Assessing the Success of ICT's from a User Perspective: A Case of Coffee Research Foundation

A Project Report Submitted in Partial Fulfillment of the Requirements for the Award of

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DECLARATION

I, **Michael Wambwere Makokha**, hereby declare that this research project, submitted to the University of Nairobi in partial fulfillment of the academic requirements for the award of Master of Science in Information Systems, is my original work. All academic rules and regulations have been adhered to and materials used in this study that are not my own have appropriately been acknowledged.

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ABSTRACT

This study was conducted to evaluate the success of an enterprise resource planning (ERP) system from the users' perspective and to validate the application of the updated DeLone and McLean IS success model (2003) within a local context.

The research involved the use of questionnaires, interviews, and focus group discussion (FGD) to collect data regarding the use of Microsoft Dynamics ERP system and to test and validate the IS success model. The questionnaires were developed based on a comprehensive review of existing literature and were later administered to users at the Coffee Research Foundation (CRF), a national coffee research institution located in Ruiru, Kenya. Pearson's correlation analysis was used to analyze quantitative data while FGD analysis helped in gaining an in depth understanding of the responses concerning the various model constructs. Quantitative data was analyzed using Statistical Package for Social Sciences (SPSS). Data was first entered into Microsoft Excel and later imported into SPSS for detailed analysis. In addition, descriptive statistics were used to help in understanding the characteristics of the study population.

A triangulation of the results from quantitative and qualitative analysis indicated that the ERP system under investigation was successful from the users' perspective and that DeLone & McLean's IS model (2003) holds when used within a local context. The study further revealed that system quality, information quality, and service quality are critical factors that dictate how ICT systems are used in organizations.

Key words: ERP system, IS Success, DeLone & McLean IS Success Model, IS Model, IS Evaluation, System Quality, Information Quality, Service Quality, Use, User Satisfaction, Net Benefits

DEDICATION

I dedicate this work to:

The Almighty God who provided me with the energy, willpower, and good health right from the start.

My wife, Princess Zulu-Wambwere; you were so understanding and offered endless support as I undertook this journey.

My children Prince Michael Jr. Wambwere, King Josiah Wambwere, and Queen Malaika Wambwere; you spice up my life and motivate me to never give up. It is my prayer that this thesis will be a stimulus for you to endeavor to achieve greater things. Always remember that all is possible when you put your trust in God.

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From the time I started, the road has been long, with many turns, back roads, repeat scenes, and new sights. Sometimes I hit the dead end but, by the assistance of many, to whom I am indebted, I managed to move on undeterred.

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My wife, children, parents, and siblings; I will forever be grateful to you for your support, motivation, and prayers.

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LIST OF ABBREVIATIONS

CRF – Coffee Research Foundation

ERP – Enterprise Resource Planning

FGD – Focus Group Discussion

ICT – Information and Information Technology

IQ – Information Quality

IS – Information Systems

IT – Information Technology

PA – Precision Agriculture

PDA – Personal Digital Assistant

NB – Net Benefits

SMEs – Small and Medium Sized Enterprises

SPSS – Statistical Package for Social Sciences

SrvQ – Service Quality

SysQ – System Quality

U – Use

UsrS – User Satisfaction

KEY TERMINOLOGIES

ICT's – Technological infrastructure and information processing systems

ERP System – Software that integrates various applications for managing different operations in an organization

ICT Assessment – Process of establishing either by quantitative or qualitative means, the worth of ICT systems to organizations or the identification and quantification of the costs and benefits of ICT investments

System Quality – A technical measure that is concerned with how good a system is from a technical perspective.

Information Quality – the quality of information produced by an ICT system for the purpose of improving the decision making process

Service Quality – the overall support delivered by the service provider which could be internal or outsourced.

Use – the use of an ICT system for daily work to perform tasks.

User Satisfaction – the fulfillment or comfort that a user draws from the use of ICT systems

Net Benefits – Value of ICT systems to organizational performance

CHAPTER 1: INTRODUCTION

1.1. Background

In the present era, where globalization and rapid technological change have taken center stage, many organizations are spending heavily on ICT's in order to increase efficiency and thrive in a competitive environment (Rao, 2006; May et al., 2007). According to Bryson and Daniels (2007), organizations in most countries used information technology (IT) in a very restricted manner before 1990. At the time, ICT was considered a cost rather than a tool that presented organizations with a new approach to business. By the end of the 1990s, IT had been transformed into ICT and was mostly associated with e-business or e-commerce. This new development enabled the use of ICT's to take a central place in most business enterprises. As noted by Al-adaileh (2009), a number of factors have contributed greatly to the increased use of ICT's by organizations. Among them are the vigorous use of the Internet and other communication technologies, changes caused by technological advancements, increased global activities, the rise of information and knowledge economy, and the evolution of a digital environment with most relationships being of a digital nature.

1.2. Statement of the Problem

Generally, ICT's are regarded as drivers for success, competitiveness and efficiency in organizations. They are said to profoundly minimize durations required to complete transactions and to cut down on the workforce required to do an equal amount of work. They also make it easier to track activities in an organization and to improve the rate at which information can be generated and circulated. Since the use of ICT's is primarily aimed at enhancing the users' ability to work better, more efficiently and to produce more, within the shortest time possible, while ensuring that cost is at its lowest, it is imperative to measure and assess the success of ICT's from the users' perspective. As argued by Akman et al. (2005) the success of ICT's is dependent more on users than on the technology itself. In addition, Gomez and Pather (2012) noted that more infrastructure and increased access to ICT's does not automatically translate to improved performance. An assessment study such as this is, therefore meant to help organizations determine whether ICT's are being used productively.

1.3. Purpose of the Study

As organizations continue to invest heavily in the use of ICT's, it is important to determine how these investments directly affect organizational performance. The main objective of this study was to assess the success of Microsoft Dynamics ERP system from the users' viewpoint. The study also tested and validated the application of the updated DeLone

and McLean's (2003) IS success model within a local context. The findings are useful for understanding the contribution of ICT's to improved user productivity and overall organizational performance. Respondents were drawn from the Coffee Research Foundation (CRF) in Kenya.

1.4. Research Objectives

The study was guided by the following three objectives:

i. Test and validate the updated DeLone and McLean's (2003) IS Success model in a local context

ii. Determine the success of the ERP system used at CRF from the users' perspective

1.5. Research Questions

i. Does the updated DeLone and McLean's (2003) IS Success model hold when assessing the success of ICT systems in a local setup?

ii. Is the ERP system used at CRF successful from the users' perspective?

1.6. Hypotheses

In undertaking this study, the following hypotheses were formulated and tested regarding the various model constructs.

H1a: System Quality positively affects Use

H1b: System Quality positively affects User Satisfaction

H2a: Information Quality is positively associated with Use

H2b: Information Quality is positively associated with User Satisfaction

H3a: Service Quality is positively associated with Use

H3b: Service Quality is positively associated with User Satisfaction

H4a: Use is positively associated with User Satisfaction

H4b: Use is positively associated with Net Benefits

H5a: User satisfaction is positively associated with Use

H5b: User satisfaction is positively associated with Net Benefits

1.7. Justification and Rationale of the Study

According to Matopoulos et al. (2009), performance in any modern sector of the economy is directly proportional to its ability to effectively integrate ICT's in its operations. As established by Gunasekaran and Ngai (2004), many organizations are presently relying on ICT's to improve efficiency, reduce costs, and meet customer expectations among others. However, little is being done to assess the real worth of ICT systems to organizational performance. As a result, ICT investment decisions are made without a sound understanding

of the accompanying benefits and challenges. At CRF, for example, such decisions, though critical, are mostly influenced by external factors which include changes in the industry and guidelines from the Ministry of Agriculture.

1.8. Significance of the Study

Without the fundamental knowledge of how ICT's influence user performance, it is very likely that ICT investment decisions will be made in a haphazard manner. In a worst case scenario, disappointments and failure of ICT investments will result. The findings of this study will, therefore, provide vital information for planning and ensuring a successful integration of ICT systems in operations. The study will also be beneficial to many other organizations seeking to implement ambitious ICT plans guided by long term strategies. Other beneficiaries of the findings of this study are:

Policy Makers

The study will provide policy makers with useful information for creating policies for effective implementation and utilization of ICT systems. According to May et al. (2007) a study such as this will provide a good foundation for understanding how to maximize the use of limited ICT resources.

Research Institutions

Research professionals and academicians will benefit from this study by gaining more insights into the relationship that exist between the use of ICT systems and the user's productivity.

1.9. Limitations of the Study

The study was based on the updated Delone and McLean's (2003) IS success model and was therefore, limited to the use of measurement aspects covered in the model. As a result, other possible aspects not covered by the model were not considered. The study was also limited to only one organization and so, the results may not be generalized to other organizations. Although CRF is a highly structured organization and access to research data is challenging, we finally managed to obtain relevant data after fulfilling all the requirements as stipulated by organization. Finally, the study utilized both primary and secondary data and was thus exposed to all the weaknesses associated with primary and secondary research.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

Over the years, the use of ICT's in a number of key economic sectors in the Kenya has continued to rise. Matopoulos et al. (2009) noted that the use of ICT's creates an excellent opportunity to facilitate, improve, and even transform business processes. The initial enthusiasm, however, quickly turns to pessimism when business enterprises realize that they cannot easily quantify or even clarify the role and real benefits of ICT's. Consequently, it is critical to assess the contribution of ICT systems to organizational performance so as to justify the associated investments.

ICT is defined differently by various authors. According to Hassan et al. (2009), ICT includes a number of components such as skills to access, record, arrange, manipulate and present data or information using tools and software. It also includes Communication Technology (CT) which consists of telecommunication tools used to disseminate and access information. In a definition given by Apulu and Latham (2011), ICT encompasses technologies that facilitate the recording, processing, retrieval, and transmission of information or data. Consequently, ICT in this study has been used to refer to infrastructure and information processing systems as implied from the above definitions.

2.2. ICT Usage at Coffee Research Foundation

CRF is a state corporation established in 1964 to carry out research and investigate issues related to coffee farming in Kenya (CRF, 2010). The organization is headquartered at Ruiru and has sub-stations in Juja, Meru, Kitale, Koru, Bungoma, and Kisii. The organization has a staff population of about 300 employees and approximately 75% of these employees utilize ICT's in their work operations. An interview with the ICT Manager revealed that the use of ICT's at CRF was introduced in the year 2003 to ensure prompt delivery of services, guarantee timely generation of reports, and enhance management, processing, and access to information. In the year 2009, the organization acquired the Microsoft Dynamics ERP system with financial, payroll, human resource, transport, and procurement modules. Over time, the use of ICT's at CRF has increased and the organization continues to invest heavily in better hardware and software systems to improve the productivity level of its employees. These investments are, however, largely influenced by external factors such as changes in the industry and directives from the Ministry of Agriculture. According to Ashraf et al. (2008), it is the lack of understanding of the actual contribution of ICT's to organizational performance that is to blame for the failure of most ICT investments. It is, therefore, imperative to carry out a study to determine the real worth of ICT systems to organizations.

2.3. Importance of ICT's

According to Pieper and Veen (2005), the use of ICT's positively influences business operations and leads to improved productivity. ICT's enable better coordination of business activities, greater productivity, faster response to new business needs, cost effective delivery of operations, and better management of customer relationships. Although initial investments in ICT's are quite costly, benefits tend to be realized in the long run. Bryson and Daniels (2007) identified three ways in which the use of ICT's adds value to business operations. First, ICT's enhance organizational efficiency in all parts of the value chain including those beyond the boundaries of the organization. ICT's also simplify the task of exchanging information between departments and individuals in an organization, resulting in increased cooperation and coordination. Secondly, ICT's help organizations to improve relationships with customers leading to loyalty and repeat business. These relationships can be made more interactive to the extent of permitting the development of customized products and services for customers. Clients and suppliers are able to invest in shared integrated ICT systems that enable real time exchange of information regarding different aspects of the organization's activities. Third, ICT's may be used by organizations to attract new customers. Websites for example, can be part of an organization's branding and marketing strategy, giving clients an opportunity to interact with the organization more frequently. According to Reijswoud (2009) the importance of ICT's for addressing poverty related issues is widely recognized at the highest international levels. Al-adaileh (2009) pointed out that ICT usage gives organizations a competitive advantage and leads to increased productivity, reduced product cycle, and automation of operations. This is besides having an overall impact on organizational management. The realization of these benefits is, however, tied to the successful use of ICT systems.

2.4. Evaluating the Success of ICT's

ICT assessment is the process of establishing either by quantitative or qualitative means, the worth of ICT's to organizations or the identification and quantification of the costs and benefits of ICT investments (Al-Yaseen et al., 2007). The evaluation process is usually performed after the adoption of ICT's and enables an organization to analyze its effectiveness and suggest further improvements to systems in order to better meet organizational objectives and targets (Davis & Jackson, 2005). Traditional approaches to the evaluation of ICT systems such as return on investments, cost-benefit analysis, payback period, and present worth have received numerous criticisms due to their limited definition of stakeholders and the fact that they only target direct tangible costs and benefits (Alshawi &

Alalwani, 2009). Ordinarily, an assessment of the success of ICT's helps to align their usage with business objectives and to increase their success rate. Effective assessment presents organizations with an opportunity to learn, reduce the level of uncertainty as far as ICT investments are concerned, and to gain investor confidence. To make ICT investments viable, many researchers believe that it is important to assess how they are used and what their influence on performance is (Gupta & Jana, 2003; Torres et al., 2005).

Challenges of ICT Success Evaluation

According to Gomez and Pather (2012), the implementation of ICT's cannot be ignored if operational efficiency has to be realized. This notwithstanding, organizations are faced with challenges of assessing the success of ICT's due to their increased complexity and the unpredictability of costs and benefits that are related to ICT investments. This has compelled research professionals to come up with different assessment techniques to help organizations understand the value of ICT investments. According to Carcary (2009), numerous complexities underlie the assessment of ICT's and this is further complicated by the fact that the uses of ICT systems are widespread. Evaluation is further complicated by limitations in assessment techniques as well as political and social concerns. Apparently, most organizations are rarely equipped with formal ways to assess ICT's and mainly depend on informal approaches to carry out the assessment process. According to Alshawi and Alalwani (2009), an evaluator must take into consideration numerous view points of stakeholders as well as the social and technical context of the use of ICT systems. ICT assessment, therefore, still remains an unresolved concern in the field of ICT/IS research. As noted by Al-Yaseen et al. (2007), assessing the value of ICTs is generally a complex and challenging activity and there is no common agreement on an ideal way to undertake the exercise.

Gomez & Pather (2012) identified Automate, Informate, and Transformate as three phases of the evolution of the assessment of ICT systems. While the Automate phase dealt with the measurement of technical aspects of ICT systems, the Informate phase concerned itself with production measurement ICT systems, and the Transformate phase focused on measuring benefits associated with the use of ICT's. Eventually, the Transformate directed the evaluation of ICT's towards looking at intangible benefits. In a business setup, a tangible benefit is seen as one that directly affects the productivity of a firm whereas an intangible benefit has no direct influence on a firm's productivity. All the same, intangible benefits affect productivity and must not be overlooked in the entire evaluation process. Gomez & Pather (2012) also proposed that since the value of investments in ICT systems encompasses

a number of interrelated issues such as increased productivity, improved profitability, and consumer satisfaction, an organization may measure the success of ICT's by checking whether the investment has led to increased output for a given input, higher profits, or more benefits to consumers. Table 1 presents a classification of tangible and intangible benefits of ICT's.

Table 1: Tangible and Intangible Benefits of ICT's

Benefits of ICTs in Business	**Tangible**	**Intangible**
Quantifiable (Can be Measured)	Increased revenue or reduction in costs	Difficult to measure in an objective way. Examples include; faster access to information and improved customer satisfaction
Unquantifiable (Difficult to Measure)	The exact impact on profitability cannot be measured. Examples include; improved security and better information	Difficult to put a financial value to the benefit, for example, increased customer confidence and customer or employees' perception of the firms products

Source: Gomez & Pather, 2012

Although unquantifiable, intangible benefits seem to be the most difficult to measure as can be seen from table 1, their inclusion is nevertheless critical to the evaluation of ICT systems. In a study by Hedman & Borell (2005), it emerged that while the evaluation of tangible benefits such as software licenses, hardware, consultancy, and training is much easier, that of intangible benefits such as productivity rise or resistance to change are more difficult to measure and evaluate. In response to these difficulties a number of methods and tools have been developed in order to support the process of understanding the value of ICT's to organizations. Their study also indicated that evaluation is not a straight forward process and may have many purposes such as improvements, change management, or long term planning, to name but a few. They identified two issues considered to be very critical to the subject of assessing ICT's. On one hand, is the evaluation gap that exists when a researcher distances himself or herself from the project, eventually losing the business objectives while on the other hand, the business objectives of ICT systems are often forgotten or treated so

casually. However, this has changed over the years and there is an increased awareness of the importance of an ongoing assessment for ICT systems.

