The Impact of Cloud Computing Usage on Educational Institutions: A Case Study of University of Venda

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Abstract: The research study investigated the impact of cloud computing on high education institutions using the University of Venda as a case study. Perceptions, challenges and benefits of cloud computing by university community were investigated. Mixed method was used for analysing data collected from sampled students, lecturers and administrative staff. The random sampling technique was applied. The factors that determine the user's perceptions of cloud computing regarding its usability and functionality were explained in the study. The research established that cloud computing plays a significant role at the University of Venda and there is availability of internet at University of Venda. Software-as-a-service is the most widely used cloud computing service. Security, privacy of information and high bandwidth costs are the major challenges threatening the adoption of cloud computing technology at the university. The research recommended that the users of cloud computing services should be provided with training for efficient utilisation and cloud computing issues should be included in IT Policy. The academic curriculum should in cooperate cloud computing issues in order to make both students and lecturers be aware of related technological developments.

Key words: Cloud computing, on-demand network infrastructure management, social learning, e-Governance, academic, technological developments, utilisation

INTRODUCTION

Cloud computing is gradually becoming a common platform that is utilised by industry, academic institutions and individuals. To be profitable, business must study contemporary methods that best support their commercial operations using limited resources. Stefan and Holger, predicted that by 2020, the market for cloud computing is projected to increase exponentially from $70-240 billion. Gartner Inc. predicted that a business with a "no cloud" policy by 2020 will be equivalent to a business with "no internet" policy today amongst which 30% will migrate from "cloud-first" to "cloud-only". This gives the general perspective about the future of cloud computing. The role of cloud computing in educational institutions has not been underemphasized. Several academic institutions in developing countries, encounter challenges in delivering the ICT infrastructure required to support their corporate activities and improve their productivity. According to Jain and Pandey (2013), cloud computing is becoming a dominant tool for higher education in facilitating educational activities and their support.

The global appreciation for cloud computing by various industries (Low *et al.*, 2011) including educational institutions globally as a business solution to enhance productivity motivated this research. Cloud computing can be a valuable technical resource in rural based higher educational institutions. The researchers saw an opportunity in promoting aspects of cloud computing within the education environment.

Background of cloud computing: Cloud computing is extensively recognised as the next generation computing infrastructure offering prodigious potential for computing future (Dinh *et al.*, 2013). This clearly emphasizes the importance of research in cloud computing for every organisation whose activities leverage on ICT. The existence and relevance of cloud computing to businesses was widely recognised in the early 2000's due to the expansion of the internet, coupled with the evolution of mobile computing after the introduction of the dot-com bubble (Delic and Walker, 2008).

From the publication of Cervone (2012), the term cloud is an abbreviation for "common location independent, online utility on demand". According to Foley (2008), Buyya and Sulistio (2008), Katz *et al.* (2011),

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Table 1: IT capabilities through cloud computing: A T (Kearney Analysis, www.atkearney.com)

| Applications management	Data management	Infrastructure management	Interface management	IT planning and governance
Application design and architecture	Data governance	Data centeland network operations	Business relationship management	IT service security and risk management
Application development	Master data management	IT asset management	Business and desktop application and portfolio strategy	Vendor and contract management
Application testing and application support	Data storage management	Server administration and management	Business intelligence and analytics	Financial, innovation and capacity management
Configuration and change	Data backup services	Data network management	End•user support	Program and project management management
Enterprise application integration and middleware	Database services	Telecommunications and infrastructure	End•user computing and devices	Enterprise architecture
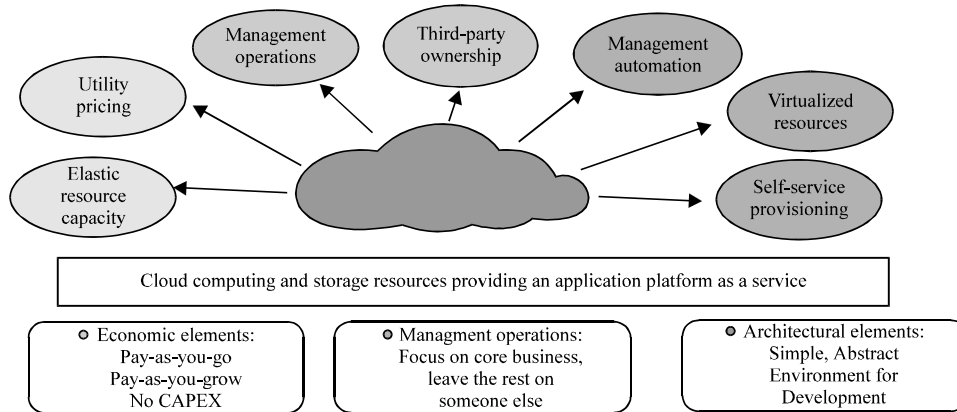
Fig. 1: Summary of cloud computing definitions

