does it support your work objectives?

In terms of work objectives, in terms of marks administration we create a marks schedule and for each course there is a continuous assessment mark. So, you go into MAS and upload marks for each of the activities that students have to perform. For example, you have a CAM mark and an examination mark. For my course CAM consists of a number of different activities, a class tests, terms test, individual and group assignment and discussion forum. These are represented in the course outline along with the percentage weighting.

So, I upload the course schedule together with the percentages. CAM counts 60% but the number of activities counts 100% so you need to calculate the 60% out of the 100%. The system is DIY you just enter the marks.

Question 2. In an ideal world, what would be your expectations of MAS in terms of its performance?

Easier to access MAS offline – if you're not physically at campus

Having a UWC issued laptop with all required features to work from at home or compensation – because I had to buy my own personal laptop to use at home exclusively for work.

Having enough capacity – while working from home I had uploading issues meaning I had to upload marks several times

Easy process for changing marks – currently users have to go back and enter the student number change the marks and give a reason for the change and get that change of mark verified or double checked by someone else. So, the verifier (MA) needs to have internet access to verify the change. The main problem was that during changing of marks I was uploading 5 changes but only 1 out of the 5 actually changed so I had to go back and re-do the other 4 and it's a process of going back to check which 1 was actually updated out of the 5 and which were not updated. Also, on top of that the marks were not updated with the CAM marks.

Question 3. How does MAS enhance your job performance?

It stops me from having to do it manually but that's about it.

Question 4. How does MAS restrict your job performance?

You still have to use excel to record marks then from excel to MAS because imagine if you have 300 students, you don't want to sit there and enter MAS marks one at a time, that takes a while.

Some of the problems were, how do you do MAS when you're not at work. So, for example when we had the protests, you weren't allowed to be at campus and complicated things for the mark's administrator. There is only 1 MA for the entire UG course and if you weren't allowed to get online, then you won't be able to upload marks.

So, if you're not at campus it causes complications and for the people who don't have internet at home that becomes an issue. Not all MA have internet at home so that complicated how they could actually upload marks.

The system hung, so if you're uploading 300 marks onto MAS and everybody is trying to upload at the same time there were some capacity issues. And combining that with slow internet issues at home, it could lead to a complete breakdown of students getting their marks on time – so deadlines had to be shifted.

MAS sends out marks via email and if students where at a place where they don't have internet access then they don't have their marks. When things happen to MAS, there is no control over marks being sent out. Marks had to be sent out manually.

MAS does not save records, if a connection problem occurs you start from scratch. That's why the spreadsheet is needed. But different departments work in different ways, also you need to verify that the marks on the spreadsheet are the same as what has been uploaded – process of verification before marks get sent out.

Password for NOVEL and password for MAS is the same but you have to update your password for NOVEL every 30 days, but the system doesn't send a reminder, so your password expires then you can't get access to mas if you're offsite. Then you have to get ICS to update your password, so essentially the people at ICS have access which they should not have.

Question 5. If you could make any changes to MAS to improve the system for your benefit as the user what would they be?

Making sure the updates actually happen at the time that I make them and not just one but all of them – because sometimes I make updates, but it reflects on my side but not on the student's side that the mark was updated. This increases the workload for me and that creates more workload on the person checking it and the student having to check.

Notifications to say that the system has updated the changes on my side, the administrator's side and the student's side.

Having remote access.

Having better capacity to suit the needs of such a big university.

MAS doing the automatic calculation, so if I say out of the 60% this assignment is 15% and then it automatically calculates what is out of the 100% without me having to do that manual calculation. It's not entirely accurate in terms of the decimal places and rounding. Students will calculate their CAM and I will calculate, and I can only calculate to a certain decimal place, but MAS will come to maybe 5 decimal places.

Question 6. Of all the things discussed today what would be the most important issues you would like to express about the system?

Availability offsite and capacity and also updates need to happen in real-time and this does not happen when offsite.