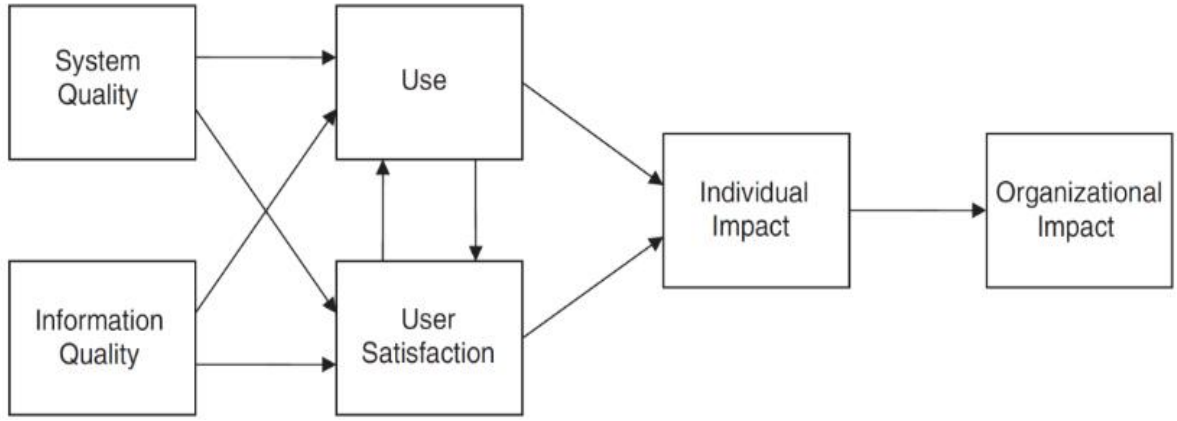
2.5. IS Success Models

The difficulties associated with the assessment of the success of ICT's led to extensive research into the subject of ICT systems evaluation and a number of evaluation models have been proposed and used by various researchers over the years to understand the influence of ICT's on organizational performance and whether returns correspond to the cost of investments in ICT's. According to DeLone and McLean (2003), measuring the success of ICT systems is very important if their value and contribution to user and organizational efficiency is to be understood. This section discusses some research contributions that are important for understanding the role of ICT's in improving user productivity as well as organizational performance.

DeLone & McLean IS Success Model (1992)

According to Petter et al (2008), early attempts made to explain information system success were poorly defined as a result of the complex and multi-faceted nature of ICT systems. To deal with this challenge, DeLone and McLean (1992) reviewed research studies undertaken between 1981 and 1987 and came up with a model commonly known as the DeLone & McLean IS success model or simply, DeLone & McLean model or D&M model for measuring IS success (figure 1). The model indicates that the success of ICT's depends on several factors that are interrelated. Six constructs including system quality, information quality, use, user satisfaction, individual impact, and organizational impact were identified as being critical to measuring the success of ICT systems. According to DeLone and McLean (1992, 2003), most ICT systems are characterized by system quality and information quality. In the model, system quality measures technical success while information quality measures semantic success. The components use, user satisfaction, individual impacts, and organizational impacts were identified as measures of effectiveness. The model also illustrates that system quality and information quality can independently or together affect use and user satisfaction. In addition, use and user satisfaction can affect each other positively or negatively. Both use and user satisfaction lead to an individual impact that in turn leads to organizational impact (DeLone & McLean, 1992).

Figure 1: DeLone & McLean IS Success Model (1992)



Source: DeLone & McLean, 1992

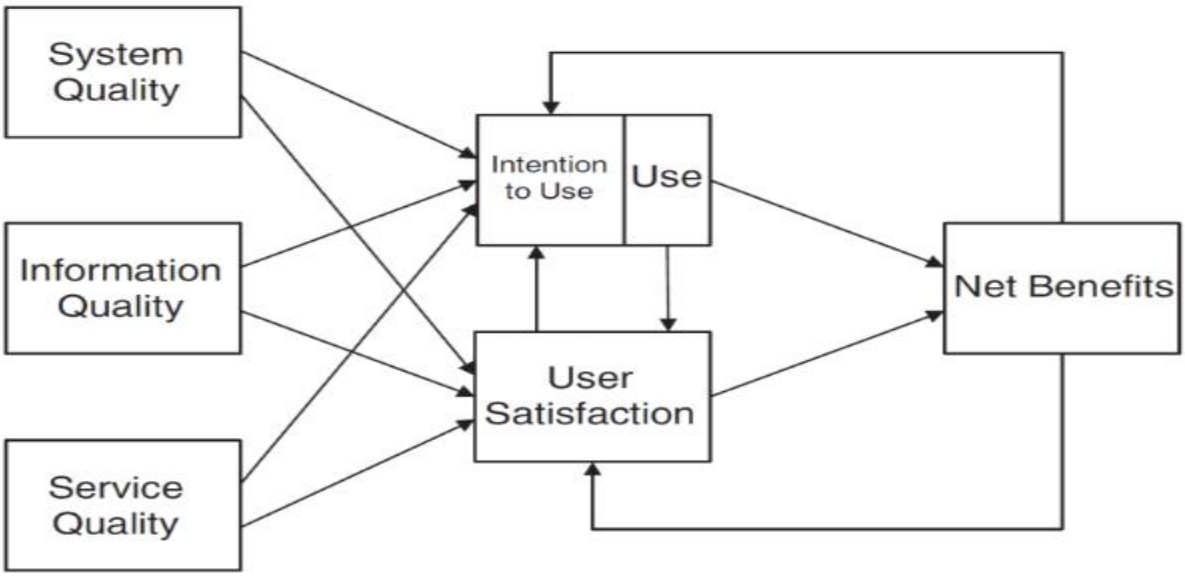
DeLone & McLean IS Success Model (2003)

Following the publication of DeLone and McLean's work, the original IS success model received several criticisms. The move was, however, welcome by DeLone and McLean who invited other researchers to give suggestions for improvement and validate their original IS success model. Heeding DeLone and McLean's invitation, Seddon and Kiew (1996), undertook to study a segment of the IS success model and suggested the modification of the construct use to usefulness. In their view, use appeared only useful where the users were not obligated to use a system. On the other hand, if the use of a system is mandatory, they opined that usefulness would be a better measure. In response, DeLone and McLean (2003) argued that it is possible to experience variability in cases where the use of ICT systems is mandatory. Although there was a concern about an alleged confusion created by combining process and variance models, DeLone and McLean argued that this was one of the strengths associated with the model. Other researchers also suggested the inclusion of service quality as an additional construct.

In view of the criticisms and suggestions made, DeLone and McLean reviewed various studies done from 1992 and based on this, revised their original model accordingly and came up with an updated model illustrated by figure 2, DeLone & McLean IS success model (2003). Based on a recommendation by Pitt et al. (1995), service quality was included in the revised success model. Individual and organizational impacts were also replaced with net benefits to account for benefits at multiple levels of analysis and to allow researchers to apply the model to any intended level of analysis (Petter et al., 2008). An additional enhancement to the updated DeLone and McLean model was the clarification of the use construct. DeLone and McLean (2003) argued that use must occur before user satisfaction

such that a positive experience with use will result in higher user satisfaction in a causal sense. Increased user satisfaction consequently leads to a higher intention to use and this ultimately has an effect on use.

Figure 2: DeLone & McLean IS Success Model (2003)



Source: DeLone & McLean, 2003

From figure 2, information quality, system quality, and service quality can positively or negatively affect intention to use/use and user satisfaction which in turn positively or negatively affect net benefits. In addition, net benefits can also affect either positively or negatively, intention to use/use and user satisfaction. The various constructs in the updated DeLone and McLean IS success model are explained as follows:

System Quality

System quality is generally regarded as a technical measure that is concerned with how good a system is from a technical perspective. In their study, DeLone and McLean (1992) explained that system quality considers the characteristics desired for a system to produce information that is useful for decision making. According to Seddon (1997) system quality is concerned with issues such as system bugs, user interface, and ease of use. Petter et al. (2008) on the other hand argued that system quality considers performance characteristics such as reliability, convenience, ease of use, and functionality. In their opinion, however, Delone & McLean (2003) suggested that system quality is an appropriate measure for the desired characteristics of an ICT system.

A study of the existing literature revealed that the commonly used measures for the system quality construct are reliability, stability, ease of use, flexibility, a user-friendly interface, usefulness, and response time. While measuring system quality in an e-commerce

context, DeLone and McLean (2003) considered adaptability, availability, reliability, response time, and usability to be the most appropriate characteristics for the construct system quality.

Information Quality

Seddon (1997) suggested that information quality refers to the quality of information produced by an ICT system for the decision making process and, is a vital factor for evaluating the success an ICT system. Information quality also looks at content, accuracy and format of the information generated (Rai et al., 2002). The most common measures that have been used in past studies for information quality include timeliness, completeness, availability, consistency, accuracy, and relevance (DeLone & McLean, 2003). Seddon and Kiew (1996) used relevance, accuracy, format, and timeliness as measures of information quality while DeLone and McLean (2003) proposed relevance, completeness, ease of understanding, personalization, and security as important information quality measures in an e-commerce context.

Service Quality

According to DeLone and McLean (2003), service quality is defined as the overall support delivered by the service provider which could be internal or outsourced. Generally, users of ICT systems are regarded as customers and if support does not come as expected, this leads to users being unhappy and ultimately, poor performance and low productivity. Some of the measures used in past studies to measure system quality are prompt responsiveness of the support team, efficiency of the support team, and availability of support services when needed. The choice of measures used for service quality may, however, vary based on the type of study in question (DeLone & McLean, 2003).

Use

DeLone and McLean (2003) argued that there is no accurate definition of the use construct. It is considered by Seddon (1997) to be the use of an ICT system for daily work to perform tasks. It is also seen as the extent to which the capabilities of ICT systems are utilized by users in task performance. Among the measures that have been used to measure system use are frequency of use, number of accesses, dependency, usage pattern, and time of use (DeLone & McLean, 2003). While measuring the use of e-learning systems, Wang, Wang, and Shee (2007) used frequency of use, dependency, and voluntariness to capture the desired aspects of system use. DeLone and McLean (2003) contend that Use and Intention to Use are alternatives in their model, and that Intention to Use may be worthwhile in the

context of mandatory usage. Where the use of the system is voluntary, Use is regarded as an actual behavior and hence preferred rather than Intention to Use as a success variable.

User Satisfaction

Literature indicates that user satisfaction is the most widespread measure of the success of ICT systems (DeLone & McLean, 1992, 2003; Seddon & Kiew, 1996; Seddon, 1997; Rai et al., 2002). In addition, DeLone and McLean (1992, 2003) considered user satisfaction to be the most important means of capturing the users' view regarding the use of ICT systems. Most commonly used measures for user satisfaction are accuracy, reliability, timeliness, relevancy, ease of use, and quality of content.

Net Benefits

According to Petter et al. (2008), this construct is concerned with how ICT systems contribute to the overall success of individuals or organizations. It is an important construct that helps to capture positive as well as negative effects of ICT systems on users. In a study by Etezadi-Amoli and Farhoomand (1996), improving the user's quality of work, making a user's job easier, saving the user's time, and meeting the user's job requirements were identified as key benefits from a user's viewpoint.

2.6. Relationships between Success Constructs

This section presents a discussion on the relationships between the different constructs suggested by DeLone and McLean for measuring the success of ICT systems as depicted in the updated DeLone and McLean (2003) IS success model. The studies included are related to various industries and apply to different ICT systems. Despite these differences, they all examine a relationship that is broadly defined within the DeLone and McLean IS success model.

System Quality and Use

In general, studies indicated that there is mixed support for this relationship. A number of studies measured the construct system quality by considering perceived ease of use and established that a positive association existed with various applications of system usage in different systems (Rai et al., 2002). However, other studies that used perceived ease of use to measure system quality revealed that no significant association existed between the construct system quality and use (Straub et al., 1995; Gefen, 2000). According to Adam et al. (1992) both system quality and use are complex constructs which exhibit a negative association when complex system applications are considered. Studies of system quality that used other measures apart from perceived ease of use, also obtained varying results. Iivari (2005) for example, established a significant association between system quality and use

while Kositanurit et al. (2006) found that the quality of a system measured using reliability did not affect the utilization of the system by its users. Caldeira & Ward (2002), in their study of small and medium sized manufacturing enterprises (SMEs) in Portugal discovered that the quality of ICT systems available in the market had an effect on their adoption and eventual use. Fitzgerald & Russo (2005) also studied the turnaround time of the London Ambulance Service Dispatch system failure and established that there was a positive association between improved system quality and use.

System Quality and User Satisfaction

From a user perspective, there is a positive association between system quality and user satisfaction (Iivari, 2005). Ostensibly, the type of ICT system in use affects how the construct system quality is measured by some researchers. Gelderman (2002) found out that the functionality of a management support system, considered as one measure of system quality, is significantly related to user satisfaction. Similar results were obtained for knowledge management systems in a number of other studies (Kulkarni et al., 2006; Wu & Wang, 2006; Halawi et al., 2007). When it comes to Web sites, system quality, measured as reliability and download time, was found to be significantly related to user satisfaction in studies by Kim et al. (2002) and Palmer (2002). In some studies, perceived ease of use was also found to have a positive association with user satisfaction (Devaraj et al., 2002; Hsieh & Wang, 2007). Other researchers also examined general ICT systems and established the existence of a strong relationship between system quality and user satisfaction (Seddon & Yip, 1992; Guimaraes et al., 1996; Seddon & Kiew, 1996; Bharati, 2002; Rai et al., 2002; McGill et al., 2003; Almutairi & Subramanian, 2005; McGill & Klobas, 2005; Wixom & Todd, 2005). However, a study by Lexlercq (2007) found that although a relationship existed between system quality and user satisfaction, it was not sufficient. Premkumar et al. (1994) also found no relationship between the complexity of a system and user satisfaction. In another study, Scheepers et al. (2004) found that a relationship existed between ease of use of a mobile computing information system and user satisfaction.

Information Quality and Use

Apparently, a small number of studies have looked at the association between information quality and system use. A reason established for this is that information quality tends to be measured as a component of user satisfaction measures, rather than being evaluated as a separate construct. According to Rai et al. (2002) information quality is significantly related to use, when use is measured by system dependence. A study of knowledge management systems by Halawi et al. (2007) established that information quality

or the quality of knowledge was significantly related to system use. Fitzgerald & Russo (2005), while studying the London Ambulance Dispatch System, also established that a positive association existed between information quality and system use. Other studies, however, found that information quality is not significantly related to the usage of an ICT system (McGill et al., 2003; Iivari, 2005).

Information Quality and User Satisfaction

To a large extent, the relationship between information quality and user satisfaction is widely supported in the literature (Iivari, 2005; Wu & Wang, 2006). Studies undertaken at different times have established that there is a consistent relationship between information quality and user satisfaction (Seddon & Yip, 1992; Seddon & Kiew, 1996; Bharati, 2002; Rai et al., 2002; McGill et al., 2003; Almutairi & Subramanian, 2005; Wixom & Todd, 2005; Kulkarni et al., 2006; Chiu et al., 2007; Halawi et al., 2007). A study of the information quality aspects of Web sites such as content and layout revealed that significant relationships existed between these factors and user satisfaction (Kim et al., 2002; Palmer, 2002). However, a study by Marble (2003), found no significant association between measures of information quality and user satisfaction.

Service Quality and Use

A study by Choe (1996) to examine accounting information systems in Korean firms found a weak association between service quality and system use. In the study of the London Ambulance System, the valuable function of the technical staff which relates to service quality was found to be positively related to the ultimate use of an ICT system (Fitzgerald & Russo, 2005). Caldeira & Ward (2002), in their study of Portuguese SMEs, also discovered that competency of support staff and vendor support affected system use. A positive association was thus found to exist between service quality and system use. Kositanurit et al. (2006) while surveying the users of ERP systems found no association between service quality and system use. Similarly, a study of knowledge management systems by Halawi et al. (2007) established that service quality did not predict intention to use or use of an ICT system.

