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Evaluating the Benefits of Cloud Computing in Small and Medium Enterprises within Gauteng in South Africa

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Abstract
The purpose of this research is to evaluate the benefits of cloud computing to small and medium enterprises (SMEs) within Gauteng in South Africa. A survey was used as a data collection method for this research. The results of this study reveal that cloud computing characteristics may have positive impacts on SMEs' performances. The results suggest that Information Quality and System Quality characteristics of cloud computing may improve Cloud Computing success by increasing User Satisfaction. The research makes a significance contribution to our knowledge on cloud computing to SMEs.

Keywords
Cloud computing, Small and medium enterprises, Small medium and micro enterprises, Information and communication technology, IS Success Model, Information quality, Systems quality, Service quality, User satisfaction, Cloud Computing Success.

1. Introduction
The breakthroughs in the Information Technology (IT) industry through cloud computing have made it possible for small and medium enterprises (SMEs) with budget constraints to be able to compete with some large organizations. Cloud computing, the long-held vision of computing as a utility, has the prospect to transform a large part of the Information and Communication Technology (ICT) industry and determining the way IT services are designed and purchased (Armbrust et al., 2010). However, recent studies on SMEs are not very convincing in how cloud computing benefits are perceived and experienced by SMEs (Hinde et al., 2012). The adoption of cloud computing among SMEs in the developing economies in general and South Africa in particular is relatively not well understood.

SMEs in country such as South Africa are adopting cloud solutions in an aggressive manner (Hinde et al., 2012). As a result of understanding that cloud computing can provide various benefits to diverse organizations (Mahmood, 2011); there is need for the researcher to evaluate its potential benefits to SMEs in South Africa, particularly in the province of Gauteng. Consequently, this study seeks to evaluate the benefits of cloud computing to SMEs in South Africa, particularly in the Gauteng province.

According to Abubakar, Bass and Allison (2014), no study to date has been carried out to show the impact of cloud computing applications on SMEs. Therefore, this study focuses on evaluating the potential benefits of cloud computing for SMEs in Gauteng South Africa. The main objective of this study was to evaluate the potential benefits of cloud computing to SMEs

within Gauteng in South Africa. In order to achieve the stated research objectives, the following primary research question was asked: *"What are the potential benefits of cloud computing to SMEs within Gauteng in South Africa?"* The next section presents the brief literature review, and the theoretical framework that guide this study.

2. Overview of Cloud Computing

In a nutshell, cloud computing is a model where anything is provided as a service rather than a product, whether it is a software, hardware, and/or storage capacity (Karada et al., 2013). Stated differently, the term "cloud computing" refers to everything that involves the delivery of hosted services over the internet by cloud service providers (Čekerevac et al., 2011). The National Institute of Standard and Technology (NIST) has defined Cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction"(Mell & Grance, 2011).

Although cloud computing provides fast start-up, flexibility, scalability, and cost efficiency (Carroll et al., 2011); these benefits can only be realized if, and when, IT is widely spread and utilized (Oliveira & Martins, 2011); by SMEs. SMEs in any economy represent a significant segment and are required to start adopting the internet-based ICT to improve their competitiveness not only in the local but also in the global marketplace (Carroll et al., 2011). Nevertheless, SMEs in reality are still confronted with different challenges that do not enable them to adopt ICT internet-based solutions in their business processes (Ongori & Migiro, 2010). Some of the challenges encountered by SMEs include: (1) unsuitability for the type of the business, (2) security, (3) trust of ICTs tools, (4) limited budget (5) human resources, (6) lack of legal framework, and (7) inadequate infrastructure. With all the above specified challenges, SMEs are therefore encouraged to start considering cloud computing solutions as an alternative to traditional (on-premises) ICT solutions (Mohlameane & Ruxwana, 2013).