there are various conflicting and contradictory definitions and viewpoints on cloud computing. This could be due to fact that cloud technologies have not been fully evolved and that cloud computing originated from various network architectures. Solms and Viljoen (2012) defined cloud computing as a model which enables user to access the IT services provided through a public or private network in a web connected device when and as required, meeting the concept of on-demand computing with concealed technical knowledge and management of how the services are provided. Large systems are linked together in a shared infrastructure. Gartner defined cloud computing as scalable and flexible IT capabilities of computing that are delivered as a service to external customers through the utilization of internet technologies (Brimbela, 2013). As shown in Table 1, it capabilities include applications management infrastructure management, data management, customer interface management it planning and governance.

A globally accepted definition of cloud computing as proposed by the US National Institute of Standards and Technology is: "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (which includes, networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction". The elements of value creation in the cloud environment can best describe cloud computing as illustrated in Fig. 1.

Cloud computing characteristics: The cloud computing paradigm contains a set of essential characteristics that narrate and distinguish it from traditional computing systems. There are five key characteristics established by the National Institute of Standards and Technology to determine its uniqueness and eight universal characteristics by to develop an understanding of what cloud computing constitutes. Amongst the key characteristics are resource pooling, on demand self-services, broad network access and measured services.

Cloud computing service delivery models: Table 2, also described three types of cloud services delivery models (Software as a service, platform as a service and infrastructure as a service) known as the SPI Model.

Table 2: Cloud computing service models

| Service model	Available services	Example
Infrastructure as a Service (IaaS)	Virtual machines, storage services and backup services	Amazon EC2
Platform as a Service 3 (PaaS)	Services for developing, testing, managing and hosting software applications	Google App. Engine
Software as a Service (SaaS)	Software applications such as email, word processing and customer relation management tool	SatesForce.com, Google Mail and Google Does
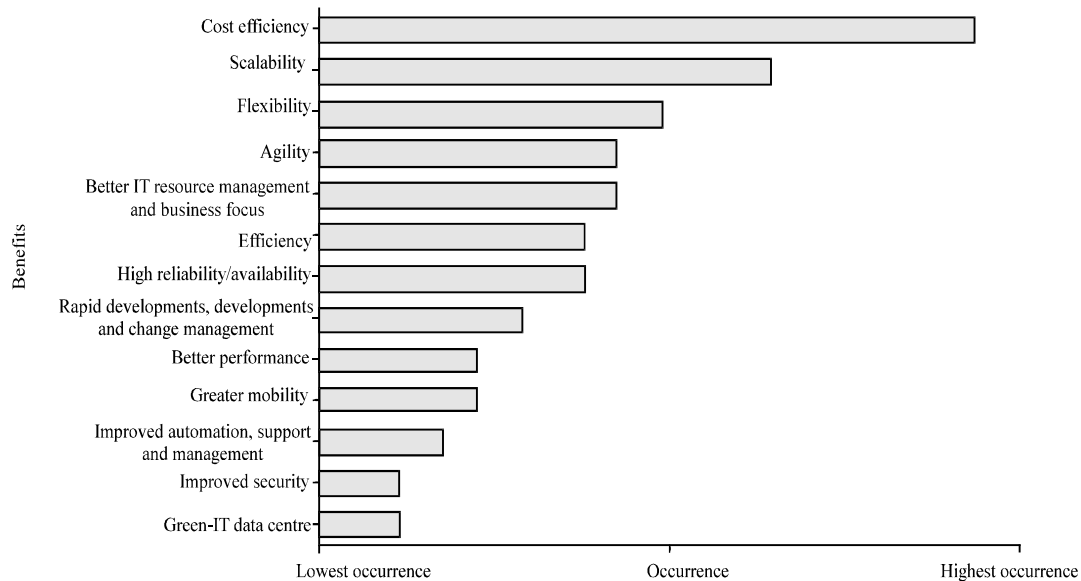
Fig. 2: Cloud computing benefits

Cloud computing benefits: The potential, benefits of cloud computing as identified by several researchers including Convery (2010), Jadeja and Modi (2012) and Anonymous (2010) are highlighted in Fig. 2 adopted from Carroll *et al.* (2011).

Cloud computing challenges: Despite the numerous benefits of cloud computing, there are various risks and challenges involved in cloud computing adoption. Common challenges for cloud computing include, the higher bandwidth required to achieve high internet speed resulting in additional operational costs. The security integrity, confidentiality, reliability and authenticity of information can be compromised due to multiple clients using the same hardware and infrastructure. The cloud provider's physical location facilitating the client's data storage poses concerns of exposures to natural disasters. The cloud users do not have full control of their data stored in the cloud systems which may raise legal compliance and regulation issues. Vendor lock-ins contributes to one of the cloud adoption challenges in which the client cannot migrate to another cloud service provider until as specified in the contract. The cloud users usually do not have the knowledge required for the management of service level agreements with the cloud service providers.