Service Quality and User Satisfaction

Although a number of studies have looked at the relationship between service quality and user satisfaction, their findings revealed mixed support for the association between service quality and user satisfaction. The inconsistencies may, however, be linked to the use of multiple methods of measurement. According to Petter et al. (2008), some researchers have examined service quality by looking at the characteristics of the support staff leading to

mixed support. Choe (1996) for example, found that the experience of ICT staff does not significantly affect user satisfaction of accounting systems in Korean firms while another study by Leonard-Barton and Sinha (1993) established that the technical performance of staff, based on how they responded to problems, was positively associated with user satisfaction. Yoon et al. (1995) came up with a similar outcome in that the skills of technical staff had a significant effect on user satisfaction of expert systems. A study by Leclercq (2007) indicated that the quality of support and services provided by the ICT personnel affected user satisfaction. While examining the role of support on user satisfaction in an e-learning environment, Chiu et al. (2007) found the existence of a non significant association. Choe (1996) also examined the role of training and education on user satisfaction of an information system and found no significant relationship at any stage of implementation. A similar mixed support was obtained when service quality was examined more broadly, rather than just in terms of personnel and training (Petter et al., 2008).

Use and User Satisfaction

While most studies have looked at the reverse relationship between user satisfaction and use, little has been done to investigate the relationship between use and user satisfaction. A study by Guimaraes et al. (1996), to examine the use of expert systems, indicated that system usage, measured as frequency of use was positively and significantly related to user satisfaction. In a knowledge management context, Halawi et al. (2007) found that a significant relationship existed between intention to use/use and user satisfaction. Seddon & Kiew (1996), however, found that in a mandatory context, use, measured by system importance, was not related to user satisfaction. On the other hand, Iivari (2005) found, in a study of a medical information system in which use was mandatory, that use measured by amount of daily use and frequency of use was significantly related to user satisfaction. While some researchers have argued that use is irrelevant when a system is mandatory, it is possible to have sufficient variability in the use construct that can result in significant relationships with other constructs in the DeLone and McLean IS success model, such as user satisfaction (Iivari, 2005; DeLone & McLean, 2003). Chiu et al. (2007) also found that there was a significant association between use and user satisfaction in an e-learning context.

Use and Net Benefits

According to Petter et al. (2008), a number of empirical studies provide reasonable support for the relationship between system use and net benefits at the individual level. Several studies have found that the use of ICT systems is positively related to improved decision making. Burton-Jones & Straub (2006) found a strongly significant relationship

between system usage and task performance. Halawi et al. (2007) established that a significant relationship existed between use and net benefits measured by improvements in the performance of tasks. These findings have been confirmed by many other studies that found significant relationships between system use and net benefits (Seddon & Kiew, 1996; Abdul-Gader, 1997; Torkzadeh & Doll, 1999; Weill & Vitale, 1999; D'Ambra & Rice, 2001; Rai et al., 2002; Almutairi & Subramanian, 2005; Kositanurit et al., 2006). However, some studies have given results that are contrary to these findings (Iivari, 2005; Wu & Wang, 2006).

User Satisfaction and Use

According to Rai et al. (2002) and Kulkarni et al. (2006), user satisfaction is strongly related to use when measured by system dependence and the frequency and duration of use. An association also existed when user satisfaction was measured using the number of applications and tasks for which the information system was used (Kim et al., 2002; McGill et al., 2003; Wu & Wang, 2006; Bharati & Chaudhury, 2006; Chiu et al., 2007; Halawi et al., 2007). In a study to examine the relationships among confirmation of expectations, perceived usefulness, satisfaction, and extent of use, Hsieh and Wang (2007) also discovered a positive and significant relationship between user satisfaction and extent of system usage among users of ERP systems. The relationship between user satisfaction and extent of use, however, became unimportant when considered in the context of a larger model that incorporated perceived ease of use. Despite the fact that several models have examined the association between user satisfaction and use, little is known regarding the order of the relationships and whether it is use that predicts user satisfaction or vice versa.

User Satisfaction and Net Benefits

User satisfaction has been found to result in improved performance (McGill et al., 2003), increased productivity and effectiveness (Rai et al., 2002; McGill & Klobas, 2005; Halawi et al., 2007), improved decision making (Vlahos et al., 2004), and enhanced job satisfaction (Morris et al., 2002). On the other hand, however, Yuthas and Young (1998) established that there was a weak correlation between user satisfaction and decision making which in turn affected system use. In addition, Law & Ngai (2007) also found that user satisfaction was related to performance when measured based on profitability and total revenues.

2.7. Other Success Frameworks

Ostensibly, not all researchers made attempts to critique or make modifications to the DeLone and McLean IS success model. Others went ahead to develop and propose alternate

frameworks for measuring the effectives of ICT systems. Grover et al. (1996) used an alternative, theoretically based perspective to come up with a theoretical approach for measuring the effectiveness of ICT systems which complemented and extended DeLone & McLean's IS success model (DeLone & McLean, 2003). The authors created six effectiveness categories classified as infusion measures equated to organizational impacts in the DeLone & McLean's (1992) success model, market measures, not covered in DeLone & McLean's model, economic measures equated to organizational impacts, usage measures equated to system use, perceptual measures equated to user satisfaction, and productivity measures equated to individual impact. While DeLone & McLean's model considered system quality and information quality as important dimensions of success, the framework developed by Grover et al. (1996) regarded them to be predecessor constructs of effectiveness. According to DeLone and McLean (2003), the effectiveness framework developed by Grover et al. (1996) only served to validate DeLone & McLean's IS success model from a theoretical point of view and made suggestions for extension of the model.

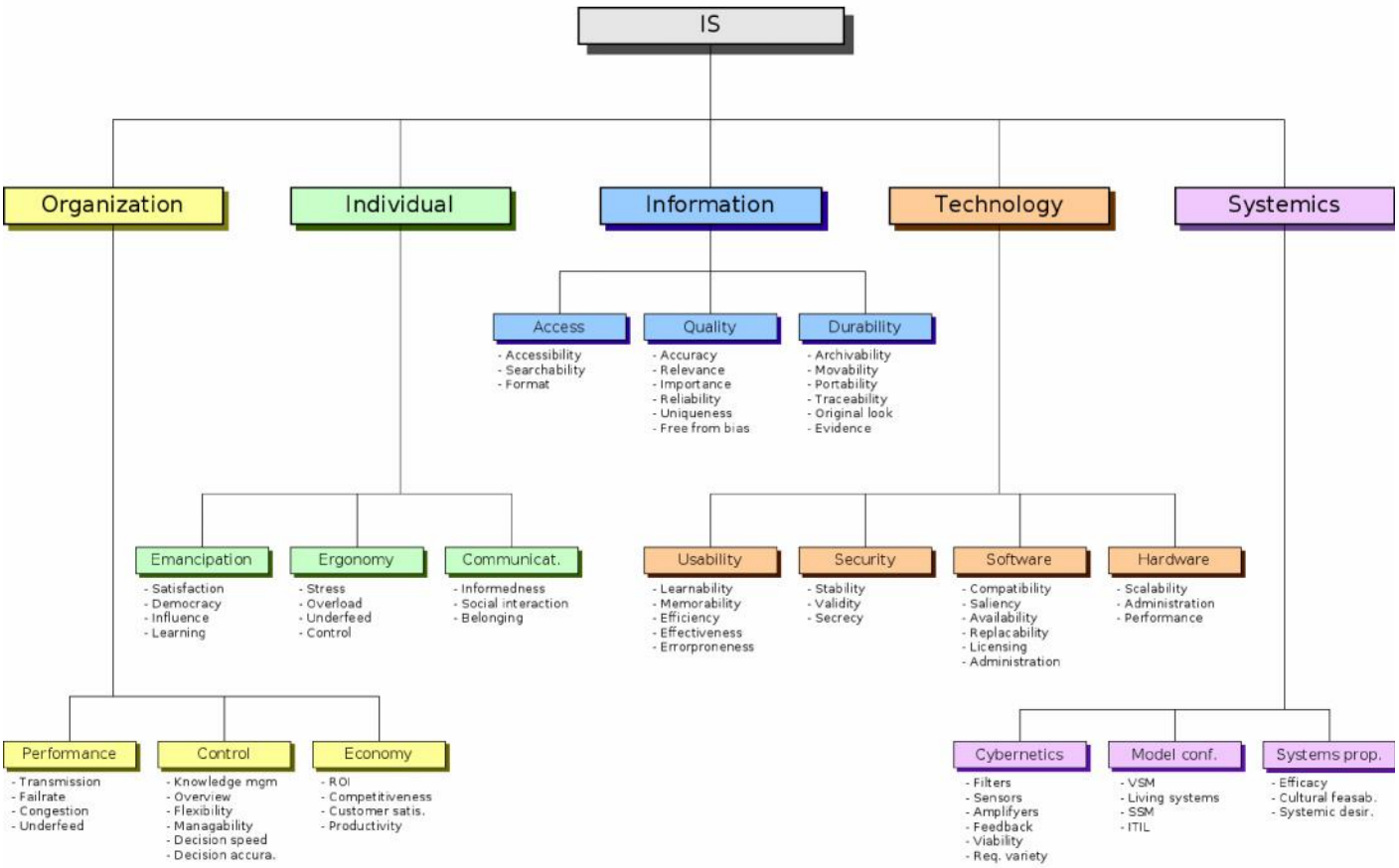
Smithson and Hirschheim (1998) also proposed a conceptual framework for evaluating ICT systems which presented efficiency, effectiveness, and understanding as dimensions for evaluating ICT systems. Apparently, their framework considered the use of evaluation aspects which overlapped with DeLone & McLean's (1992) success dimensions. They included hardware and software metrics which were equivalent to system quality in DeLone & McLean's success model, system usage, user satisfaction, and cost-benefit analysis among others. DeLone and McLean argued that the authors came up with a framework that was a source for identifying and developing evaluation measures for ICT systems rather than being a single framework of success dimensions and their interrelationships. Their framework did not specify actual success constructs and related measures and could not, therefore, be applicable in a practical sense.

Criteria Model

The criteria model was proposed by Palmius and presented through a paper published in 2007. Based on the model, it is necessary for an evaluator to have operational criteria for measuring the success of ICT systems. This in turn can provide a foundation for improving the use of ICT systems where needed (Palmius, 2007). By reviewing the existing literature, Palmius came up with a framework of criteria found useful for measuring the success of ICT systems (figure 3). The main components of the criteria model are organization, individual, information, technology, and systemics. Organization criteria were considered to be those useful from the point of view of the organization. The criteria in this category were further

classified as performance, control, and economy. Individual criteria were linked to the performance and satisfaction derived from the use of ICT systems. They were classified as emancipation, ergonomy, and communication. The information category of the criteria relates to the quality and access of information and consists of access, quality and durability. The technology criteria are those that related to the tangible artifacts that help with the distribution and management of information. This category included usability, security, software, and hardware. Finally, the systemics criteria were related to the systems point of view of ICT systems. The criteria were used to determine how well ICT systems were aligned to what a user regarded as a good system. This category was further divided into cybernetics, model conformance, and system properties.

Figure 3: Criteria Model

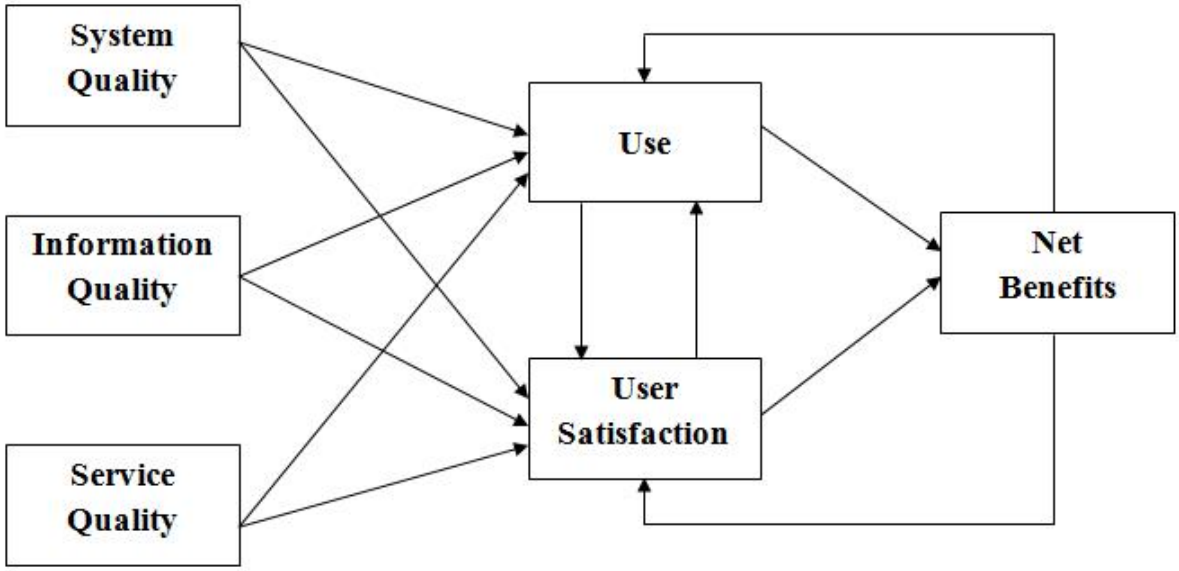


Source: Palmius, 2007

2.8. Adoption of DeLone & McLean's (2003) IS Success Model

A key objective of this study was to test and validate the updated DeLone & McLean IS success model in a local setup. DeLone and McLean's (2003) IS success model (figure 4) was thus adopetd for the study.

Figure 4: Research Model



Source: Adopted from DeLone & McLean (2003)

As mentioned earlier, DeLone and McLean (2003) argued that Use and Intention to Use were alternatives in their model, and that Intention to Use may be worthwhile in the context of mandatory usage. Where the use of the system is voluntary, Use is regarded as an actual behavior and hence preferred to Intention to Use as a success variable. As system usage in this study was voluntary, the construct Use was adopted.

CHAPTER 3: METHODOLOGY

3.1. Introduction

This study was designed to evaluate the success of ICT's and specifically, Microsoft Dynamics ERP system at the Coffee Research Foundation in Kenya, and to test and validate the updated DeLone and McLean (2003) IS Success model in a local context. The independent variables used in the study were information quality, system quality, and service quality with use and user satisfaction as dependent variables. In turn, use and user satisfaction were independent variables with a causal effect on net benefits.

3.2. Research Design

According to Kothari (2004), a research design is the arrangement of conditions for collection and analysis of data in a manner that is relevant to the purpose of a research. It is the conceptual structure within which a research is conducted and provides the blue print for collection, measurement, and analysis of data. This study was about evaluating the success of ICT systems with a focus on the use of Microsoft Dynamics ERP system at CRF, a national organization in Kenya with its headquarters in Ruiru and sub-stations in Juja, Kitale, Bungoma, Kisii, and Koru.

Both quantitative and qualitative techniques were used in this study and, included the use of numerical methods and statistical tools for data collection and analysis. Primary data was collected based on relevant criteria and measurements developed from literature review while secondary data was accessed from different sources including text books, journals, and company documents. Online ICT evaluation studies were also used as a source of secondary data. Primary data was collected directly through questionnaires, interviews, and focus group discussion. A non-probabilistic sampling approach, explained later in this chapter, was used to determine the sample size. Finally, Pearson's correlation analysis was used to establish the relationship between model variables and to validate the research model.

3.3. Data Collection Instruments and Techniques

As pointed out earlier, the study used both primary and secondary data. Secondary data was accessed from different sources including text books, journals, and company documents as well as online resources. Primary data on the other hand, was collected directly by the researchers through questionnaires, interviews and focus group discussion. These are briefly described in the following subsections.

Interviews

Interviewing involves a verbal interaction between the researcher and the respondent which may be personal or through telephone conversations. While personal interviews

require a face-to-face contact between the interviewer and the respondent, telephone interviews allows the interviewer to contact the respondents via telephone. One of the strengths of this technique is that it makes it possible for researchers to collect more information and in greater depth. It is also flexible and can allow researchers to control how questions should be answered by the respondents. The method is, however, very expensive and time consuming especially when dealing with a very large sample. It is also possible for both the interviewer and the respondent to be biased. Furthermore, some respondents may not be easily approachable.