Appendix 4.3: Example of Code Table (Service Quality)

Code Group: Service Quality

Code	Description	Example Quotes
Support Access	The user's knowledge of how to attain the support. Convenient access to staff or team employed to provide help with technical issues relating to the system. Also including end user training to fully prepare users on how to use the system and all its functionality.	**Faculty Officer** – "Currently no appointed support staff" **Lecturer** – "From a lecturer's point of view getting support help for technical issues is quite a process because you have to go through the MA, and they contact ICS" **Lecturer** – "Training needs to be better, it's still confusing even after training" **Lecturer** – "They don't push you enough to attend the training" **Administrator** – "We (Marks Administrators) do unofficial training of the lecturers because lecturers do not attend the training provided by the university"
Support Reliability	The consistency or dependability of the support given by support staff in aiding users when they have problems.	**Lecturer** - "I have mentioned this to the support staff, but nothing has been done about it" **Administrator** – "The training is excellent; the support staff are always available"
Support Responsiveness	The responsiveness of the support services for the system	**Faculty Officer - "**Previously that single person assisted the entire campus. That was already an issue because if she was on leave then there is no one to assist" **Administrator – "**That one support staff gets inundated with queries especially around peak times."

Understanding/Knowing the user	How well the users know their role/functions and how well the support team are aware of problems that users encounter within their specific roles	**Administrator – "**Training is offered, and the training is split up into groups of different roles, so there will be training for lecturers, training for module coordinators and different training for marks admin. Sometimes lecturers may forget that they have two roles, so they go to training for lecturers but forget they need to go for training as the module coordinator as well, because of that they come into problems and don't know what to do."

Appendix 5.1: Email from Registrar's office

UNIVERSITY OF THE WESTERN CAPE

MARKS ADMINISTRATION SYSTEM - USER SATISFACTION SURVEY

Dear Colleague

You are kindly requested to participate in a survey which seeks to develop an instrument to assess your satisfaction with the UWC Marks Administration System (MAS). The outcomes of the study will improve the University's ability to identify areas for potential enhancement of MAS, which ultimately will be for the benefit of your user experience and the nett productivity gains of the system.

The study is being conducted by Ms Tatenda Watungwa, a Masters student of the Department of Information Systems, and is titled **"Evaluation of Information Systems in a university administration context: Measurement of User Satisfaction"**.

It would be highly appreciate it if you could complete the survey shared via the link below, by 10 October . It will take approximately 15 minutes.

Click here to take the SURVEY

If you have any questions please feel free to contact

- The student, Ms Tatenda Watungwa: 3362868@myuwc.ac.za
- The study leader, Prof Shaun Pather: spather@uwc.ac.za

Thanking you in advance.
Ms Tatenda Watungwa & Prof Shaun Pather

A place of quality, a place to grow, from hope to action through knowledge.

UNIVERSITY of the WESTERN CAPE

Appendix 5.2: Survey Instrument

User Satisfaction of MAS

You are invited to participate in this research project because you are a user of MAS and a valuable source for this study. The procedure involves filling an online survey that will take approximately 15 minutes.

1) Your participation in this research study is voluntary. You may choose not to participate.
2) If you decide to participate in this research survey, you may withdraw at any time.
3) If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized.
4) There are no risks to your participation in the survey.
5) Your responses will be confidential and we do not collect identifying information such as your name, email address or IP address.
6) The data from this survey will be used for scholarly purposes in the first instance. The resultant findings will be shared with relevant MAS stakeholders at UWC .

** ELECTRONIC CONSENT: Please select your choice below. Clicking on the "Agree" button below indicates that you have read the above information, and that you voluntarily agree to participate. If you do not wish to participate in the research study, please decline participation by clicking on the "Disagree" button.

* Required

1. **Do you agree to participate ?** *
   Mark only one oval.
   - Agree
   - Disagree *Stop filling out this form.*

User Demographics

2. **Which faculty are you based in ?** *
   Check all that apply.
   - [ ] Arts
   - [ ] Dentistry
   - [ ] Community & Health Sciences
   - [ ] Economics & Management Sciences
   - [ ] Education
   - [ ] Law
   - [ ] Natural Science
   - [ ] General Administration

3. **Please state which department within your faculty** *

4. **What is your job title ?** *

5. **Gender** *
Mark only one oval.

- Female
- Male
- Prefer not to say
- Other: _____

6. **Which age category do you fall under ?** *
Mark only one oval.

- 20-30
- 30-40
- 40-50
- 50+

7. **Rate your expertise as a user of computer-based systems** *
Mark only one oval.

- Novice
- Intermediate
- Advanced
- Expert

8. **Experience using MAS (years)** *
Mark only one oval.