Cloud computing in South African context: South Africa is a developing country. Hence, cloud computing is still in the inception phase with low adoption levels as compared to developed countries. The ability of South Africa to gain advantage from cloud technologies depends on the availability of infrastructure and consistency of internet connections (Arinze and Anandarajan, 2010). A study by Grobler and Dlamini (2012) revealed that compared to other African countries, South Africa had the highest number of online activities. Irwin *et al.* (2010) indicated that internet technology in South Africa is an amenity not broadly used in comparison to developed countries. However, it is advocated by various IT experts that developing countries, such as, South Africa are demanding markets for cloud services (Kshetri, 2012). It was reported by Slaheddine that cloud computing adoption in South Africa is beneficial for contributing significantly in decreasing the digital divide. Gartner also specified in a survey that the software development and the call centre industries are the fastest growing areas for cloud computing in Southern Africa.

Cloud computing in high education institutions: Cloud computing has the potential to significantly contribute

Table 3: Cloud computing benefits-educational sector

Users	Benefits
Students effectively	The accessibility of the computing resources raises
	The integrity and availability of the data with applications and research work increases
	The mobility for the use of provided services increases
	The client applications and resource usage footprints are minimized
	The performance of the application and the computing resources is increased
	The capacity of the storage and the computing is increased
	The access to the virtual class is made convenient
Administrators	The process and application delivery are standardized
	The management of data and applciations are made provisioned accordingly
	The total cost of ownership is minimized from 50-90%
	The inhouse IT infrastructure need is reduced
	The management of IT infrastructure cost is reduced `including power and cooling costs
	Reduces the burden of purchasing the licences of software
	The allocation of resources is optimized
Faculty	The virtual machines can be provided
	The delivery of instructions, assignment and materials can be scheduled
	Custom images for the specific course can be created
	The departments are isolated and climates the information leakage

towards a "smart campus" domain. Smart environments contain a connection of interrelated devices for maintaining their stability and recovery. Education as a system consists of educators, learners, researchers, administrative staff and developers as the prime users of information technology (Sultan, 2010). HEIs utilise cloud computing to accomplish their unique mission based on their organisational culture. As business organisations, HEIs aim to recognise the potential of data in making informed strategic decisions. Factors that influence the implementation of cloud computing in the educational sector are: resource sharing, security, social learning, service balancing, learning in a network and diversifying educational information. Table 3 shows the benefits of cloud computing in the educational sector.

Statement of the research: It is stated by Marston *et al.* (2011) that several researches conducted currently is on the technology itself, therefore, a need to understand cloud computing from a business perspective arises. As reported by Santos *et al.* (2009), this involves studying the business-oriented matters surrounding cloud computing. It is acknowledged that managers at higher level are still lacking the required knowledge about the potential of a cloud systems and still prefer to utilise the traditional systems. Similarly, various institutions interested in adapting the capabilities of cloud technology do not understand where to anticipate and implement changes (Joint *et al.*, 2009). Therefore, once the organisational institutions are clear about the impact of using cloud computing, they will be able to make sound

choices of where and how to use it. Cloud computing has an impact on the teaching and learning context surrounded by students, academics and administrators by enabling them to obtain a vast number of different educational research resources, applications and tools. Most of the academic research completed, relate to the cloud computing models, cost, quality and security as well the service level agreements. The researchers saw the opportunity to investigate cloud computing usage and its impact within the context of University of Venda, a rural based university.

Aim and objectives: The aim of the study was to investigate the impact of cloud computing usage on HEIs with a case study of University of Venda. The following are the objectives of the study:

- To establish the application for cloud computing in educational institutions
- To determine the current usage of cloud computing technology by University of Venda
- To identify the factors that influenced the adoption of cloud computing solutions at the University of Venda
- To establish the perceptions of users towards cloud computing at University of Venda
- To help the institution develop effective strategies that will promote greater use of cloud computing

MATERIALS AND METHODS

A research design is the "blueprint" for fulfilling research objectives and answering questions or hypothesis. It is basically an outline or plan for a study used as a guideline in collecting as well as analysing data. This study was descriptive in nature and it used a positivist paradigm that ensures that there is a gap between the researcher's subjective bias and the objective reality being studied. The research took a descriptive analytic approach based on the case study (Yin, 1994) of the University of Venda. This study investigated issues related to cloud computing applications in rural universities. Amongst the boundaries of this case is the fact that the research is limited to a developing country in a rural university setup. Mixed method was used for analysing data collected from sampled students, lecturers and administrative staff. The random sampling technique was applied to define the samples of respondents to questionnaires of the research.