Focus Group Discussion

A focus group discussion is a group interview of people who share similar characteristics or common interests. The group is guided by a facilitator who creates an environment that encourages participants to share their opinions with others more freely. A major strength of focus groups is that they are fast and easy to setup. The technique also enables the researcher to gain useful insights into the topic of study. It may, however, be affected by facilitator bias and dominance by outspoken participants. Moreover, data analysis generally consumes so much time (CDC, 2008). In this study, focus group discussion was organized by selecting users of the Microsoft Dynamics ERP system from different departments at CRF. Participants were then engaged using a focus group discussion guide.

Questionnaires

A questionnaire consists of a number of questions to be answered by the respondents on their own. An important strength of questionnaires is that they are inexpensive and can easily be administered to a large sample group. They are also free from the interviewer's bias and can offer the respondent a high level of anonymity. Respondents regarded as being unapproachable may also be easily reached through questionnaires. In addition, respondents get enough time to give well thought out answers to the questions asked.

There are, however, some limitations associated with the use of questionnaires. According to Al-adaileh (2009), it is usually difficult for the researcher to secure adequate responses especially when the motivation for answering the questionnaire is not clearly known to the respondents. Another shortcoming of questionnaires is the possibility of questions being misunderstood by the respondents. Moreover, the use of open ended questions may lead to wide verbal variations and it is possible for respondents to ignore important issues. Also, respondents may fail to provide responses to some questionnaire items and data analysis may be time consuming.

The questionnaire for this study, included as appendix I in this report, was divided into four different parts. The first part consisted of 3 questions to capture data on the demographic profile, the second part considered the users' experience in using ICT systems, the third part captured information on the ICT components in use at CRF, and the last part consisted of the model constructs and ICT measurement factors for each to capture the success of the Microsoft Dynamics ERP system. The measurement variables and the items used for each are shown in table 2. In total, 21 questionnaire items were used to capture the users' perception of the Microsoft Dynamics ERP system.

Table 2: Measurement Constructs and Questionnaire Items

Construct	**Questionnaire of Items**
System Quality	1. Using the ERP system is easy for me 2. Functions provided by the ERP system are useful for my work 3. The use of the ERP system speeds up my work operations 4. The services of the ERP system are always available for my work
Information Quality	1. The ERP system ensures information availability 2. The ERP system provides me with relevant information 3. The ERP system guarantees reliability of information 4. The ERP system allows me to access information securely 5. The ERP system provides me with timely information
Service Quality	1. I always receive support for the ERP system when needed 2. Support availability for the ERP system is prompt
Use	1. I use the ERP system frequently for my work 2. I access the ERP system several times in a day for my work
User Satisfaction	1. Using the ERP system improves the quality of my work life 2. I find it easy to use the ERP system interface provided 3. I receive adequate support when using the ERP system for my work 4. My experience of using the ERP system is satisfying
Net Benefits	1. The use of the ERP system improves my performance of tasks 2. The use of the ERP system improves my efficiency at work 3. The use of the ERP system improves my level of effectiveness 4. The use of the ERP system helps me to reduce errors in my work

Source: Research

To give the respondents a wider scope of choice a 5-point likert scale illustrated by table 3 was used to design the study questionnaire.

Table 3: Likert Scale

Strongly Agree **(SA)**	Agree **(A)**	Neutral **(N)**	Disagree **(D)**	Strongly Disagree **(SD)**
5	4	3	2	1

Source: Research

3.4. Population, Sampling, and Sample Size Determination

Population

Statistically, population refers to the total number of items from which data is to be collected. The population for this study consisted of approximately 300 CRF employees based at the organization's headquarters in Ruiru. According to the ICT Manager, approximately 75% of the employees use ICT systems in their work operations. This translates to about 225 employees. Furthermore, some of these employees are casual laborers who spend most of their time in the coffee fields. The actual number of those using ICT systems in their daily work operations is thus slightly less than 200.

Sampling

As the study population was pre-determined, a non-probabilistic sampling approach was used to arrive at the sample. According to Kothari (2004), non-probabilistic sampling provides no basis for determining the probability that each item in the population will be included in the sample. The technique is also known as deliberate, purposive, or judgment sampling. Respondents were, therefore, deliberately selected by the researchers. Although there is a danger of the sample selection being affected by subjective bias, Kothari (2004) argued that reliability can still be assured if the researchers remained impartial and exercised due diligence throughout the selection process.

Sample Size Determination

According to Israel (2012), three criteria have to be specified in order to arrive at the appropriate sample size. They include precision level, confidence or risk level, and the degree of variability. The author also identifies various approaches that may be used to determine the sample size including the use of a census when dealing with a small population, imitating a sample size of similar studies done in the past, using published sample size tables, and applying mathematical formulas. Bearing in mind that the target population was approximately 200, the study sample comprised the entire population. As noted by Israel (2012) a sample size of 200 or less is considered small and as such, all items in the

population should be included in the sample. Ostensibly, the use of the entire population eliminates errors, and allows the achievement of the desired precision level.

3.5. Data Collection and Cleaning

Before embarking on the data collection process, an introductory letter was obtained from the office of the Deputy Director, School of Computing and Informatics. The data collection process commenced after the letter was handed to the relevant authorities at CRF and permission granted by the Director of Research. A total of 200 questionnaires were later randomly distributed to possible respondents. Out of the distributed questionnaires, 174 were filled and returned. The received questionnaires were later screened for possible errors and 19 questionnaires were spoilt and as such, invalid for use in the analysis process. From the valid questionnaires, 54 were separated for the users of the Microsoft Dynamics ERP system. Data items from these 54 questionnaires were then entered into a Microsoft excel spreadsheet and later imported into SPSS for detailed analysis of the success of the ERP system at CRF.

3.6. Reliability of Instruments

According to Tavakol (2011), reliability is concerned with the ability of an instrument to measure consistently. It is an important concern in research especially where quantitative methods are used (Bryman, 2008). To ensure that the study questionnaires were reliable, experts were first consulted to determine their suitability. The questionnaires were also pre-tested by distributing them to some of the respondents and making revisions based on the feedback received. Finally, Cronbach's alpha was used to measure internal consistency of the model constructs. Cronbach's alpha values for the different model constructs are as presented in table 4. Since acceptable alpha values range from 0.7 to 0.95 (Tavakol, 2011), the results in the table demonstrate that all constructs in the model exhibited an acceptable level of reliability.

Table 4: Reliability Analysis of Constructs

Construct	Number of Questionnaire Items	Cronbach's Alpha
System Quality	4	.767
Information Quality	5	.817
Service Quality	2	.804
Use	2	.824
User Satisfaction	4	.764
Net Benefits	4	.830

Source: Research

3.7. Data Analysis and Presentation

Data analysis implies the computation of measures as well as searching for relationships among data components (Kothari, 2004). As pointed out earlier, data analysis was performed using Microsoft excel and SPSS. Data items were first entered into a Microsoft excel spreadsheet and later imported into SPSS for detailed analysis. Pearson's correlation analysis was used to check for associations between the different model constructs and to validate the research model while measures of central tendency were used to give summaries of the research data.

3.8. Hypotheses Formulation

The study was conducted based on the research model described by figure 5. As can be seen from the model, information quality, system quality, and service quality jointly or separately affect use and user satisfaction while use and user satisfaction have either a positive or negative effect on net benefits. To test and validate the research model in a local context, the following hypotheses were formulated:

System Quality (SysQ)

This construct was used to measure the desired characteristics of the ERP system. The characteristics associated with the success of ERP system that have been used in this study are ease of use, usefulness, execution speed, and availability. Considering the importance of system quality we hypothesized as follows:

H1a: System Quality positively affects Use

H1b: System Quality positively affects User Satisfaction

Information Quality (IQ)

While system quality focuses on the characteristics of the ERP system, information quality looks at the characteristics of the information produced by the ERP system. Typically, the information is in the form of reports. The measures for information quality used in this study are availability, relevance, reliability, security, and timeliness. The hypotheses devised for information quality are:

H2a: Information Quality is positively associated with Use

H2b: Information Quality is positively associated with User Satisfaction

Service Quality (SrvQ)

Service quality measures the overall quality of support delivered by service providers regardless of whether the support is provided by the ICT department or outsourced. Metrics used in this study for the service quality construct are support availability and support promptness. We therefore hypothesized as follows:

H3a: Service Quality is positively associated with Use

H3b: Service Quality is positively associated with User Satisfaction

Use (U)

As discussed earlier, DeLone and McLean (2003) argued that Use and Intention to Use are alternatives in their model. While Intention to Use was preferred where usage was mandatory, Use was considered worthwhile where system use is voluntary. As system use in this study was voluntary, Use was preferred to Intention to Use (figure 5). The measures used in this study for the use construct are frequency of use and number of accesses on a daily basis. We therefore hypothesized as follows:

H4a: Use is positively associated with User Satisfaction

H4b: Use is positively associated with Net Benefits

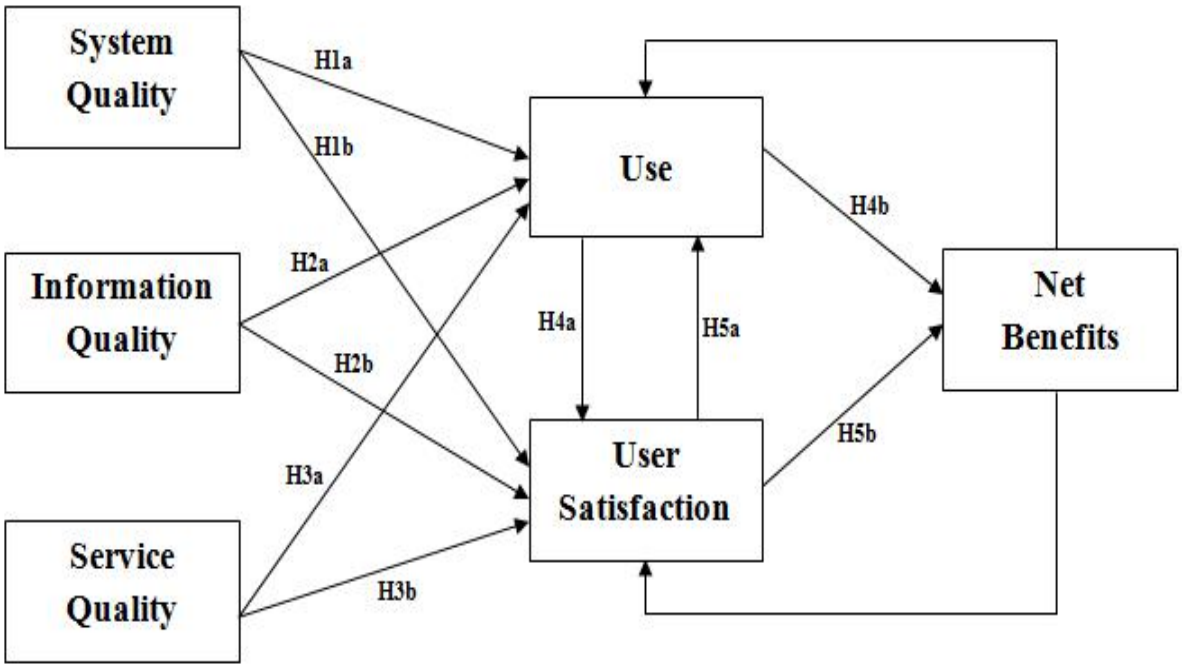
User Satisfaction (UsrS)

According to DeLone and McLean (2003), user satisfaction is a very important measure of the users' opinion regarding the success of ICT systems. Specific measures that were used for this construct in this study are quality of work-life, user-friendliness of the ERP system interface, support availability, and level of satisfaction. Regarding this construct, we hypothesized as follows:

H5a: User satisfaction is positively associated with Use

H5b: User satisfaction is positively associated with Net Benefits

Figure 5: Research Model and Hypotheses



Source: Adopted from DeLone & McLean IS Success Model (2003)

3.9. Hypotheses Testing and Model Validation

The stated hypotheses as well as the validity of the research model were tested using Pearson's correlation analysis. In testing the research model, the relationships between the dependent variables and each of the independent variables were examined and the hypotheses were accepted as long as the p value was less than 0.05.

3.10. Ethical Considerations

Ethical concerns are very critical in research and it is important for researchers to pay careful attention to them. Ordinarily, they relate to matters of confidentiality, privacy, and transparency among others. According to Israel and Hay (2006), researchers tend to have a positive influence on respondents when they act in an ethical manner. Acting in an ethical manner can also enable researchers to obtain data that is highly reliable.

In this study, the researchers acted ethically by following the guidelines of obtaining permission to interact with employees at CRF and to collect research data. Before the commencement of data collection, an introductory letter was first obtained from the Deputy Director, School of Computing and Informatics. The said introductory was later used to request for permission to freely operate within the precincts of CRF and to interact and collect research data from the respondents. The final authorization was granted through a letter of permission from the office of the Director of Research. A copy of the introductory letter and letter of authority from the Director of Research at CRF are both included in this report as appendix II and appendix III respectively. To eliminate any form of ambiguity, the objectives of the research and the role of the respondents were clearly explained.

CHAPTER 4: DATA ANALYSIS, INTEPRETATION, AND DISCUSSION OF RESULTS

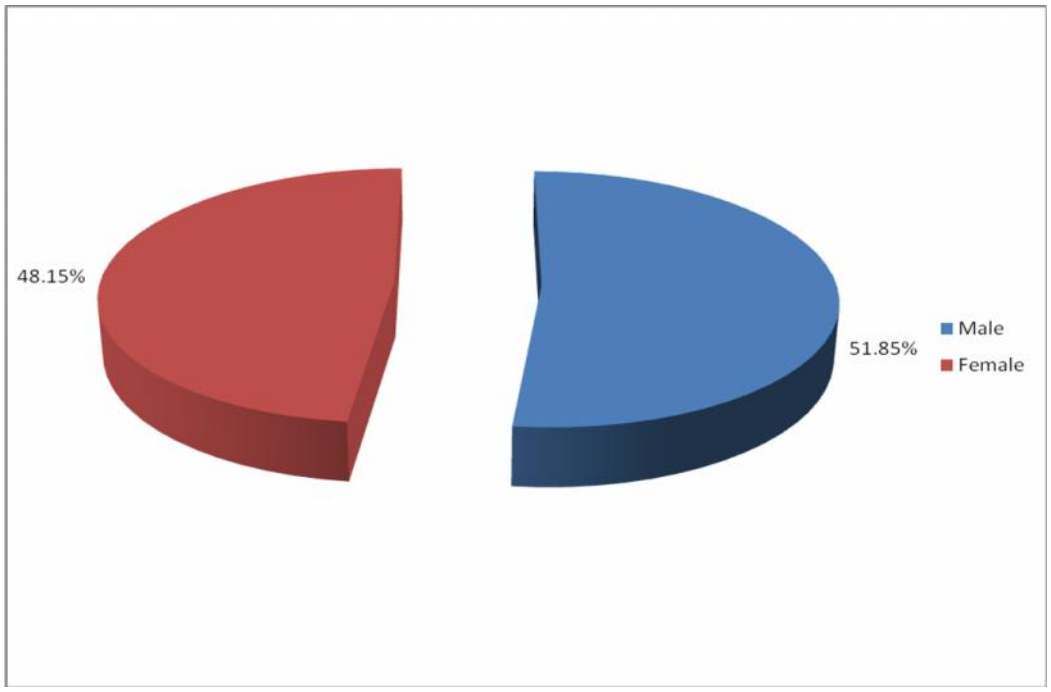
4.1. Introduction

As explained previously, questionnaires were used to understand the users' experience with the ERP system at CRF. The use of the questionnaires was backed up by qualitative data collected through interviews and FGD. The data collected was also used to validate DeLone and McLean's (2003) IS success model in a local context. Initially, a total of 220 questionnaires were distributed to various respondents out of which 174 questionnaires were filled and returned. This represented a response rate of about 80%. After cleaning the data, 19 questionnaires were considered spoilt and only 155 were valid for use in the analysis. From the 155 questionnaires, 54 respondents indicated that they use the Microsoft Dynamics ERP system for their work. These 54 questionnaires were utilized in this study to determine the success of the ERP system at CRF. The data from these questionnaires was entered into a Microsoft excel spreadsheet and later imported into SPSS version 18 for detailed analysis.

4.2. Demographic Characteristics

Figure 6 presents the gender distribution among the users of the ERP system and shows that 51.85% of the respondents were male while 48.15% were female.