- <1
- 1-2
- 2-3
- 4+

User reflection on the Marks Administration System (MAS)

The following sections will require you to reflect on your usage of MAS. On a scale of 1 to 5, where 1 means Strongly agree and 5 means Strongly disagree, please state the extent to which you agree with each of the following:

Business Process Quality

Business Process Quality is described as the quality of processes users intends to undertake on the system in order to fulfill their work objectives. Taking this into account, indicate your agreement with the following statements

9. **Reflect on the Business Process Quality of MAS** *

Mark only one oval per row.

	1 - Strongly Agree	2 - Agree	3 - Neutral	4 - Disagree	5 - Strongly Disagree
I am satisfied with the number of steps I have to take to complete a task.					
The processes to perform tasks are simple					
The system's process for uploading marks manually is easy					
The system's process for uploading marks via spread sheet is easy					
It is easy to undertake changes to marks					
It is easy to make changes to a mark schedule					

10. **Are there any further comments you would like to make regarding Business Process Quality Please add them below:**

System Functionality

System Functionality is described as how well the system functions with regard to the users' purpose on the system.
Taking this into account, indicate your agreement with the following statements

11. **Reflect on system functionality of MAS** *

Mark only one oval per row.

	1 - Strongly Agree	2 - Agree	3 - Neutral	4 - Disagree	5 - Strongly Disagree
The functionality offered by the MAS system aligns well with my work processes					
The system responds quickly to commands					
The system currently offers all necessary functionality for my job role					
The system allows me to complete and save a task before timing out					
The system allows me to do multiple tasks simultaneously					

12. **Are there any further comments you would like to make regarding System Functionality Please add them below:**

Information Quality

Information Quality is described as the value that is created with the information that the system produces
Taking this into account, indicate your agreement with the following statements.

13. **Reflect on the information quality of MAS** *

Mark only one oval per row.

	1 - Strongly Agree	2 - Agree	3 - Neutral	4 - Disagree	5 - Strongly disagree
The information provided by MAS is always timely					
The information provided by MAS is always accurate					
The information that I source from MAS is reliable					
The system does accurate calculations of students' semester marks					
The data on MAS is accurately imported from SASI.					

14. **Are there any further comments you would like to make regarding Information Quality Please add them below:**

System Quality

System Quality is described as the quality of the system in respect of how it is able to transform your inputs into meaningful outputs.
Taking this into account, indicate your agreement with the following statements

15. **Reflect on your experience of System Quality, in respect of MAS support** *

Mark only one oval per row.

	1 - Strongly Agree	2 - Agree	3 - Neutral	4 - Disagree	5 - Strongly Disagree
Only basic computer proficiency is needed to use the system					
The system is user friendly					
The system is easily accessible on university premises					
The system is easily accessible when I am not on campus					
The system is always available when I need to use it					
The system securely stores data					
The systems response to queries is quick					
The system's response time is not affected during times of peak use					

16. **Are there any further comments you would like to make regarding System Quality Please add them below:**

Service Quality

Service quality is defined as the quality of the support that users of the system receive from the system's organisation and IT support team.
Taking this into account, indicate your agreement with the following statements

17. **Reflect on the Service Quality provided** *

Mark only one oval per row.

	1 - Strongly Agree	2 - Agree	3 - Neutral	4 - Disagree	5 - Strongly Disagree
When using the system, I do not experience problems which I cannot resolve alone					
When I encounter a problem, I know who to contact and the procedure to go through					
The procedure for acquiring technical support for the system is easy					
I believe that there is sufficient support staff available					
The technical support for MAS provides users with a fast service					
The support staff for the system are technically competent					
It is possible to use MAS without having being trained					
I am encouraged to attend training					

18. **Are there any further comments you would like to make regarding Service Quality Please add them below:**

User Satisfaction

User Satisfaction is defined as the overall fulfillment users attain from using the system to aid their work objectives.
Taking this into account, indicate your agreement with the following statements

19. **Reflect on how satisfied you are with MAS** *

Mark only one oval per row.

	1 - Strongly Agree	2 - Agree	3 - Neutral	4 - Disagree	5 - Strongly disagree
I enjoy using MAS					
I am satisfied with the systems user interface					
Using MAS makes my job easier					
Overall I am satisfied with MAS					

20. **Please note any other comments or improvements that could be made with regard to the usage of the system**

End of survey

Thank you for your valuable time. Your inputs are appreciated and will contribute to providing evaluation data to improve the quality of service that MAS provides.

Appendix 5.3: Survey Responses