In order to determine the usage of cloud computing, statistical data regarding the number of direct users of cloud computing technology within the university had to

be established. Statistics on availability of resources and infrastructure for promoting cloud computing were analysed through quantitative methods. Qualitative methods were used to establish the user's perceptions on the usage of cloud computing. Quantitative approach was used in establishing the role of cloud computing at the University of Venda which contributes in responding to the main research question of the study. With the use of a closed-ended questionnaire, respondent's characteristics such as age, gender, educational status can be determined and compared statistically to determine the influence of each characteristic towards the adoption of cloud computing.

The population of 120 participants for this research was selected based on the availability of students and staff from the eight faculties at the University of Venda. Purposive sampling technique was used by the researchers to guarantee that data was collected from members of the population who are knowledgeable about cloud computing. This research mainly based on primary data. Using the Statistical Package for Social Sciences (SPSS) Software the data was captured, coded and analysed quantitatively.

RESULTS AND DISCUSSION

This study provided the data analysis, results and discussions for the student questionnaire based on the impacts of usage and adoption of cloud computing at the University of Venda of the 120 well contacted participants, a total of 96 valid research questionnaires were given back, resulting in a total response rate of 80 %. The response rate was deemed acceptable due to its higher percentage. Data analysis is based on the 96 questionnaires received. 79% of the received questionnaires were from the students, 10% were received from the lecturers and 10% were received from the admin staff members.

Demographic profiles of student respondents: Table 4 is the results of the questionnaire aimed at establishing the distribution of demographic information of 76 students in terms of gender, age and the level of study. In terms of gender, the males dominated the gender profile of respondents constituting 57.89% of the participants while female respondents constituted 44.11% of participants from the total student sample. The results depicted that the dominant gender is male.

On the age distribution, the majority, 81.6% of the respondents were between the 21-29 years age group. The least proportion was between 15-20 and ≥40 years age groups which had 2.6% of the respondents each. This implies that most students enrolled in South African universities fall under the 23-29 age group. This result

Table 4: Distribution of demographic information

Variable/Categories	F-values	Percentage
Gender		
Male	44	57.89
Female	32	44.11
Age (Years)		
15-20	2	2.6
21-29	62	81.6
30-39	10	13.6
40 and more	2	2.6
Level of study (Years)		
1st	5	6.58
2nd	7	9.21
3rd	31	40.78
4th	12	15.79
Honours	13	17.11
Masters	6	7.89
Doctorate	2	2.63

validated the findings made by the (University World News newsletter). The importance of age classification was to determine if the age factor influenced the participant's perception of cloud computing usage at the University of Venda. There was no significant relationship between the age groups of the participants and cloud computing usage and perception.

Last in terms of the variation of participant's responses in terms of their level of study shown in Table 4, there was a negative relationship between the usage of cloud computing and the level of participant's study. More cloud computing is a relatively new concept whose appreciation might as much depend on the level of study. The researchers found it important to establish the level of education since, it might influence the level of appreciation for the concept.

Computer facilities: With regard to the computer facilities which would directly relate to the level of usage for cloud computing, the respondents asked whether each owns a computer or laptop, whether they utilise computer facilities at the university, whether they have internet access at home or work, how often they access the internet and whether they have received any computer training from the university. Figure 3 represented the distribution of responses by the respondents in relationship to the questions. The purpose of asking this question was to determine if usage of cloud computing was used by students who are working or those who were not working and therefore, contributing to the main objective of the study which is determine the usage of cloud computing.

Cloud computing usage adoption and application: This sub-section included questions on respondent's level of cloud computing knowledge, respondents understanding and familiarity with cloud computing, the applications and services of cloud computing used, the devices used to
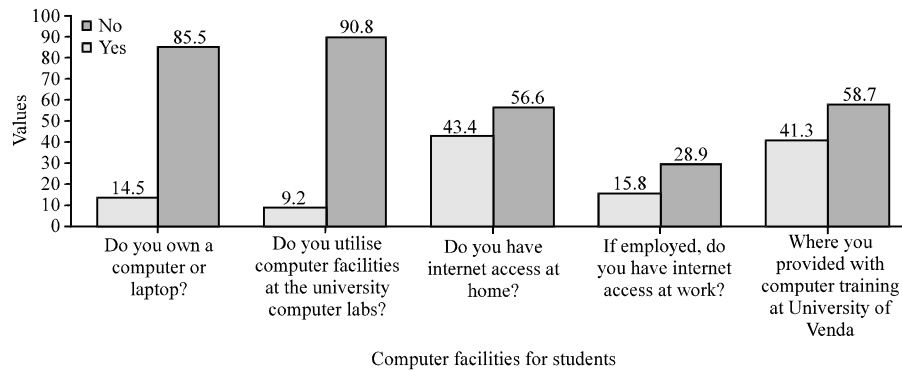
Fig. 3: Computer facilities of students from University of Venda