Cloud computing can offer tremendous value propositions or sets of benefits to SMMEs with limited budgets, physical IT assets, and human resources (Hinde et al., 2012). Despite the potential benefits of cloud computing, the shift from the traditional (on-premises) ICT solutions to cloud computing is a bit unclear and confusing amongst South African SMEs. Hinde et al., (2012), note that the penetration of cloud computing is high and acknowledged that returns by adopters could be higher than for non-adopters. Conversely, cloud computing is asserted to have a slow rate of adoption amongst SMEs in South Africa (Mujinga, 2013) or in other developing countries (Hinde et al., 2012).

2.1 Cloud Computing Benefits

Cloud computing offers potential benefits such reduced costs, flexibility, scalability, capacity utilization, higher efficiencies and mobility (Carroll et al., 2011). Cloud computing offers SMEs satisfaction of business requirements, energy saving and improving the efficiency of resource management. Time saved dealing with technology issues, and enabling staff to focus on core competencies are additional benefits of cloud computing (Neves et al., 2011). In addition, businesses are not tied to vendor specific traditional applications which are restricted by user-licenses, software upgrades, and suffer annual licenses fees (Hinde et al., 2012). Thus, the main

driver for cloud computing implementation is cost efficiency (Carroll, et al., 2011). However, there are some disadvantages of cloud computing to be highlighted which include: privacy and security, service continuity such as internet connection problems and service migration (Hinde et al., 2012).

2.2 Cloud Computing Deployment Models

There are four types of cloud computing deployment models: private cloud, community cloud, public cloud, and hybrid cloud (Mell & Grance, 2011).

Private cloud is dedicated to a single particular organization as it is not shared with other organizations. It can be owned or leased, and is managed by the organization or a third party, and can exist at on or off-premises (Karada et al., 2013).
Community cloud is usually used by a set of organizations with similar requirements and shared interests in order to share the cloud infrastructure but keeping a certain level of security and privacy. This model could be hosted by a third-party provider or within the premises of one of the organizations in the community (Jadeja & Modi, 2012).
Public cloud is less secured compared to other models, the model lets users access the cloud through interfaces using web browsers, and is a pay-per-use model (Jadeja & Modi, 2012).
Hybrid cloud is a combination of two or more different cloud infrastructure models (private, community, public) that remain unique entities, but are bound together by standardized technology that supports data and application portability (Mell & Grance, 2011).
However, three main types of deployment models are: public cloud, private cloud, and hybrid cloud (Jadeja & Modi, 2012); as depicted below in Figure 1.

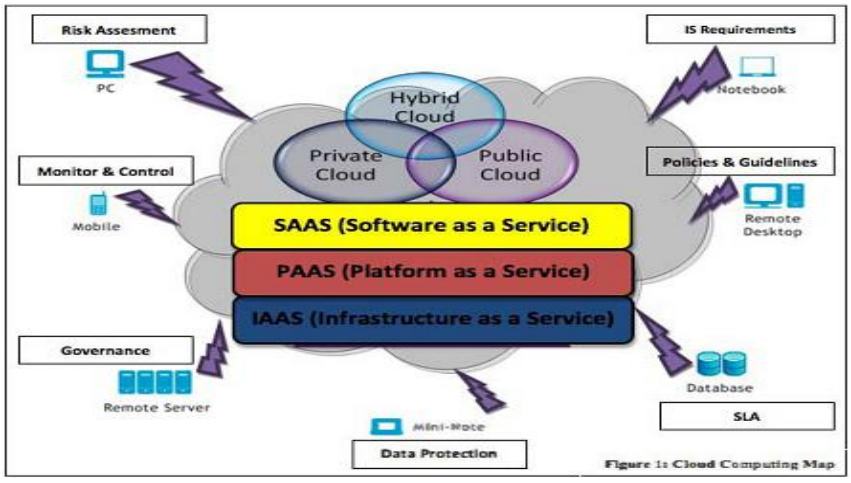

Figure 1: Cloud Computing Deployment Models
(Source: Jadeja & Modi, 2012)

2.3 Cloud Computing Service Models

The three main service models of cloud computing are: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), as shown in Figure 2.