Figure 6: Percentage of Male and Female Respondents who use the ERP System



Source: Research

As can be seen from table 5 most respondents who use the ERP system were aged between 28 and 37 years of age. A very small percentage (3.70%) of those who use the ERP system were aged 48 years and above.

Table 5: Age Distribution

Age Group	**Percent**
18 – 27	22.22%
28 – 37	44.44%
38 – 47	29.63%
48+	3.70%

Source: Research

4.3. System Evaluation

This section presents findings and discussions on the evaluation of the use of the ERP system at CRF from the users' perspective. The constructs of the evaluation model were evaluated using a number of questionnaires items. The responses were summarized and analyzed based on a scale derived from the Likert scale (*table 5*) used in the study. While the original Likert scale had 5 levels; Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD), the derived one was made up of 3 levels; Agree (A), Neutral (N), and Disagree (D) as depicted by table 6. The table shows that the responses for Strongly Agree and Agree were combined to form Agree, Neutral remained as Neutral, and Disagree and Strongly Disagree constituted Disagree.

Table 6: Responses Analysis Scale

Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Combined to form **"Agree"**		Neutral	Combined to form **"Disagree"**	

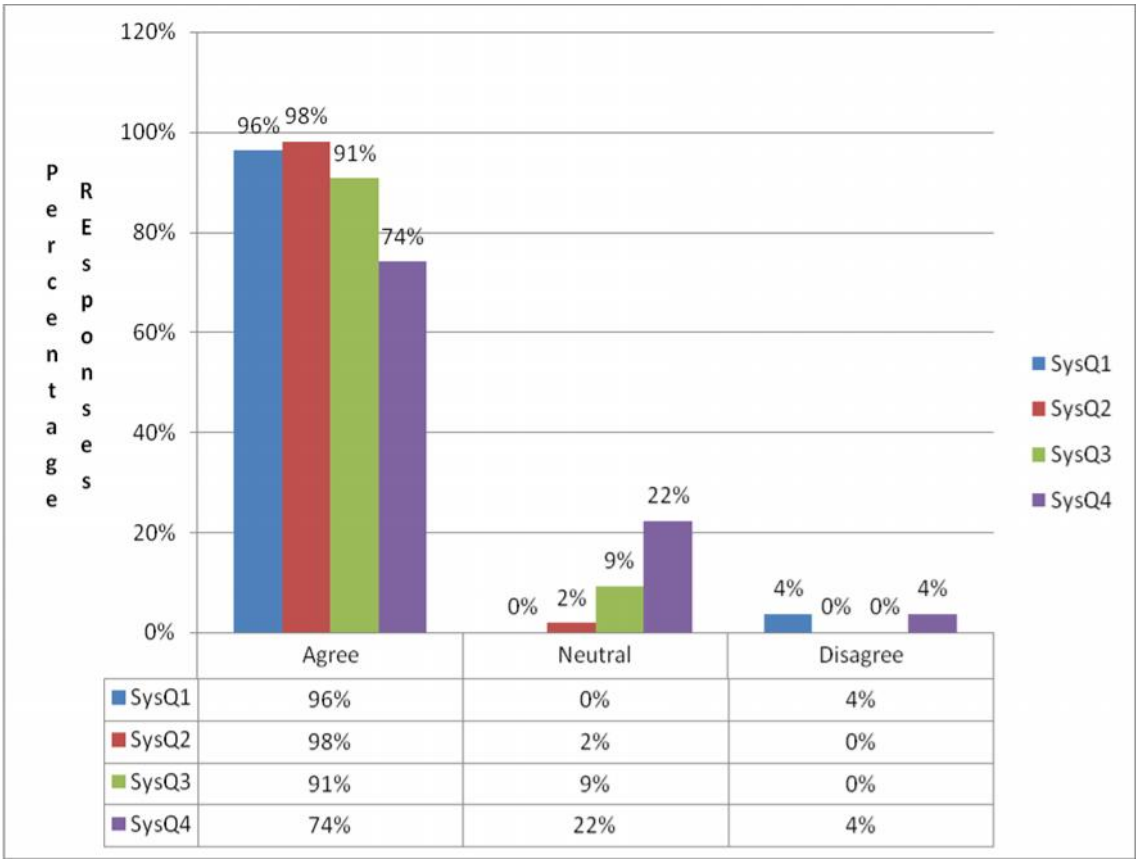
Source: Research

System Quality

Figure 7 shows the general distribution of the responses for the construct system quality. The results of the analysis indicate that 96% of the respondents were satisfied or highly satisfied with the ease of use of ERP system. Approximately 4% of the respondents felt that the use of ERP system was a challenge. As far as the usefulness of the ERP system is concerned, about 98% of the respondents were either satisfied or highly satisfied with the usefulness of the ERP system while only 2% were either unsure or disappointed with the usefulness of the system. Regarding the effect of the ERP system on the rate at which tasks could be performed, 91% of the respondents were either satisfied or highly satisfied while 9%

were dissatisfied. Concerning the last item of measurement for the system quality construct, which addressed the availability of the ERP system, 74% of the respondents were either satisfied or highly satisfied while 26% were unsure, dissatisfied or highly dissatisfied with the aspect of availability.

Figure 7: Percentage Responses for System Quality Items



Source: Research

Table 7 shows the mean and standard deviation statistics for each of the questionnaire items as well as the overall mean value of 4.33 +/- 0.690 for the system quality variable. The results indicate an overall positive response for the items used to measure the construct system quality.

Table 7: Descriptive Statistics of System Quality Items

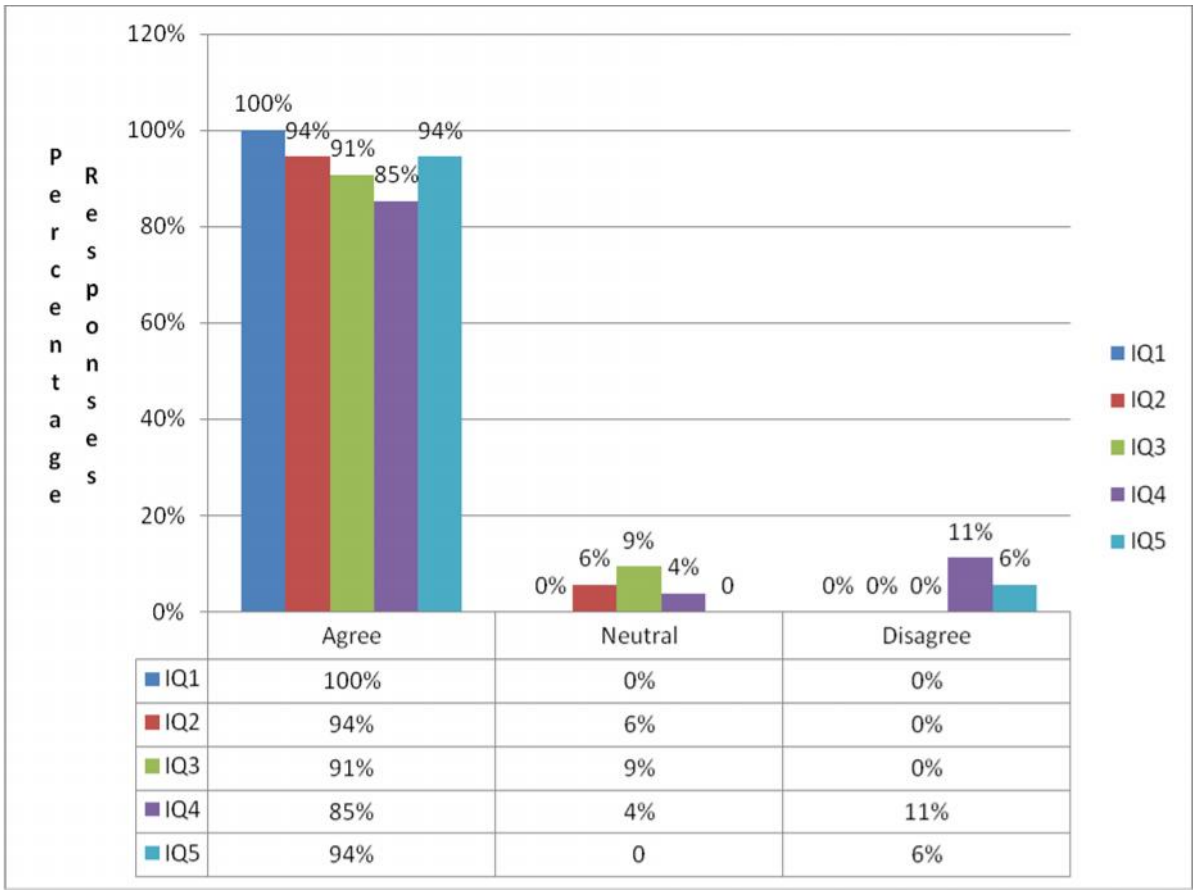
Questionnaire Item	**Mean**	**Std Deviation**
SysQ1: Using the ERP system is easy for me	4.33	.673
SysQ2: Functions provided by the ERP system are useful for my work	4.48	.540
SysQ3: The use of the ERP system speeds up my work operations	4.39	.656
SysQ4: The services of the ERP system are always available for my work	4.13	.891
System Quality (SysQ)	**4.33**	**.690**

Source: Research

Information Quality

Figure 8 shows the percentage responses for the information quality construct. From the figure, all respondents either agreed or strongly agreed with the item regarding information availability. Regarding the relevance of information accessed through the ERP system, 94% were satisfied while 6% were either unsure with the relevance of information accessed through the ERP system. About 91% of the respondents were happy with the aspect of information reliability whereas approximately 9% were either not sure with the questionnaire item on reliability of information accessed through the ERP system. Looking at secure access to information, 85% either agreed or strongly agreed with the statement while 15% were either not sure or did not agree. Finally, 94% of the respondents were either satisfied or highly satisfied with the item regarding timely access to information while about 6% were dissatisfied.

Figure 8: Percentage Responses for Information Quality Items



	Agree	Neutral	Disagree
IQ1	100%	0%	0%
IQ2	94%	6%	0%
IQ3	91%	9%	0%
IQ4	85%	4%	11%
IQ5	94%	0	6%

Source: Research

Table 8 presents the means and standard deviations of each questionnaire item for the information quality construct. An overall mean value of 4.51 +/- 0.686 indicates that the

respondents were generally in agreement with the questionnaire items and thus that they were happy with the quality of information provided by ERP system.

Table 8: Descriptive Statistics of Information Quality Items

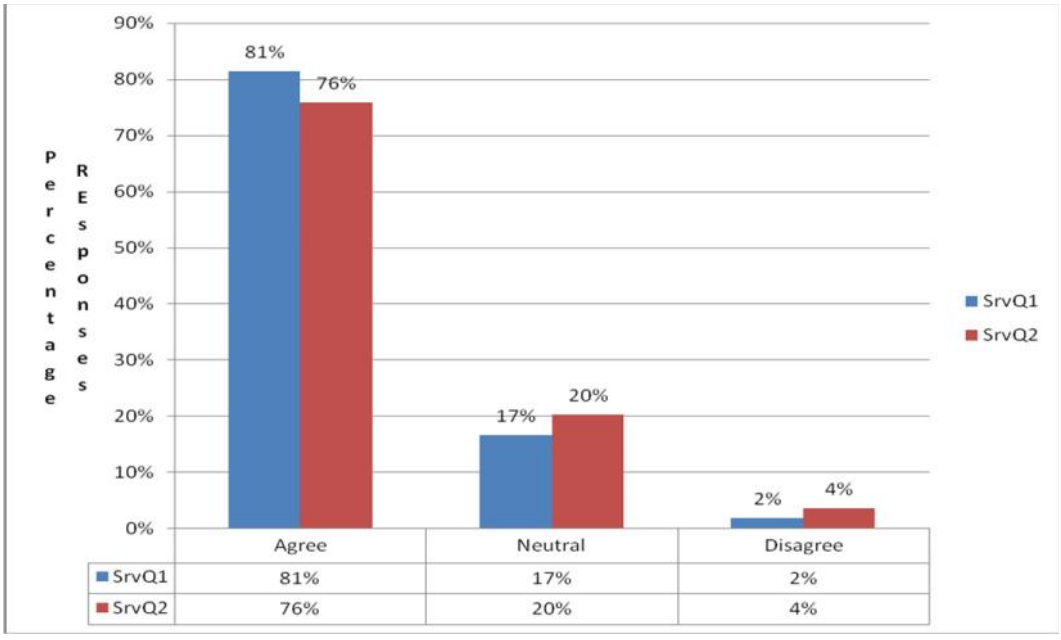
Questionnaire Item	Mean	Std Deviation
IQ1: The ERP system ensures information availability	4.80	.407
IQ2: The ERP system provides me with relevant information	4.69	.577
IQ3: The ERP system guarantees reliability of information	4.41	.659
IQ4: The ERP system allows me to access information securely	4.17	.947
IQ5: The ERP system provides me with timely information	4.48	.841
Information Quality (IQ)	**4.51**	**.686**

Source: Research

Service Quality

The results of the service quality construct are shown by figure 9 and indicate that 81% of the respondents either agreed or strongly agreed with the item regarding access to support services for the ERP system. Approximately 19% were not sure, dissatisfied or highly dissatisfied with the level of support received while using the ERP system. As far as promptness of the support services is concerned, 76% were either satisfied or strongly satisfied while about 24% of the respondents were not sure, dissatisfied, or highly dissatisfied with the prompt availability of support services for the ERP system.

Figure 9: Percentage Responses for Service Quality Items



Source: Research

The mean values as well as overall score of 4.18 +/- 0.857 (table 9) obtained by running descriptive statistics for the service quality construct revealed that the respondents were generally in agreement with the respective questionnaire items used for this construct.

Table 9: Descriptive Statistics of Service Quality Items

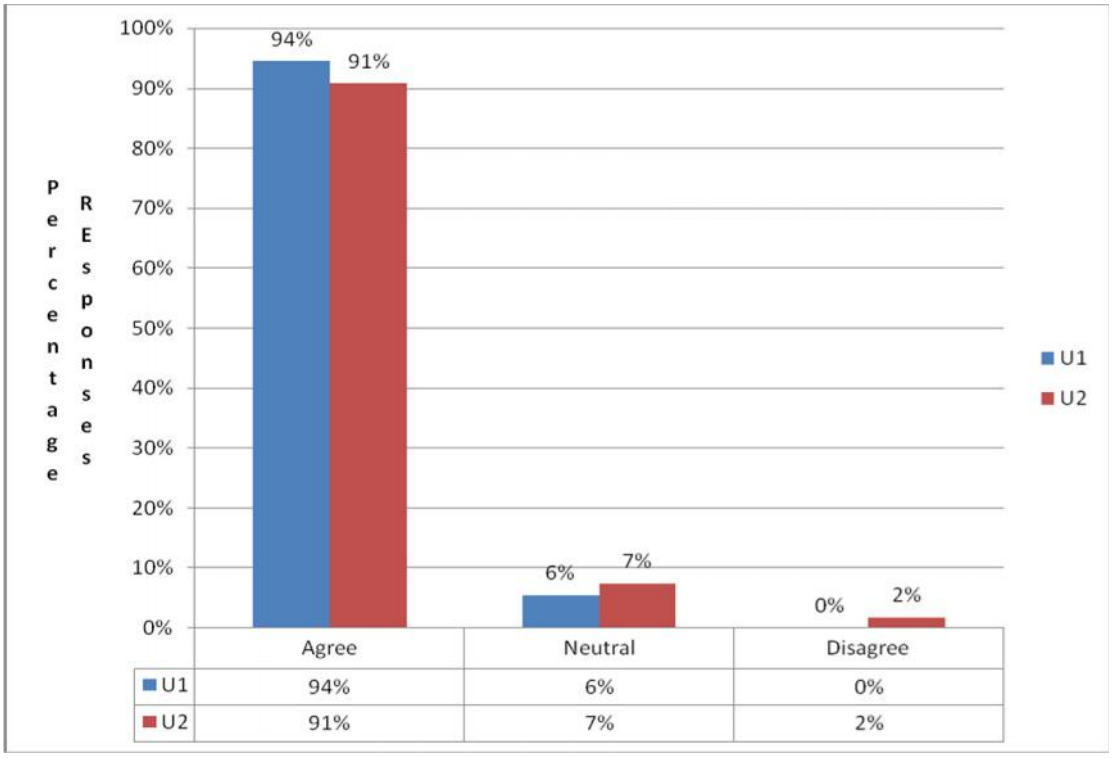
Questionnaire Item	**Mean**	**Std Deviation**
SrvQ1: I always receive support for the ERP system when needed	4.30	.816
SrvQ2: Support availability for the ERP system is prompt	4.06	.899
Service Quality (SrvQ)	**4.18**	**.857**

Source: Research

Use

As can be seen from figure 10, 94% of the respondents frequently utilize the services provided by the ERP system in their work operations while about 6% were not certain regarding their frequency of use of the ERP system services. On the other hand, 91% of the respondents indicated that they access the ERP system for their work operations several times on any given working day.