Table 5: Level of cloud computing knowledge amongst student respondents

Valid	Frequency	Percentage
Poor	11	14.5
Basic	11	14.5
Fair	14	18.5
Good	20	26.3
Excellent	20	26.3
Total	76	100.0

Table 6: Cloud computing services and applications used

Cloud services and applications frequencies	Responses		
	N	Percentage	Percentage of cases
Cloud services and application[a]			
Microsoft cloud service	55	35.0	72.4
Google apps	63	40.1	82.9
Online data storage solutions	27	17.2	35.5
Amazon web service for education	12	7.6	15.8
Total	157	100.0	206.6

[a]Dichotomy group tabulated at value 1

Table 7: Cloud technologies facilitating teaching and learning

Cloud technologies used to facilitate teaching and learning	Responses		
	N	Percentage	Percentage of cases
Email technology	66	39	88.65
Learning management system	11	8	18.50
e-Learning technology	35	20	45.65
Social networks	55	33	75.75
Total	167	100	228.60

access cloud computing, how often cloud services are used, the cloud technologies used to facilitate student learning and the reasons for using cloud services. This part of the questionnaire was mainly aimed at establishing the level of usage for cloud computing at the University of Venda in fulfilment of one of the partial objectives of the research.

Cloud computing knowledge: Before checking on the level of usage for cloud computing it was important to first determine if the respondents were aware of the cloud computing technology, since, it's most likely that level of usage depends on awareness of the technology by the users. About 75% of the respondents specified that they were aware of the cloud computing technologies whilst 25% were ignorant about cloud computing. This indicated that the participants were extremely aware of usage the latest technological trends including cloud computing technologies.

The respondents were further asked to grade their level of cloud computing knowledge. The study found a positive relationship between the usage of cloud computing and the level of cloud computing knowledge because the students with excellent knowledge where found be using cloud computing more than those who have poor knowledge (Table 5).

Cloud computing applications and services used: One of the research objectives was to establish the applications

and services for cloud computing that were popular within the institution. Table 6 represented the rankings in terms of popularity for the listed applications within the institution.

Figure 4 showed the distribution of service providers for cloud computing in terms of popularity within the university. The purpose of asking this question was to determine which cloud service providers are mostly preferred by students in using cloud computing service. 31.98% of the respondents selected Microsoft as most popular and Google was second with 21%.

Cloud technologies facilitating teaching and learning: The participants were required to indicate the technologies they utilise to facilitate their learning. Multiple options were provided and respondents were allowed to select more than one response. Table 7 illustrated that 39.7% of the respondents make use of the
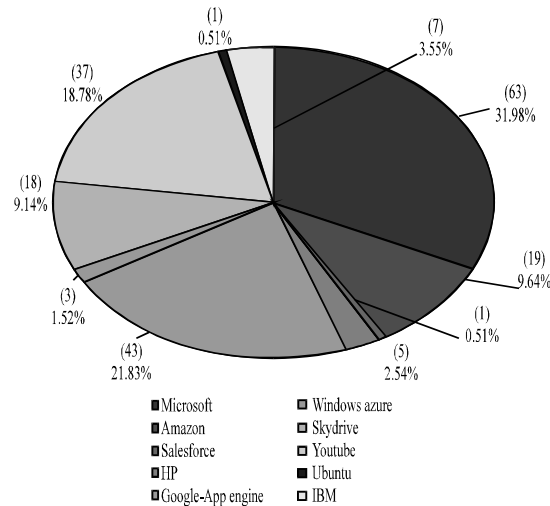
Fig. 4: Popular cloud service providers in the university

cloud-based email facility whilst least 6.2% use the cloud-based learning management systems. This indicated that learning management systems is not popular and not widely used at University of Venda.

Reasons for using cloud services: In order to determine the usage of cloud computing it is important to determine which cloud computing services are used or planned to be used by the respondents. Two categories of users were identified within the university. One category is made up of lecturers and students. These use technology mainly to support teaching and learning activities. The second group are the support staff and administrators who mainly use technology to process administrative data and support decision making processes.

For the first category of users, those involved in teaching and learning, five areas of use for cloud computing were identified. These are submitting assignments, accessing lecture notes, taking online tests, accessing feedback from lecturers and for learning discussions. Figure 5 represents the distribution in terms popularity for the categories of usage. It is clear from the statistics that sharing of documents is the dominant form of use by students for cloud.