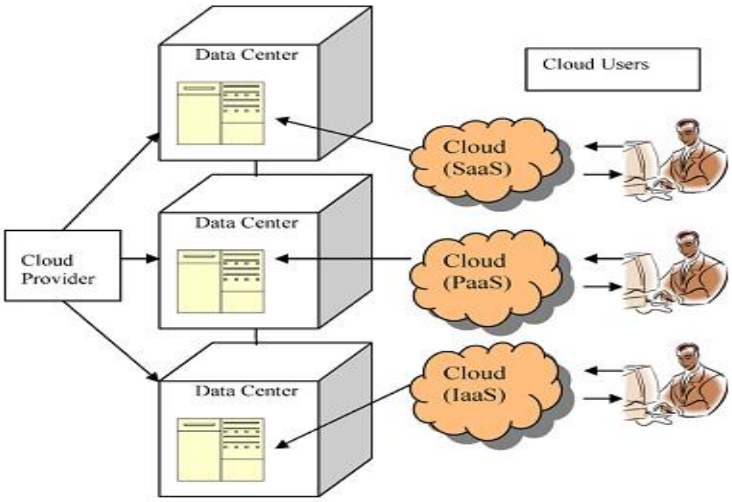

Figure 2: Cloud Computing Service Models
(Source: Sultan, 2011).

IaaS provides to the client the full computer hardware environment. The client does not manage cloud infrastructure but has control over operating systems, storage, and deployed applications (Sultan, 2011). It is the most basic service model (Catherine & Edwin, 2013).
PaaS enables the consumer to deploy acquired applications onto the cloud infrastructure. Under this model, the consumer does not control the cloud platform (network, servers, operating systems, or storage) but has control over deployed applications (Mell & Grance, 2011).
SaaS the consumer does not have control of the applications. In this model, applications are delivered through the network or internet as a service. The client does not install, maintain or manage applications but accesses them through the internet (Sultan, 2011). "SaaS is also a pay-as-you-go subscription licensing model" (Catherine & Edwin, 2013).

2.4 Small and Medium Enterprises (SMEs)

There is no commonly agreed applicable definition of SMEs, but in general, there is an attempt to define SME using the number of employees (Modimogale & Kroeze, 2009). In South Africa, the terms SMMEs and SMEs are used interchangeably (Mahembe, 2011); and are defined by the number of employees based on the enterprise size category as follows, a micro business (less than 5), very small business (less than 20), small business (less than 50), and medium business (less than 100 or 200) (*National Small Business Act*, 1996). In this particular study, we have decided to conform to the definition of SMEs as defined by the South African department of Trade and Industry. The next section discusses related work from the literature in the study area.

2.5 Related Work

In this study, we considered a few available studies that are related to cloud computing and/or ICT, though there are many studies on the technology adoption that have used D&M IS Success Model to measure IS success. Hinde and Van Belle (2012) studied the adoption and perceptions

of cloud computing by SMEs in an emerging economy. The study discovered that the adoption benefits and perceived risks differ to some extent with those factors uncovered in empirical studies in developed countries. Hinde et al. (2012) emphasize an interesting point that reliability had scored more as the main benefit of moving to cloud computing. However, Gupta et al., (2013) contradict Hinde et al. (2012) in that they reveal that reliability is ignored as SMEs did not agree that cloud computing is reliable, and SMEs refuse to use cloud computing for sharing and collaboration.

A study by Neves et al. (2011) on cloud computing adoption by SMEs reveals that cloud computing has the potential to increase productivity, efficiency and profitability of SMEs. A study conducted by Dernbecher (2014) found that System Quality significantly influenced User Satisfaction and subsequently improved the Net Benefits by increasing User Satisfaction. In addition, Information Quality had an influence on User Satisfaction and subsequently the Net Benefits. The study did not find a significance impact for Service Quality on User Satisfaction.