Figure 10: Percentage Responses for Use Items



Source: Research

Table 10 presents the mean and standard deviation for each of the questionnaire items and the overall mean value of 4.45 +/- 0.661 for the use construct. The results of the table indicate an overall agreement with the items used for this construct.

Table 10: Descriptive Statistics of Use Items

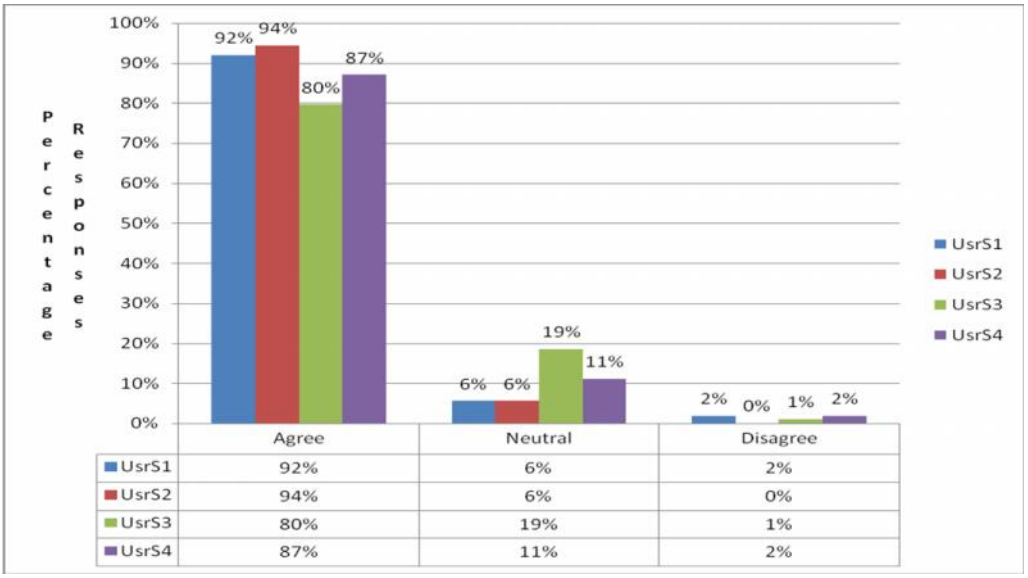
Questionnaire Item	Mean	Std Deviation
U1: I use the ERP system frequently for my work	4.48	.606
U2: I access the ERP system several times in a day for my work	4.43	.716
Use (U)	**4.45**	**.661**

Source: Research

User Satisfaction

As can be seen from figure 11, users were generally satisfied with the use of the ERP system. The results indicate that 92% of the respondents were in agreement that the use of the ERP system improves the quality of their work life. The other 8% of the respondents were either not sure or disagreed with the item on the connection between the use of the ERP system and the quality of their work life. Concerning the second item for the construct user satisfaction, 94% of the respondents were satisfied while 6% were not sure. The figure also indicates that 80% of the respondents agreed with the third item while 20% were either not sure or disagreed with the item measuring the quality of support received while using the ERP system in their work operations. Finally, 87% of the respondents were satisfied while 13% were not sure or dissatisfied with the last item regarding the link between the use of the ERP system and personal fulfillment at work.

Figure 11: Percentage Responses for User Satisfaction Items



Source: Research

The mean values and overall scores obtained by running descriptive statistics for the user satisfaction construct depicted in table 11, indicate that respondents were generally in agreement with the questionnaire items used for the construct. The overall mean value was 4.31 +/- 0.719 (table 11).

Table 11: Descriptive Statistics of User Satisfaction Items

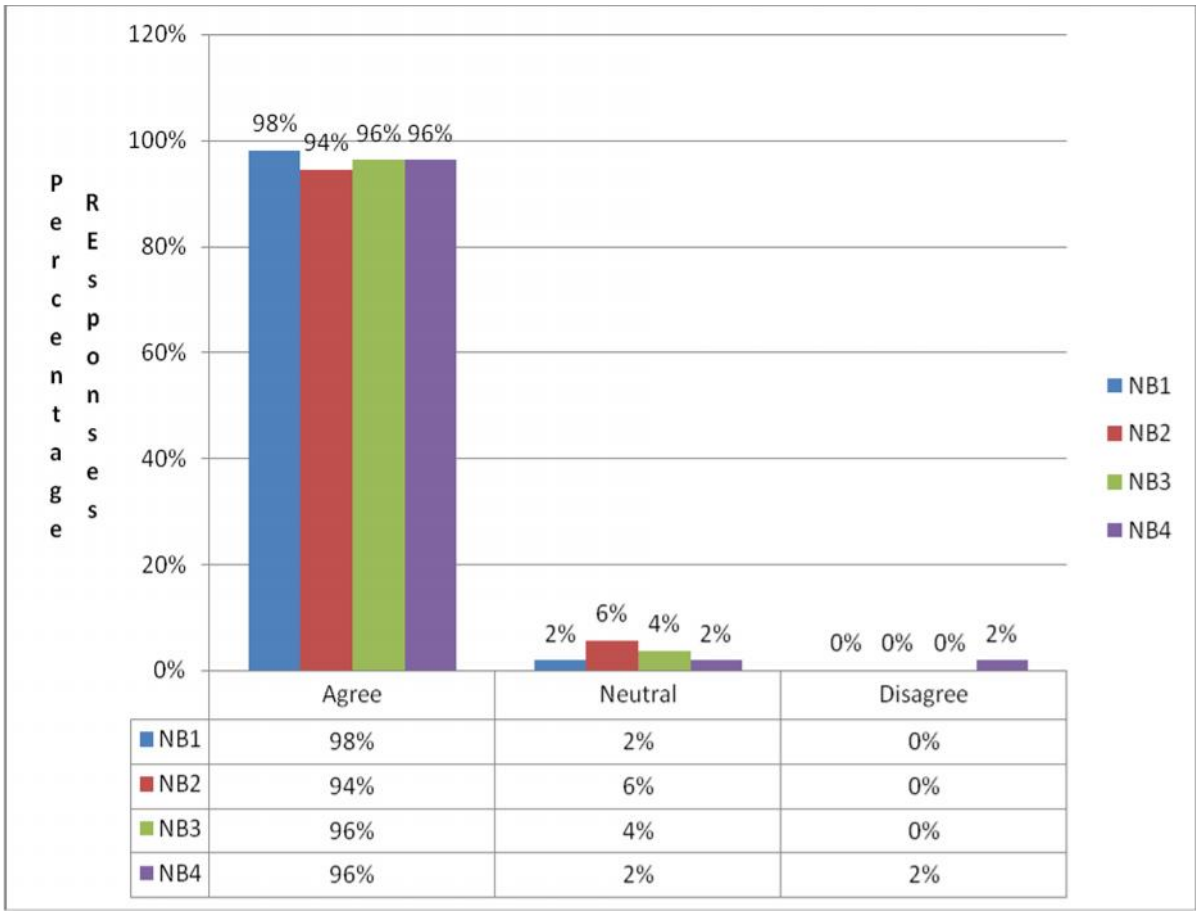
Questionnaire Item	**Mean**	**Std Deviation**
UsrS1: Using the ERP system improves the quality of my work life	4.46	.770
UsrS2: I find it easy to use the ERP system interface provided	4.35	.588
UsrS3: I receive adequate support when using the ERP system for my work	4.15	.787
UsrS4: My experience of using the ERP system is satisfying	4.26	.732
User Satisfaction (UsrS)	**4.31**	**.719**

Source: Research

Net Benefits

On whether the use of the ERP system improves performance of tasks, 98% of the respondents agreed while 2% were uncertain (figure 12). Regarding the second item 94% of the respondents were in agreement that the use of the ERP system improves their efficiency at work while 6% were not sure. As for the third measure for the construct net benefits which looked at the connection between the use of the ERP system and effectiveness, 96% of the respondents agreed that the use of the ERP system improved their level of effectiveness at work while 4% were uncertain. For the last item, 96% of the respondents were in agreement while 4% were not sure or disagreed that the use of the ERP system helped them to reduce the number of errors in their work.

Figure 12: Percentage Responses for Net Benefits Items



Source: Research

From table 12, the mean values and overall scores obtained for the construct net benefits indicates that a large number of respondents were generally in agreement with the items used to measure the net benefits construct. The mean score for the construct is 4.53 +/- 0.634 as represented in the table and this is within the acceptable range.

Table 12: Descriptive Statistics of Net Benefits Items

Questionnaire Item	**Mean**	**Std Deviation**
NB1: The use of the ERP system improves my performance of tasks	4.61	.529
NB2: The use of the ERP system improves my efficiency at work	4.54	.605
NB3: The use of the ERP system improves my level of effectiveness	4.52	.574
NB4: The use of the ERP system helps me to reduce errors in my work	4.44	.634
Net Benefits (NB)	**4.53**	**.634**

Source: Research

4.4. Pearson's Correlation Analysis of Variables

Table 13 shows the correlation analysis results obtained for the 6 constructs from SPSS output. The results demonstrate the existence of significant correlations among several constructs of the research model.

Table 13: Correlation Analysis of Variables

		System Quality	Information Quality	Service Quality	Use	User Satisfaction	Net Benefits
System Quality	Pearson Correlation	1	.563**	.703**	.427**	.709**	.327*
	Sig. (2-tailed)		.000	.000	.001	.000	.016
	N	54	54	54	54	54	54
Information Quality	Pearson Correlation	.563**	1	.389**	.279*	.308*	.522**
	Sig. (2-tailed)	.000		.004	.041	.023	.000
	N	54	54	54	54	54	54
Service Quality	Pearson Correlation	.703**	.389**	1	.291*	.761**	.185
	Sig. (2-tailed)	.000	.004		.033	.000	.180
	N	54	54	54	54	54	54
Use	Pearson Correlation	.427**	.279*	.291*	1	.548**	.398**
	Sig. (2-tailed)	.001	.041	.033		.000	.003
	N	54	54	54	54	54	54
User Satisfaction	Pearson Correlation	.709**	.308*	.761**	.548**	1	.406**
	Sig. (2-tailed)	.000	.023	.000	.000		.002
	N	54	54	54	54	54	54
Net Benefits	Pearson Correlation	.327*	.522**	.185	.398**	.406**	1
	Sig. (2-tailed)	.016	.000	.180	.003	.002	
	N	54	54	54	54	54	54

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Research

4.5. Hypotheses Testing and Model Validation

This section presents the results of the hypotheses testing and model validation based on the interpretations of the SPSS output depicted in table 13. Although some of the hypothesis were more significant than others, they all were significant nevertheless. A stated hypothesis was accepted as long as the p-value was less than 0.05.

H1a: System Quality is positively associated with Use

As can be seen from table 13, the Pearson's correlation coefficient value between system quality and use which supports our hypothesis is 0.427 and, asserts that there is a strong positive association between system quality and the use of the ERP system. A p-value of 0.001 which is less than 0.01 points to the fact that the correlation is a very significant one. This is in agreement with past findings such as DeLone & McLean (1992), Seddon (1997), Rai et al. (2002), and DeLone & McLean (2003) that arrived at similar conclusions. The first hypothesis concerning the construct system quality was therefore supported.

H1b: System Quality is positively associated with User Satisfaction

From table 13, Pearson's correlation coefficient between system quality and user satisfaction is 0.709. The p-value of 0.000 is also less than 0.01 indicating that the correlation between these two variables is a very significant one. Consequently, the second hypothesis concerning the construct system quality was supported.

H2a: Information Quality is positively associated with Use

From table 13, Pearson's correlation coefficient between information quality and use is 0.279. Although the association is a weaker one, a p-value of 0.041 which is less than 0.05 indicates that the said correlation is significant. The first hypothesis concerning information quality was therefore supported.

H2b: Information Quality is positively associated with User Satisfaction

Information quality is positively associated with user satisfaction. As can be seen from table 13, the results of this hypothesis indicate that Pearson's correlation coefficient between information quality and user satisfaction is 0.308 implying that there is a positive association between information quality and user satisfaction. The association is, however, a weak one but nonetheless significant as the p-value is 0.023 and is less than 0.05. The second hypothesis concerning the variable information quality was therefore also supported.

H3a: Service Quality is positively associated with Use

From the results of table 13, Pearson's correlation coefficient between service quality and use is 0.291 with a p-value of 0.033 which indicates the presence of a weak but

significant relationship between service quality and use. The first hypothesis regarding the construct service quality was therefore supported.

H3b: Service Quality is positively associated with User Satisfaction

According to the results of table 13, a strong positive association exists between service quality and user satisfaction. Pearson's correlation coefficient of 0.761 and a p-value of 0.000 indicate that there is a positive and very significant correlation between the construct service quality and the independent variable user satisfaction. The second hypothesis concerning the service quality construct was therefore supported.

H4a: Use is positively associated with User Satisfaction

Table 13 shows that Pearson's correlation coefficient between use and user satisfaction is 0.548 affirming that there is a strong positive association between use and user satisfaction. A p-value of 0.000 which is less than 0.01 also indicates that the correlation is a very significant one. Accordingly, this hypothesis was supported.

H4b: Use is positively associated with Net Benefits

Use is positively associated with net benefits. From table 13, Pearson's correlation coefficient between use and net benefits is 0.398 confirming that there is a positive correlation between use and net benefits. A p-value of 0.003 which is less that 0.01 further indicates that the correlation is a very significant one. Consequently, the second hypothesis regarding the use construct was equally supported.

H5a: User Satisfaction is positively associated with Use

From table 13, Pearson's correlation coefficient between user satisfaction and use is 0.548 indicating that there is a positive association between user satisfaction and use. A p-value of 0.000 also points to the fact that the correlation is a very significant one. The first hypothesis concerning the construct user satisfaction was therefore supported.

H5b: User Satisfaction is positively associated with Net Benefits

User satisfaction is positively associated with net benefits. As can be seen from table 13, the results of this hypothesis indicate that Pearson's correlation coefficient between user satisfaction and net benefits is 0.406 indicating that there is a positive correlation between user satisfaction and net benefits. A p-value of 0.002 also indicates that the correlation between user satisfaction and net benefits is also a very significant. For these reasons, the second hypothesis concerning the variable user satisfaction was also supported.

Table 14: Summary of Hypotheses Test Results

Hypothesis	**Pearson's Correlation Coefficient**	**p-value**	**Interpretation**
H1a: System Quality is positively associated with Use	+0.427	.001	Very Significant
H1b: System Quality is positively associated with User Satisfaction	+0.709	.000	Very Significant
H2a: Information Quality is positively associated with Use	+0.279	.041	Significant
H2b: Information Quality is positively associated with User Satisfaction	+0.308	.023	Significant
H3a: Service Quality is positively associated with Use	+0.291	.033	Significant
H3b: Service Quality is positively associated with User Satisfaction	+0.761	.000	Very Significant
H4a: Use is positively associated with User Satisfaction	+0.548	.000	Very Significant
H4b: Use is positively associated with Net Benefits	+0.398	.003	Very Significant
H5a: User Satisfaction is positively associated with Use	+0.548	.000	Very Significant
H5b: User Satisfaction is positively associated with Net Benefits	+0.406	.002	Very Significant

Source: Research

As can be seen from table 14, seven of the stated hypotheses were very significant while three were weakly supported though still significant.

4.6. Focus Group Discussion

To gain a deeper understanding of the responses given by the participants regarding the different constructs, FGD was used. At the start of the FGD we had 9 participants but 3 participants had to leave for official duties. The FGD guide is included in this report as appendix II. The discussion of the outcome of the FGD follows next.