The second category of users were given multiple options and were allowed to select more than one response aligned to their use for cloud computing. The results were presented in Fig. 6 indicated that 55.56% of the respondents have used or plans to use "software as a service", e.g., e-mails, file storage/sharing, customer relationship management and desktop/office software.
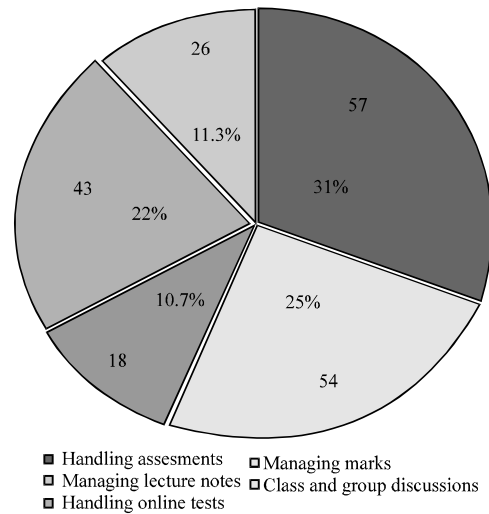

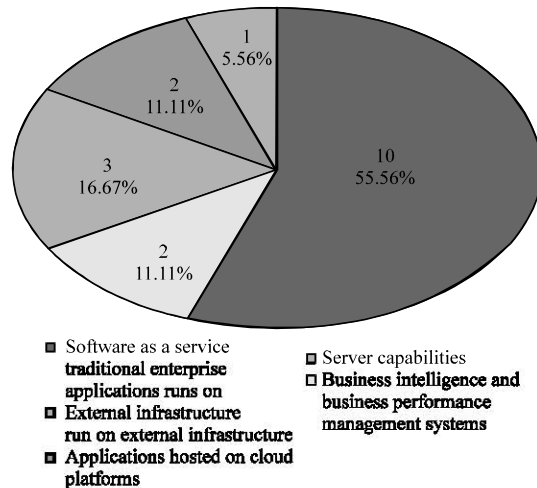Fig. 5: Purpose of use for cloud computing by students and educators

Fig. 6: Cloud computing services currently utilised at the university

This is followed by 16.7% of respondents who used or plan to use applications hosted on the cloud such Google App. Engine and Amazon. Equally, 11.2% of the respondents used or plan to use traditional enterprise applications run on external infrastructure and server capabilities. However, only 5.56% of responses indicated to have used or plan to use business intelligence and business performance management systems.

Based on the statistical data presented on Table 8, 96.1% of the respondents recommended the increased use of cloud computing.

Table 8: Usability and recommendation of cloud computing in terms of innovation

Valid	Do you think cloud computing is an innovative means for learning? (%)	Do you think cloud computing should be formally introduced to Univen? (%)	Do you intend to increase the use of cloud computing? (%)	Would you recommend using cloud computing to your colleagues and students? (%)
Yes	3.9	5.3	3.9	3.9
No.	96.1	94.7	96.1	96.1
Total	100.0	100.0	100.0	100.0

Table 9: Perceptions on cloud computing technology

Perception statement	SA (%)	A (%)	N (%)	D (%)	SD (%)
Perception on usage of cloud computing	34.2	41.3	22.4	1.2	0.2
Perception based on perceived easiness of cloud computing	31.8	35.0	25.5	7.6	0.0
Perception based on speed of cloud computing	38.4	35.0	19.8	5.5	1.3
Perception of cloud computing based on its perceived costs	34.7	30.0	27.2	7.7	0.4

Table 10: Contractual implications for cloud computing service providers

Contract implications frequencies	Responses		Percentage of cases
	N	Percentage	
Contact implications a no implications	1	5.6	100
Not sure of implications	3	163.0	301
High implications	6	313.0	600
Vendor lock-in	4	222.0	410
High costs	4	222.0	400
Total	18	1000.0	180.0

Perception on cloud computing usage and adoption: Table 9 established the student's and lecturer's perceptions with regard to the usage of cloud computing. The respondents were required to rank their agreement to the corresponding perception on use of cloud computing on a scale of 1-5 ranging from strongly agree to strongly disagree.

Perception of administrative staff on cloud computing adoption: This study explains the perceptions of administrative staff members with regard to the adoption and usage of cloud computing. It includes the intentions of using cloud computing in future areas requiring support with regards to cloud-based decision making, impact of cloud on organisational structure, contractual implications for changing cloud service providers, the impact of cloud usage in the market and improvements required in the overall cloud system.

Intention of cloud usage in foreseeable future: In order to determine the attitude of administrative staff towards cloud computing usage, respondents were required to indicate their intention of using cloud computing in future. About 100% of the respondents indicated that they are willing to use cloud computing in future.