2.6 Theoretical Framework

This study is informed and underpinned by the DeLone and McLean (D&M) IS Success Model. The model as stated by D&M has six interrelated or major variables to assess information systems (IS) success: System Quality, Information Quality, and Service Quality as independent variables; Use and User Satisfaction, and the Net Benefits as dependent variables (Delone & McLean, 2003). The D&M IS Success Model is a framework widely used in research since it was published for measuring IS success (DeLone & McLean, 1992, 2003).

However, DeLone and McLean (2002) argue that system use when informed and effective will continue to be an important indication of IS success. They disagree on Seddon and Kiew's (1996) statement that says the variable Use does not cause benefits as it is a behavior, and believe that system usage is a relevant measure of system success in many cases. Interestingly, given the difficulties of interpreting the multidimensional aspects of Use (a behavior), the Intention to Use which is an attitude was proposed as an alternative measure (DeLone & McLean, 2002).

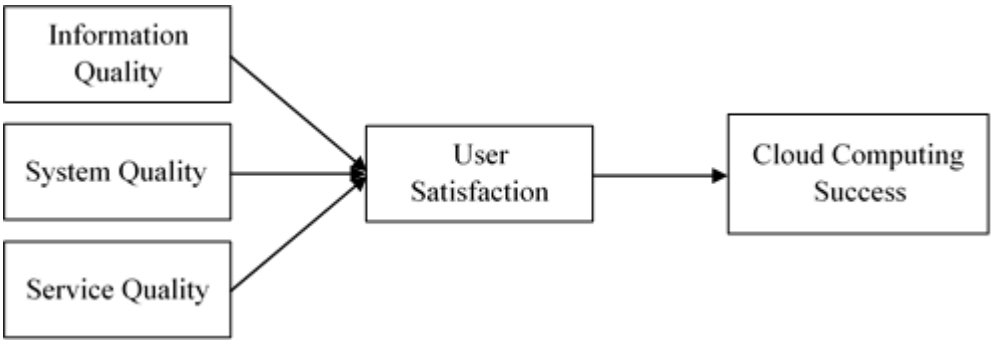

Figure 3: Modified IS Success Model
(Source: Adapted from DeLone et al. 2003)

In any cases, there are several studies that have examined and confirmed the relationship between D&M IS Success Model constructs. However, given the criticisms and arguments in the

literature and based on the purpose of this study, the Intention to Use/Use construct is not studied. As a result, D&M IS Success Model was modified to allow it to be more suitable in evaluating the benefits of cloud computing to SMEs within Gauteng in South Africa as shown in Figure 3.

Information Quality → User Satisfaction: Theoretical and empirical studies support that an increase in Information Quality will cause an increase in User Satisfaction or affect it (DeLone et al., 1992; Seddon & Kiew, 1996). The results from previous studies found that Information Quality has a significant influence on User Satisfaction or the relationships between the two variables at individual level of analysis are significant (Al-Shibly, 2011; Iivari, 2005; Petter & McLean, 2009).

System Quality → User Satisfaction: Empirical results from previous studies suggest that increase in System Quality will affect or cause an increase in User Satisfaction (DeLone & McLean, 1992; Seddon & Kiew, 1996). Findings of empirical tests of the D&M of IS Success Model also show the significant influence System Quality has on User Satisfaction (Iivari, 2005; Petter & McLean, 2009;Al-Shibly, 2011).

Service Quality → User Satisfaction: The construct Service Quality was introduced on the revised IS Success Model by D&M. DeLone et al., (2002) believe that Service Quality, correctly measured, merits to be added as a component of IS Success. They acknowledge that Information Quality and System Quality may be the most significant variables to measure the success of a single system.

User Satisfaction → Net Benefits: User Satisfaction is a direct antecedent of the Net Benefits at either individual or organizational level (DeLone et al., 1992). A study by Iivari (2005) found a strong influence of User Satisfaction on individual impact. Another study of human resources information systems success models by Al-Shibly (2011), reveals an association between User Satisfaction and Net Benefits or IS success (Al-Shibly, 2011). The next section discusses the research methodology used in this study.