Concerning the construct system quality, there was a general consensus that the introduction of the ERP system at CRF has greatly improved efficiency and has led to among other things, quick and easy generation of reports. In a similar way, participants noted a great improvement in decision making and efficiency in handling financial matters. As pointed out by one of the respondents, the ERP system provides insights on how users can gain more efficiency or reducing errors in their work. There are, however, concerns about the rigidity of

the ERP system which apparently makes it difficult for it to be adapted to some specific processes in the organization. For most users, this reduces flexibility and is quite frustrating. Despite the great contributions made by the ERP system to CRF's operations, users are faced with the challenge of having to share the system with colleagues. There was a common desire for users to be allowed unlimited access to the ERP system. The discussion clearly indicated that system quality has a very significant effect on use and user satisfaction such that greater quality leads to more usage and greater satisfaction and vice versa.

Regarding the information quality construct, participants were generally happy with the fact that the ERP system facilitates access to reliable information as and when required. However, as one participant noted, resistance in sharing sensitive internal information between departments compromises the effectiveness of the ERP system. As such, the use of the ERP system may sometimes be avoided when a user intends to share information with specific individuals or departments across the organization. Information quality thus has a significant effect on both use and user satisfaction. While greater quality leads to more usage and greater satisfaction poor quality creates a negative effect.

The construct service quality applies whether support is offered internally by the organization's ICT department or externally by an outsourced service provider. To a large extent, participants were dissatisfied with the quality of support services offered for the ERP system and claimed that this eventually affects their frequency of using the system. Many of the participants felt that their frequency of usage could be increased if support services were made promptly available. Service quality thus has a significant impact on use and user satisfaction. Where service quality is poor, the usage of the system is equally low and vice versa.

Generally, the use of the ERP system at CRF is on a voluntary basis. This not withstanding, there is an increased desire to use the ERP system often as expressed by the participants. To a great extent, the use of the ERP system is affected by unavailability of the system either because it has to be used by a colleague or it has developed a problem that requires fixing. Use of the ERP system also gets affected when the quality of the support services declines. According to most participants, low use has a negative effect on net benefits while increased usage presents the organization with greater benefits. System use accordingly has a very significant effect on net benefits.

Regarding the construct user satisfaction, the participants unanimously expressed their satisfaction with the ERP's system interface despite accepting that it is complex. By and large, participants were happy as long as their objectives were successfully met. As noted by

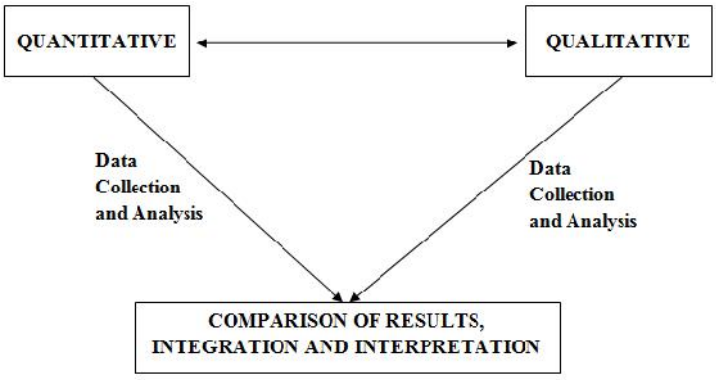
one of the participants, the complexity of the system interface is not a major hindrance as long as a user is able to accomplish his or her objectives of using the system at any given time. A high level of user satisfaction in turn influences use and with increased usage, there are greater benefits to the organizations. Participants were also in agreement that using the ERP system has greatly improved the quality of their work life. It is now get work done more efficiently and with less stress unlike in the past. User satisfaction consequently has a significant effect on use and essentially on net benefits.

From the FGD, we were able to establish that the use of the ERP system has led to a drastic improvement in task accomplishment at CRF. As one participant noted, it took so much time in the past to get things done, but this has improved greatly since the use of the ERP system was introduced. Furthermore, participants were in agreement that errors have also considerably reduced due to the use of the ERP system. As a result most users are encouraged to use the system even more. As a consequence, net benefits have a significant effect on use as well as user satisfaction with the use of the ERP system.

4.7. Triangulation of Quantitative and Qualitative Analysis

As earlier explained, this study used both quantitative and qualitative research techniques. This section presents a triangulation of the quantitative and qualitative analysis. As defined by Hussein (2009), it is the use of more than one approach, mostly quantitative and qualitative, in the same study. Triangulation helps to increases the width and depth of understanding in a study and it may also be used as a measure of validity in order to increase the level of accuracy in a study. The design of the FGD guide used in this study was based on the structure of the questionnaire and borrowed heavily from the items used to measure the different constructs. Figure 13 illustrates how triangulation has been used in this study while table 15 shows the triangulation of the analysis from questionnaire and FGD results.

Figure 13: Triangulation



Source: Research

Table 15: Triangulation of Qualitative and Quantitative Analysis

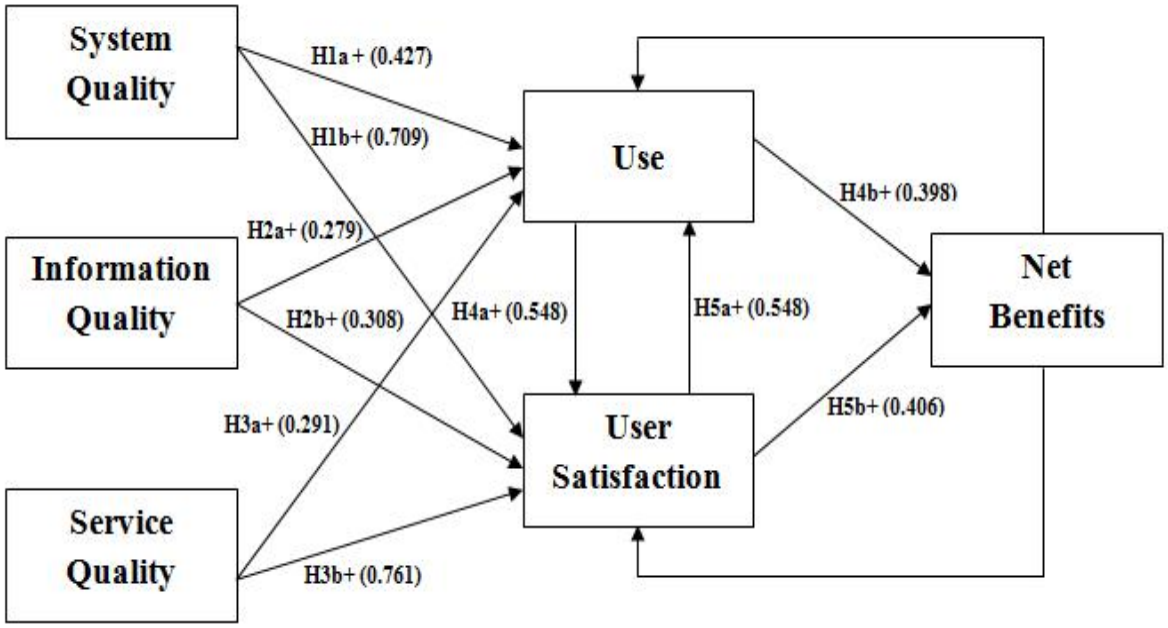
Construct	**Qualitative (Questionnaires)**	**Quantitative (FGD)**	**Interpretation**
System Quality (SysQ)	System Quality has a very significant effect on the use of the ERP system as well as user satisfaction	System quality has a very significant effect on use and user satisfaction such that greater quality leads to more usage and greater satisfaction and vice versa.	Very significant
Information Quality (IQ)	There is a significant though weak association between information quality and both use and user satisfaction	Frequency of usage can increase if the quality of support services and ERP system availability are improved	Quantitative analysis shows a weaker association while quantitative points a very strong significance of this construct
Service Quality (SrvQ)	Association between service quality is significant but weak while there is a very strong association between service quality and user satisfaction	Promptness of support services can increase the frequency of support services	Quantitative indicates a significant but weaker association between service quality and use while that between service quality and user satisfaction is very strong. Quantitative analysis on the other hand points service quality has a strong effect on both use and user satisfaction
Use (U)	A very strong correlation exists between use and user satisfaction	Results indicate that the use of the ERP system a negative effect on net benefits such that increased usage presents the organization with greater benefits and vice versa.	Use has a strong effect on both user satisfaction and net benefits as supported by both approaches
User Satisfaction (UsrS)	System Quality has a very significant effect on the use of the ERP system as well as user satisfaction	An indication that user satisfaction does not necessarily affect use and subsequently, net benefits	Quantitative analysis indicates that user satisfaction has a very strong effect on both use and user satisfaction while qualitative results point to the existence of a much weaker association

Source: Research

From table 15, we can deduce that the results obtained through the FGD offer a useful confirmation of the outcome of quantitative analysis. A part from information quality, service quality, and user satisfaction where the results differ slightly, the outcome on system quality and use are similar. Generally, the results obtained using the two approaches clearly indicate that the updated DeLone and McLean (2003) IS success model holds within a local context.

Figure 14 presents the research model with hypotheses and Pearson's correlation coefficient values.

Figure 14: Research Model with Hypotheses and Correlation Coefficients



Source: Adopted from DeLone & McLean IS Success Model (2003)

Although all the hypotheses were significant as depicted by the positive correlation coefficient values, some hypotheses had a weaker association than others. From figure 14, there are weak associations between information quality and both use and user satisfaction. Similarly, the relationship between service quality and use is significant but quite weak. The remaining seven hypotheses were very significant. Therefore, while the effects of information quality on use and user satisfaction and of service quality on use are not major, the magnitude of the effects from the remaining seven hypotheses on use as well as user satisfaction can be quite huge. Use and User Satisfaction in turn have a joint effect on net benefits.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1. General Conclusion

This research was based on the updated DeLone and McLean (2003) IS success model and indicated that generally, most users will use ICT systems in their work operations if they are satisfied with system quality, information quality, and service quality. The study also aimed to determine factors that are critical to understanding the users' perception of the success of ICT systems. Based on the findings, an improvement in system quality, information quality, and service quality will positively affect use and user satisfaction which in turn could have a positive or negative effect on net benefits. In addition, the study sought to validate the use of DeLone and McLean (2003) IS success model in a local setup in Kenyan. In order to realize the research objectives the study used three research questions revisited and discussed in this chapter under section 5.2. A discussion of the general characteristics of the study population and related findings now follows.

5.2. Characteristics of the Study Population and Related Findings

The study revealed that most respondents were aged between 28 and 47 years old (table 5). While male respondents comprised 51.85% of the total population, female respondents made up 48.15% of the respondents (figure 6). Averagely, most respondents had used ICT systems for between 6 to 10 years. The study also revealed that a majority of the respondents, accounting for approximately 92% utilized ICT systems in their work operations on a daily basis. In general, respondents use PCs, LANs, and WANs. ICT systems at the organization are used for various purposes including communication, data capture, and data analysis. ICT systems in some cases are, however, reserved for technical staff and those with acceptable level of experience in using them. Through interviews and FGD, we managed to establish that non-technical and novice users of ICT systems undertook most of the data capturing while data analysis was left for the more advanced users. Despite being a research institution, the use of software applications for research purposes is quite limited. With the help of interviews and FGD, we established that this was attributable to lack of financial resources dedicated to research work. In order to undertake major research work, users felt that a dependable financial source was necessary. Office applications are also widely utilized by employees at CRF.

Challenges faced by respondents while using ICT systems in their work operations include limited access, lack of skills, language problems, and inability to use ICT systems. As can be noted from figure 9, approximately 80% of the respondents cited limited access to ICT systems as a major challenge, 50% cited lack of skills, 7.7% language problems, and 6.3%

inability to use ICT systems. This was a very interesting finding considering that most respondents as depicted by figure 8 use ICT systems daily in their work operations. A probe into this anomaly through interviews and during the FGD indicated that the organization currently has a challenge of satisfactorily providing ICT systems to all eligible employees. With the exception of technical staff required to each have a laptop, the other users have to share the available PCs at a ratio of 1 PC to 6 employees. Another interesting finding has to do with opportunities for ICT usage. To most respondents, ICT systems could be used to improve communication. Again, through interviews and FGD, we were able to establish that most employees prefer using emails to other available options to pass communication. Slightly more or less, 24.7% of the respondents saw the need to use ICT systems to research on latest technologies.

Out of the selected 155 questionnaires, approximately 54 were filled by participants using the ERP system for their work operations. An earlier interview with the ICT Manager pointed to the fact that the acquisition of the Microsoft Dynamics ERP system was informed by the need to improve performance and deliver services more efficiently. The implementation is, however, being done in phases. The first phase of implementation which took place at the start of the year 2012 saw the use of the system introduced to only a section of the organization. The plan is to deploy the system in all departments across the organization. The discussion under section 5.3 relates to the use of the ERP system at CRF.

5.3. Research Objectives

Objective 1: Test and validate the updated DeLone and McLean's (2003) IS Success model in a local context

The validity of the DeLone and McLean (2003) IS success model was tested by obtaining Pearson's correlation coefficients for the associations between the various constructs of the research model. As can be seen from table 13, all the associations tested gave acceptable coefficients of correlation values and a p-value that was less than 0.05, indicating the existence of significant correlations between the related variables. In addition, the summaries in table 14 show that all the stated hypotheses were significant, implying that the updated DeLone and McLean IS success model holds when used in a local context. Seven out of the ten hypotheses tested, however, were more significant than the remaining three.

Objective 2: Determine the success of the ERP system used at CRF from the users' perspective

An assessment of the success of the ERP system at CRF from the users' perspective indicated that the users largely agreed with the statements used to measure the different constructs of the study model, implying that they were satisfied with the use of the ERP system. The results of the assessment are presented in tables 7 to 12 and in figures 7 to 12. The findings for the different constructs are explained as follows:

System Quality

The testing of this construct revealed that there was a significant association between system quality and use such that users were more satisfied using a high quality system. This is in agreement with the findings of a number of other studies that examined the general use of ICT systems and found a strong association between system quality and user satisfaction using a variety of measures and ICT systems (Seddon & Kiew, 1996; Bharati, 2002; Rai et al., 2002; McGill et al., 2003; Almutairi & Subramanian, 2005; McGill & Klobas, 2005; Wixom & Todd, 2005). Kim et al. (2002) and Palmer (2002) while examining the use of Web sites also found that when measured using reliability and download time, system quality was significantly related to user satisfaction. However, some researchers found no significant relationship between the quality of a system and user satisfaction (Premkumar et al., 1994). Gill (1995) also noted that technical factors such as system quality had no major effect on system use or discontinuance of use. Caldeira and Ward (2002) while studying small and medium sized manufacturing enterprises in Portugal discovered that the quality of ICT systems available in the market place played a major role in their adoption and success. Another study undertaken by Fitzgerald and Russo (2005) to examine the turnaround of the London Ambulance Dispatch system established that improved system quality was positively related to subsequent system use.

Information Quality

Our study indicated that there was a strong positive association between information quality and use of the ERP system. This implies that a high quality of information provided by the ERP system would prompt the users to want to use the system more and vice versa. This is in agreement with the findings of a study by Rai et al. (2002) which established that information quality is significantly related to system use. Similarly, a study by Hawali et al. (2007) on knowledge management systems found a significant association between information quality and system usage. However, studies by McGill et al. (2003) and Iivari (2005) revealed that information quality is not significantly associated with the usage of ICT systems. As far as user satisfaction is concerned, Iivari (2005) and Wu and Wang (2006) found that the association between information quality and system quality is one that has

been supported widely by various researchers. Our study also established that there is a significant relationship between information quality and user satisfaction as depicted in table 14.

Service Quality

A test of the service quality construct in this study indicated the presence of a significant association between service quality and use such that users would be more satisfied with the use of the ERP system when this was accompanied with a high level of service quality. These results, however, disagreed with the findings of Halawi et al. (2007) who in a study of knowledge management systems established that service quality was not significantly associated with system use. The results were, however, in agreement with the findings of Fitzgerald and Russo (2005) who in a study of London Ambulance systems found that the role of technical staff which translates to service quality in our study was positively related to the use of ICT systems.

Our study also revealed that there was a very significant positive association between service quality and user satisfaction. Findings of different research studies, however, pointed to mixed support for the relationship between service quality and user satisfaction. While some studies found that the relationship between the quality of support and services provided by ICT systems had an effect on user satisfaction (Leclercq, 2007; Shaw et al., 2002; Halawi et al., 2007), several other studies found no significant association between service quality and user satisfaction (Aladwani, 2002; Palmer, 2002; Devaraj et al., 2002; Marble, 2003).