Areas requiring support and impacting the decision to use cloud based solutions: Respondents were allowed to choose more than one response and the results are presented in Fig. 7. The results indicated that more support is required for issues relating to security, privacy and data protection.
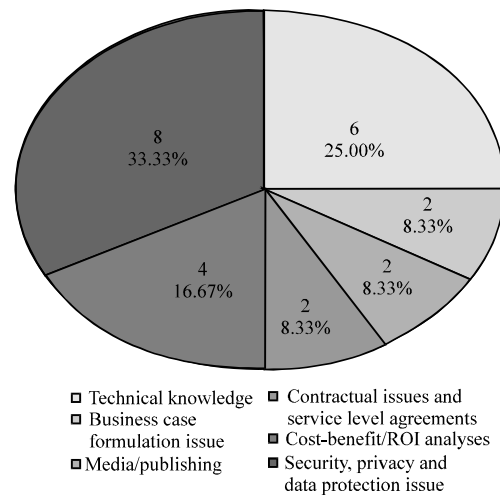

Fig. 7: Required support for cloud based decisions

User's perceptions on cloud service providers for the university: Based on the data represented in Table 10, the majority of the administrative staff members using cloud computing services at the university had a feeling that, changing the service providers for cloud computing issues might negatively impact the university.

Improvements required in the overall cloud system: From statistics presented in Table 11, 41.7% of the respondents stated that training and skill for staff should be provided as an improvement in preparation of efficient utilisation of cloud computing by staff.

Overall factors influencing adoption of cloud computing services: One of the objectives of this research as initially stated was to establish the factors influencing the usage of cloud computing within the university.

Table 11: Improvements required in the cloud system

What can be improved in the overall cloud system frequencies	Responses		
	N	Percentage	Percentage of cases
What can be improved in cloud system[a]			
Provision of training and skills for staff	5	41.7	50.0
Strengthening cloud based policies including privacy and security	4	33.3	40.0
Cloud to be accessible by all staff members and storage for students should be provided	1	8.3	10.0
Improve the speed	1	83	10.0
One drive on share point	1	8.3	10.0
Total	12	100.0	120.0

[a]Dichotomy group tabulated at value 1

Table 12 dealt with factors influencing the cloud computing adoption, benefits of cloud computing and challenges of cloud computing.

About 60% of the respondents agreed that competitive conditions in the education industry influences the usage of cloudcomputing solutions while only 10% of the respondents disagree with the statement. About 60% of the respondents agree that the benefits of cloud computing outweigh the cost of integration with existing hardware, software and applications and 10% have indicated to disagree. Approximately 40% of the respondents agree that the benefits of cloud computing outweigh the cost of IT staff training and 30% of the

Table 12: Factors influencing cloud computing adoption

Items	Strongly agree		Agree		Neutral		Disagree		Strongly disgree	
	N	Percentage	N	Percentage	N	Percentage	N	Percentage	N	Percentage
Competitive conditions in the education industry requiresUniven to use cloud computing solutions	1	10	6	60	2	20	1	10	0	0
The perceived benefits of cloud computing outweighs the cost of integrating cloud computing with existing hardware, software and IT applications	2	20	6	60	1	10	1	10	0	0
The perceived benefits of cloud computing outweighs the cost of staff training	1	10	4	40	3	30	2	20	0	0
The perceived benefits of cloud computing outweighs the cost of initial investment	1	10	4	40	3	30	2	20	0	0
The management of the firm establishes goals and standands to monitor cloud computing usage	0	0	5	50	2	20	3	30	0	0
The management actively formulates strategies for organisational use of cloud computing	0	0	3	30	6	60	1	10	0	0
The management actively articulates a vision for organisational use of cloud computing	0	0	5	50	4	40	1	10	0	0
The management believes that cloud computing has the potential to provide significant business benefits at Univen	2	20	6	60	1	10	1	10	0	0
The organisation provides adequate technical support for using cloud computing	1	10	6	60	2	20	1	10	0	0
It is well known in the organisation as to who within the IT team can help solve problems associated with cloud computing	1	10	5	50	2	20	2	20	0	0

Table 13: Effective use of cloud computing and its prior-learning skills

Skills	Strongly agree		Agree		Neutral/uncertain		Disagree		Strongly disagree	
	N	Percentage	N	Percentage	N	Percentage	N	Percentage	N	Percentage
Locate and access relevant high quality information	37	48.7	36	47.4	3	3.9	0	0.0	0	0.0
Define projects and identify significant questions	28	36.8	30	39.5	16	21.1	2	2.6	0	0.0
Analyse, integrate and evaluate evidence	18	23.7	38	50.0	17	22.4	3	3.9	0	0.0
Monitor progress and self-regulate appropriately	16	21.1	38	50.0	19	25.0	2	2.6	1	1.3
Articulate thoughts in both written and verbal form	22	28.9	35	46.1	14	18.4	3	3.9	2	2.6
Interact and collaborate with peers	30	39.5	31	40.8	11	14.5	4	5.3	0	0.0
Enables creativity and innovation	29	38.2	29	38.2	12	15.8	5	6.6	1	1.3
Effectively employ technology to express creativity	23	30.3	34	44.7	15	19.7	4	5.3	0	0.0
Effectively employ technology to communicate	25	32.9	32	42.1	15	19.7	2	2.6	2	2.6
Effectively employ technology to conduct research	27	35.5	33	43.4	15	19.7	1	1.3	0	0.0