3. Research Methodology

This chapter discusses the research design, approach, methods and procedure used to gather and analyze data. "A research design is a plan or blueprint of how you intend conducting the research" (Mounton, 2001). Cooper and Schindler (2003), described research design as a plan for fulfilling objectives and answering the research questions. Post-positivism paradigm was found appropriate for this study based on the research objectives and research question.

3.1 Research Approach

Vos, et al., (2005), describe quantitative research as an inquiry into a human problem, based on testing a theory composed of variables, measured with numbers and analyzed with statistical procedures to determine whether the predictive generalizations of the theory hold true. This research used the quantitative research approach due to the nature of the research problem. Given the nature of this study, a survey was found to be the most appropriate research strategy. The survey research strategy is more appropriate to collect data from a large number of respondents.

The target populations for this study were SMEs in different business categories. The unit of analysis was the individual working for the SMEs. The respondents were individuals such as

business owners, executive managers, administrators, IT roles and other key decision-makers. The number of staff members of SMEs ranges from 1 to 200, depending on the company size. A total of 158 questionnaires were distributed through online mails or self-administration, but only 58 responses were obtained.

3.2 Data Collection Methods

Data for the study was primarily collected using questionnaires. The respondents were required to answer the questionnaire and indicate on the questionnaire to what extent they agreed or disagreed with the statements on a 5 point Likert-type scale from "1" strongly disagree, "2" disagree, "3" neutral, "4" agree, and "5" strongly agree. Cronbach's alpha was used to measure the reliability of the constructs. All constructs had coefficients above 0.80 which was acceptable as reliable. Validity was enhanced by using constructs drawn from literature.

3.4 Data Analysis and Ethical Considerations

The statistical analysis was conducted using in Statistical Package for the Social Sciences (SPSS) software package v20. Descriptive and advanced statistics were used to present the demographic information and key variables under study. The study took seriously ethical considerations as defined by the university ethical committee during the whole process of the research which included confidentiality and anonymity. The next section discusses the results of the study.

4. Results

This section presents the results from analyzed data collected from the respondents. The results suggest that 32.7% of respondents were business owners, 12.7% IT role. However 18.2% of respondents, 18.2% administrator, 18.2% executive managers and 18.2% other key decision-makers. The size of SMEs interested in the study is between 1 and 5 employees (32.7%), 6 and 20 employees (30.9%), 21 and 50 employees (16.4%), 51 and 100 employees (10.9%), 101 and 100 employees (9.1%). Almost 24% of those SMEs were in the computer and internet sector, while 20% of SMEs were in the business services industry and rest in other sectors. Most of those SMEs (83.6%) who took part in our survey used SaaS as their cloud services layer, 5.5% of SMEs did not make use of any cloud services layer and the remainder used other layers.

4.1 D&M IS Success Model Constructs

This sub-section presents the results of each statement related to the modified D&M IS Success Model constructs. All respondents were asked to rate each statement on a five point Likert-scale of (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree. For ease of presentation and interpretation of the results, the responses of "strongly disagree" and "disagree" were combined to form "disagree", and the responses for "agree" and "strongly agree" were combined to form "agree". As a result, we were left with three point scales of (1) disagree, (2) neutral, and (3) agree. The next sections presents the frequencies of IS Success Model constructs variables.

4.1.1 Information Quality

Information Quality was used to measure the value which the information provided to the user of that information. According to the results the majority of respondents were favourable with the Information Quality characteristics of cloud computing. This was shown by their positive level of agreement to four questions presented to them. About 78.2% of respondents agreed that they

were satisfied with the accuracy of the data they could access via cloud computing; 76.4% agreed that information accessed via cloud computing was up-to-date. An equal percentage 69.1% of respondents agreed that cloud computing provided the precise information needed and saw it as providing the desirable output.