Use

Our study also revealed that a significant relationship existed between use and user satisfaction. A study by Guimaraes et al. (1996) to examine expert systems established that system usage, measured as frequency of use, and user satisfaction were positively and significantly related. In a knowledge management context, Halawi et al. (2007) also found a significant relationship between the use construct and user satisfaction. Chiu et al. (2007) also identified a significant relationship between use and user satisfaction in an e-learning context. Seddon & Kiew (1996), discovered that, in a mandatory context, use, measured by system importance, was not related to user satisfaction. On the contrary, Iivari (2005) found, in a study of a medical information system in which use was mandatory, that use, measured by the amount of daily use and frequency of use was significantly related to user satisfaction. While some researchers have argued that use is irrelevant when a system is mandatory, DeLone and McLean (2003) and Iivari (2005) demonstrated that it is possible to have

sufficient variability in the use construct that can lead to significant relationships with other constructs in the DeLone and McLean success model, such as user satisfaction.

This study also found a positive significant association between system use and net benefits. A review of literature also revealed that the use of ICT systems is positively associated with improved decision making. Yuthas & Young (1998) found that the duration of system use is positively correlated with decision performance. Other studies also found a significant relation between system usage and task performance (Burton-Jones & Straub, 2006; Halawi et al., 2007). Some studies, however, suggested that no significant relationship existed between use and net benefits (Iivari, 2005; Wu & Wang, 2006).

User Satisfaction

Our study revealed that there is a significant association between user satisfaction and use. This is in line with a range of many other studies which found similar results. Apparently, user satisfaction is strongly related to use when measured based on system dependence, frequency and duration of use, and the number of applications and tasks for which the information system is used (Rai et al., 2002; Kulkarni et al., 2006). Other studies, however, gave conflicting results. For example (Vlahos et al., 2004), found that the duration of use of ICT systems was not significantly correlated to user satisfaction.

Our study also indicated that there is a positive significant relationship between user satisfaction and net benefits. This is in line with several empirical results that also revealed a positive correlation between user satisfaction and net benefits (Iivari, 2005; McGill et al., 2003; Rai et al., 2002; Halawi et al., 2007). Yuthas and Young (1998), however, found that user satisfaction was only weakly correlated to net benefits.

5.4. Research Assessment

In a study to understand the qualities of a well done research paper, Whetten (1989) suggested the use of seven critical questions to determine whether a study has made positive contributions to a particular study area. This paper has thus been assessed based on the framework as follows:

a) What is new? Does the research make a significant, value-added contribution to the current thinking?

This study was guided by three objectives; to test and validate the updated DeLone and McLean's (2003) IS Success model in a local context, to establish factors used to measure the success of ICT systems in organizations, and to determine the success of the ERP system used at CRF from the user's perspective. The study established that significant associations existed between the different constructs for measuring the success of the ERP

system. Despite the findings differing from those of some previous studies in the field of IS/ICT systems success (Vlahos et al., 2004), they were generally in agreement with a number of other studies undertaken in the past (Iivari, 2005; McGill et al., 2003; Rai et al., 2002; Halawi et al., 2007).

b) So what? How will the research change the practice of ICT success evaluation?

Literature indicates that assessing the success of ICT systems in most cases is motivated by external factors. The findings of this study will empower business enterprises with information relevant for understanding the subject of ICT success assessment which in turn will enable them to understand the contribution of ICT systems to business operations before any such investments are made. In addition, organizations will be able to understand the importance of carrying out an assessment such as this one in order to realize better results from investments in ICT systems.

c) Are the underlying logic and supportive evidence compelling?

The study was conducted based on DeLone and McLean (2003) IS success model. This model has been criticized, tested, and validated in numerous studies. It therefore stands as the most reliable model for assessing the success of ICT systems in business enterprises (Rai et al., 2002). Relationships between the various constructs of the model were tested n this study to determine their significance and to check if the results agreed with past findings. The final results indicated that the model is reliable and can be used in a local context.

d) How thorough was the study

Initially, a detailed review of literature was done to gain valuable insights into the assessment of the success of ICT systems. While several studies have been carried out in other places to evaluate the success of ICT systems, studies based on a Kenyan context appeared to be very scarce. To ensure that the sample size used was reflective of the study population, an approach suggested by Israel (2000) who argued that for a sample size that is equal to or less than 200, a researcher can only obtain reliable results by using the entire population. The study made use of questionnaires backed by interviews to collect data. While questionnaires are easy to work with, they have shortcomings that could easily be addressed through the use of interviews and focus group discussions. The study questionnaire was devised based on findings from the reviewed literature. Cronbach's alpha was also used to ensure internal consistency among the constructs and guarantee reliability. The questionnaires were also pre-tested among the respondents and revised based on the received

feedback. The data was later cleaned by getting rid of questionnaires considered spoilt before finally being analyzed using SPSS.

e) Is the thesis well written? Does it flow logically?

The paper followed a logical flow starting with a brief introduction, statement of the problem, objectives, and research questions in that order. It then provided background information of ICT systems and ICT success evaluation. Various models were reviewed and finally the study model adopted the updated DeLone and McLean (2003) IS success model. A detailed methodology was also given to guide the reader on how data was to be collected and objectives realized. A comprehensive analysis of data followed the data collection process and finally the conclusion and discussion of findings were presented.

f) Why now? Is it of interest to the people?

As noted by Gomez and Pather (2012), more infrastructure and increased access to ICT systems does not automatically translate to improved performance. An assessment study such as this is, therefore meant to help business enterprises to determine whether ICT systems are being used in a productive manner. At CRF, for example, ICT investment decisions are largely influenced by changes in the industry and directives from the Ministry of Agriculture. This study will, therefore enable CRF to understand the place of ICT systems in their operations and to make investment decisions guided by research findings.

g) Who else including academic researchers are interested in this research?

First and foremost, CRF is the greatest beneficiary of the results of this study. Other interested parties are policy makers, academic researchers, and business enterprises in Kenya.

h) Limitations and Recommendations for Further Research

The major limitation of this study was that it only considered a single organization in one country. The results may therefore not be generalized for all organizations in Kenya and for other countries. There is need to carry out a similar study that will comprise a cross section of organizations found in Kenya. The study was also based on the updated Delone and McLean's (2003) IS success model and was therefore, limited to the constructs of the model.

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APPENDIX 1: QUESTIONAIRE

Introduction

This questionnaire is part a research to evaluate the success of ICT's from the users' perspective at the Coffee Research Foundation in Kenya. ICT evaluation is regarded as the process of establishing either by quantitative or qualitative means, the worth of ICTs to organizations or the identification and quantification of the costs and benefits of ICT investments. It helps to align the use of ICTs with business objectives and to increase the success rate of ICT investments. ICT impact evaluation also presents organizations with an opportunity to learn and reduce the level of uncertainty in ICT investments.

PART A: GENERAL INFORMATION

1. **Name of respondent** (Optional): _____

2. **Age**: ☐ 20 – 24 years ☐ 25 – 29 years ☐ 30 – 34 years ☐ 35 years and Above

3. **Gender**: Male ☐ Female ☐

PART B: EXPERIENCE

1. How long have you used ICTs? Please tick (√) as appropriate

   ☐ 0 – 5 years ☐ 6 – 10 years ☐ above 10 years

2. How often do you use ICT service(s) in your work? Please tick (√) as appropriate

   ☐ Daily ☐ Weekly ☐ Fortnightly ☐ Monthly

PART C: ICTs IN USE

1. What ICT hardware components do you use in your work? Please tick (√) as appropriate

Personal Computer (PC)	☐	Personal Digital Assistants (PDA)	☐
Local Area Network (LAN)	☐	Wide Area Network (WAN)	☐
Mobile Phone	☐	Radio Frequency Identification (RFID)	☐

2. Please list any other ICT hardware components you use in your work operations

_____

_____

_____

_____

_____

_____

3. Please explain how you use ICT hardware components in your work operations

_____

_____

_____

_____

_____

4. What ICT software applications do you use in your work? Please tick (√) as appropriate

Enterprise Resource Planning (ERP) Please specify ERP module used: ……	☐	Geographical Information Systems (GIS)	☐
Statistical Package for Social Sciences (SPSS)	☐	Personal Digital Assistants (PDAs)	☐
GENSTAT	☐	Mobile Phone Applications	☐
MSTAT	☐	Precision Agriculture (PA)	☐
QuickBooks	☐	Internet and Web-based Applications	☐
Email	☐	Office Applications (Word, Excel etc)	☐

5. Please list any other ICT software applications you use in your work operations

_____

_____

_____

_____

_____

_____

6. Please explain how you use ICT software applications in your work operations

_____

_____

_____

_____

_____

_____

7. What challenges do you face in using ICT for your work? Please tick (√) as appropriate

Inability to use ICT	☐
Lack of Skills	☐
Limited Access to ICT	☐
Language Problems	☐

8. Please list any other challenges you face while using ICT for your work operations

_____

_____

_____

_____

_____

_____

9. In what other ways can the use of ICT improve your work operations? Please list

_____

_____

_____

_____

_____

_____

PART D:

Please tick (√) the appropriate box to indicate your level of agreement with the following statements regarding the use of the Microsoft Dynamics ERP system in your work operations:

Key: Strongly Agree (**SA**); Agree (**A**); Neutral (**N**); Disagree (**D**); Strongly Disagree (**SD**)

1. SYSTEM QUALITY (SysQ)

No.	Statement	SA	A	N	D	SD
SysQ1	Using the ERP system is easy for me					
SysQ2	Functions provided by the ERP system are useful for my work					
SysQ3	The use of the ERP system speeds up my work operations					
SysQ4	The services of the ERP system are always available for my work					

2. INFORMATION QUALITY (IQ)

No.	Statement	SA	A	N	D	SD
IQ1	The ERP system ensures information availability					
IQ2	The ERP system provides me with relevant information					
IQ3	The ERP system guarantees reliability of information					
IQ4	The ERP system allows me to access information securely					
IQ5	The ERP system provides me with timely information					

3. SERVICE QUALITY (SrvQ)

No.	Statement	SA	A	N	D	SD
SrvQ1	I always receive support for the ERP system when needed					
SrvQ2	Support availability for the ERP system is prompt					

4. USE (U)

No.	Statement	SA	A	N	D	SD
U1	I use the ERP system frequently for my work					
U2	I access the ERP system several times in a day for my work					

5. USER SATISFACTION (UsrS)

No.	Statement	SA	A	N	D	SD
UsrS1	Using the ERP system improves the quality of my work life					
UsrS2	I find it easy to use the ERP system interface provided					
UsrS3	I receive adequate support when using the ERP system for my work					
UsrS4	My experience of using the ERP system is satisfying					

6. NET BENEFITS (NB)

No.	Statement	SA	A	N	D	SD
NB1	The use of the ERP system improves my performance of tasks					
NB2	The use of the ERP system improves my efficiency at work					
NB3	The use of the ERP system improves my level of effectiveness					
NB4	The use of the ERP system helps me to reduce errors in my work					

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~~~~~~~~~~~~~~~ Thank you for your participation ~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~

APPENDIX II: FOCUS GROUP DISCUSSION GUIDE

Assessing the Success of ICT's from a User Perspective: A Case of Coffee Research Foundation

Focus Group Discussion Guide

Preparation:

Before the start of the FGD sessions, consent forms will be distributed to all the participants.

Step I: Introduction – 10 minutes

1. Welcome the participants and introduce the research team explaining who we are and what we do
2. Circulate an attendance form to be signed by the participants. The form should capture age, department, and the length of period one has used the ERP system.
3. Allow the participants to introduce themselves
4. Provide an explain for conducting the research and what will happen to the information collected
5. Explain why the participants are taking part in the FGD

Step II: Explanation of the FGD process

This step will involve detailing the process of the FGD. The following will be addressed:

1. Establish the number of participants who have taken part in an FGD before
2. Provide an explanation of what an FGD is about
3. The researchers will clarify that we are only interested in gathering information and not achieving consensus

Step III: Formulate Logistics and Ground Rules

At this point, logistics and ground rules will be devised. Participants will be involved as much as possible. Rules will include:

1. Agreeing on the duration which should be last at most 60 minutes
2. Appropriate mobile phone etiquette
3. Respect for opinions by other participants

Step IV: Conduct the FGD

After going through the above steps, any questions from the participants will be addressed before proceeding and if allowed, the tape recorder will be turned on.

The role of the researchers will clarified as to ask questions, to listen, and to make sure everyone has a chance to share.

Participants will be given a chance to respond to questions before further probing.

The discussions will be informal and participants will be encouraged to express themselves freely.

The following questions will form the basis of the discussion:

SYSTEM QUALITY

SysQ1: First, we'd like to hear about your experience of using the ERP system. What is your general feeling regarding the quality of the ERP system?

Probes:

a) How has the ERP system been of help to you?
b) In what ways do you feel that the ERP system falls short of your expectation?

SysQ2: What would you say are the challenges you face when using the ERP system?

Probes:

a) What would you say about the services of the ERP system? Are they useful?
b) What is your comment about the execution speed? Does the ERP system speed up your operations?
c) How available are the ERP system services for you?

INFORMATION QUALITY

IQ1: What would be your comment regarding the quality of information generated by the ERP system?

Probes:

a) Remember, these can be in areas such as availability, relevance, reliability, secure access, and timeliness or any other you can think of.
b) In what ways do you feel the quality of information fails to meet your expectation?
c) Does the quality of information affect your frequency of using the ERP system?

SERVICE QUALITY

SrvQ1: What is your experience with the quality of support services offered for the ERP system?

Probes:

a) Is support always available?
b) In what ways do you feel the support services fall short of your expectation?
c) How does the quality of support services affect your use of the ERP system?

USE

U1: We would now like to hear about your use of the ERP system.

Probes:

a) Is the use of the ERP system mandatory or voluntary?

b) How often do use the ERP system?

c) What in your opinion discourages you from using the ERP system?

USER SATISFACTION

UsrS1: How has the use of the ERP system improved the quality of your work life?

Probes:

a) What is your level of satisfaction with the system interface provided?

b) Is your experience of using the ERP system satisfying?

NET BENEFITS

NB1: What would you say are some of the benefits of using the ERP system?

Probes:

a) Remember these can be in areas such as task performance, efficiency, effectiveness, error reduction or any other you can think of.

Step V: Conclusion

Thank the participants for taking part in the FGD.

APPENDIX III: INTRODUCTORY LETTER

UNIVERSITY OF NAIROBI
SCHOOL OF COMPUTING AND INFORMATICS

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P. O. Box 30197
Nairobi -
Kenya

21-Feb-13

Director of Research
Coffee Research Foundation
P.O. Box 4 – 00232
Ruiru, Kenya

Attention: Mr. Nicholas K. Saina, ICT Manager

MAKOKHA, Michael Wambwere (P56/61361/2011)
MSC RESEARCH PROJECT

The above named is a bona fide student in the MSc in Information Systems of this University. As part of the requirement for the programme, the student is carrying out a final project entitled: **Evaluating the Impact of ICTs within the Agricultural Sector in Kenya.**

This project involves gathering relevant information from various stakeholders and yours has been identified as a source of that information. We are therefore requesting that you accord the student the necessary assistance. Your assistance will be highly appreciated.

Yours faithfully,

CHRISTOPHER A MOTURI
DEPUTY DIRECTOR
SCHOOL OF COMPUTING & INFORMATICS

APPENDIX IV: LETTER OF PERMISSION

COFFEE RESEARCH FOUNDATION

TELEPHONE: 020 - 2029090/7133
FAX: 020 - 2044923
CELL PHONE 0733-333 060/0724-527 611

COFFEE RESEARCH STATION
P.O. Box 4 - 00232 RUIRU
KENYA
E-mail: info@crf.co.ke

When replying please quote
Our Ref: CRF/SOP/09/07
Your Ref:

16th May 2013

Michael Wambwere Makokha
P O Box 31607, 00600
NAIROBI.

PERMISSION TO COLLECT RESEARCH DATA

We acknowledge receipt of your letter requesting for permission to collect data for your Msc. Research Project entitled "Evaluating the impact of ICTs within the Agricultural Sector in Kenya.

This is to inform you that your request has been approved on condition that you will adhere to the Foundation's terms and conditions and that the data collected will be used for the purpose of research only.

Report to Mr. Saina the ICT Manager for direction.

Kennedy Alusa
Administrative Manager
FOR DIRECTOR OF RESEARCH

C c Ag. Director of Research
ICT Manager

All communications should be addressed to the Director of Research
CRF is ISO 9001 - 2008 Certified