4.1.2 System Quality

System Quality measured the technical success of cloud computing. According to the results most respondents positively rated cloud computing's technical aspect. The results indicate that 74.5% agreed that it was easy to use; 65.5% saw it as being user friendly; 80.0% agreed that it allowed information to be readily accessible; 81.8% saw it enabling easy information access. About 74.5% agreed that it provided information in a timely fashion; and 70.9% agreed that it would quickly respond to their requests. An equal percentage, 63.6%, agreed it could be adapted to meet a variety of needs and could flexibly adjust to new demands or conditions; 67.3% saw it as being reliable; and 63.6% agreed that its operation was dependable.

4.1.3 Service Quality

Service Quality measured the overall support delivered by cloud computing service providers. According to the results this, as a whole, was not fairly good – respondents were not too certain with the facts presented to them. For instance, when asked about cloud computing service desk colleagues, the majority, 53.7%, was uncertain that they provided prompt service; 53.7% agreed that they had the knowledge to answer questions. A majority, 61.1%, responded with uncertainty that their problems and needs were addressed thoroughly. On the statement to find out whether service desk colleagues resolved their problems satisfactorily, 51.9% of respondents were uncertain, 44.4% agreed, and only 3.7% disagreed with the statement.

4.1.4 User Satisfaction

User Satisfaction measured the overall satisfaction with cloud computing. Most respondents were generally satisfied with cloud computing usage. This was revealed by their positive feedback to three statements presented to them. Based on the findings 79.2% agreed that it met the information processing needs of their area of responsibility. About 75.5% of respondents saw it being efficient; and 79.2% agreed that they were, overall, satisfied with cloud computing.

3.1.5 Cloud Computing Success

The CC success measured the job/task performance. The majority of respondents agreed on the positive impact of cloud computing on their job performance. The results indicate that an equal number, 65.5%, agreed that it enabled tasks to be accomplished more quickly and improved the job performance; 67.3% saw it increasing productivity; and 65.5% agreed that it enhanced job effectiveness. About 68.5% agreed that it made their job easier to be done. The majority, 85.5%, rated cloud computing as being useful to their job.

4.2 Analysis of Variance Results

Analysis of variance (ANOVA) was used to investigate the effect of demographic external variables on Information Quality, System Quality, Service Quality, User Satisfaction and CC success (Table 1).

Independent Variable	Dependent Variable	F	Significance
Company size	Information Quality	2.926	.042
Company size	User Satisfaction	3.580	.012
Business Category	User Satisfaction	2.592	.017

Note: * p< 0.05, ** p<0.01, *** p<0.001, (n=55)

Table 1: ANOVA for demographic variables

The ANOVA was conducted to explore the impact of company size on Information Quality and User Satisfaction. Table 1 suggests there was a significant difference (F = 2.926 & 3.580, p = 0.042 & 0.012 < 0.05) respectively. The ANOVA was also conducted to explore the impact of business category on User Satisfaction and it suggests that there was significant difference (F = 2.592 and p = 0.017 < 0.05). Thus there is a significant difference between User Satisfaction and business category. The business category has an effect on User Satisfaction.

4.3 Correlation Results

The correlation results (Figure), indicate a positive strong correlation between the independent variable Information Quality and User Satisfaction dependent variable (p=0.613). The results also show a positive strong correlation between independent variable System Quality and User Satisfaction dependent variable (p=0.613). However the results show that there was no significant correlation between Service Quality and dependent variable User Satisfaction. The correlation results suggest a very strong positive significant correlation between independent variable User Satisfaction and dependent variable CC success (p=0.613). In summary, the results in Figure 4 indicated that the independents variables Information Quality and System Quality were positively correlated with the User Satisfaction. In addition User Satisfaction correlated significantly with CC success.

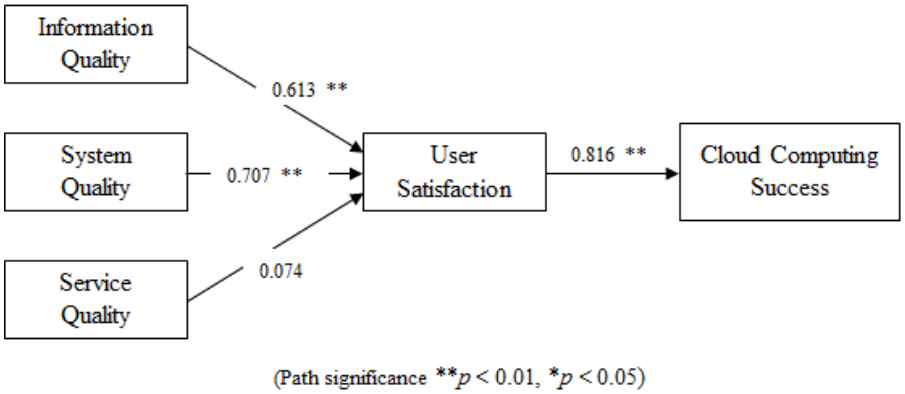

Figure 4: Correlation Results

4.4 Regression Analysis

Multiple regression and simple regression analysis were used to predict to what extent the independent variables predict dependent variable. In this case, Service Quality, Information Quality, Systems Quality is independent variables and User Satisfaction is the dependent

variable. According to the model summary (Table 2) below, the results suggest that the coefficient of determination (r^2) was 56.9%. This shows that 56.9% of the variance in the dependent variable User Satisfaction was explained by the independent variables Information Quality, System Quality, and Service Quality.

Model					Change Statistics				
	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	*df1*	*df2*	Sig. F Change
1	.755[a]	.569	.542	.980	.569	20.718	3	47	.000

a. Predictors: (Constant), Service Quality, Information Quality, System Quality

Table 2: User Satisfaction model summary

Model					Change Statistics				
	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	*df1*	*df2*	Sig. F Change
1	.816[a]	.666	.659	2.012	.666	99.664	1	50	.000

a. Predictors: (Constant), User Satisfaction

Table 3: CC success model summary

The simple regression analysis (Table 3) was performed between independent variable User Satisfaction and dependent variable CC success with results showing ($p = 0.000 < 0.01$) and the standardized coefficients Beta value of 0.816. The results suggest that User Satisfaction may predict the CC success, which suggest that high levels of User Satisfaction may lead to high levels of CC success.

5. Discussion and Conclusions

The objective of the study was to evaluate the benefits of cloud computing to SMEs within Gauteng in South Africa. This study found a significant relationships or association between the independent variables (Information Quality and System Quality) and User Satisfaction, and subsequently with CC success. The results are consistent with previous studies (Al-Shibly, 2011;Dernbecher, 2014; Iivari, 2005 & Petter & McLean, 2009) which also established this type of relationship amongst independent variables and dependent variables. In conclusion, this study found cloud computing to have a positive impact on individuals' job performance, and therefore, has provided answer to our research main objective.

The study revealed that cloud computing characteristics (Information Quality and System Quality) positively impact on individuals' job performances (CC success). These are the potential benefits of cloud computing to SMEs this study had found. Thus, two variables Information Quality and System Quality of cloud computing improve CC success by increasing the user's level of satisfaction. The research made a significant contribution by furthering our understanding on cloud computing research from SMEs point of view, particularly in an emerging country such as South Africa, and contributed to cloud computing body of knowledge.

This study has some limitations, which offer opportunities for possible future research in the field of cloud computing. The study was limited to Gauteng within South Africa to make it manageable. This study results are based on respondents' perceptions and it was a cross section study. The study merely evaluates the benefits of cloud computing by involving only a few business categories neglecting other industry sectors. Including other sectors probably would have allowed for a more representative sampling though the research sample size was deemed acceptable. As a result of all these stated limitations, the research findings cannot be considered as representative of all South Africa SMEs or be generalized.

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