respondents neither agree nor disagree. About 40% of the respondents agree that the benefits of cloud computing outweigh the initial cost of investment, however, 20% disagree with the statement. About 50% of the respondents indicated to agree that management of the University of Venda actively formulates strategies for cloud computing usage and 30% indicated that management establishes goals and strategies for using cloud computing. Most of the respondents (50%) agree that management articulates vision with regards to the utilisation of cloud computing and 60% agree that cloud computing has provides significant business benefits. The majority (60%) of the respondents agree that University of Venda provides adequate technical support for using cloud computing and 50% agree that IT team is well known to the respondents and can be approached to solve cloud related problems.

Use of cloud computing and its prior-learning skills: Targeting student users of cloud computing, one set of questions investigated the benefits in terms of skills required by the students through using cloud computing for teaching and learning activities. Table 13 showed the perceived skills and how students rated them in their responses.

Research findings discussions: The first research objective of this study was to identify the application of cloud computing in educational institutions of higher learning. Cloud computing has enabled educational institutions such as the University of Venda, to utilise resources available globally through the internet for delivering their services and virtualising classrooms through cloud-based learning managements systems. As indicated by the survey results, the university has the capacity to provide the relevant infrastructure for supporting cloud computing.

The second objective of the research was to establish the exact current use of cloud computing at the University of Venda. A high percentage of students uses software provided through cloud computing services. Google proved to be the most widely used cloud-based application at the University of Venda followed by Microsoft. The lecturers on the hand, utilise cloud services such as e-mails, Google documents, Google drive and OneDrive. The results also indicated the popularity of cloud computing services in facilitating teaching and learning. However, there is need to promote awareness for e-Learning by the university since, its awareness amongst students and lecturers is poor. Cloud-based business intelligence systems are scarcely utilised at by the university and it is an area that need to be considered

with utmost urgency. The third objective of the research was to identify the factors that influence the adoption of cloud computing solutions at the University of Venda. The following factors were identified from the data collected from students, lecturers and administrative staff: supporting lifelong learning, entertainment, socialisation, supporting educational needs and effective data management solutions. These factors were found to be amongst the major push factors towards the adoption of cloud computing by the university community.

The fourth objective of this research was to identify and establish factors that could be influencing the adoption of cloud computing at the university of Venda. This also include challenges being faced by the university community in using cloud computing technologies. The adoption of cloud computing presented many risks and challenges as established by this research and ranked as follows: security, high initial costs and bandwidth costs dependability on internet service providers (27.3%), limited control of data and lack of data ownership. An analysis of the benefits and challenges will assist the university in strategizing the adoption in order to minimise negative impact. Susceptibility to security breaches is a major challenge for universities in adopting the cloud computing technology.

In achieving the fifth objective of this research, the researchers established the perceptions of users with respect to the use of cloud computing. Generally, there is a positive perception towards cloud computing within the university community of users. Based on the results of the research, the majority of users were satisfied with the benefits of using the cloud computing platforms. The contribution of cloud computing in facilitating teaching and learning has also been applauded by the learners and educators within the university.

CONCLUSION

According to, the findings of this study, most users of cloud computing at the university of venda were found to be mainly using its software as-a service application. Most of the university community were found to be knowledgeable about cloud computing and had relevant skills to be able to utilise the cloud computing facilities. Students (postgraduates) and academic staff were found to be the most users for cloud computing applications due to their level of education. The perceived benefits of cloud computing usage from the user's point of view at the university are as follows: flexibility of use, less complex, promotes collaboration promotion, broad network accessibility, promotion of green IT, better functionality, improved security, cost saving, easy access

to shared data resources, access to advanced technology services, greater mobility, unlimited storage space and assured backup and recovery facilities. The major challenges associated with the use of cloud computing by the users at were identified as follows: online data security, limited control of sensitive data, dependence on internet service providers, high bandwidth costs and property rights issues.

Significance statements: This research has contributed in terms of literature, to the discourse of cloud computing, particularly with regard to use in higher educational institutions. The study explained the factors that determined the user's perceptions of cloud computing with regards to its usability and functionality. The findings of the study are important to the cloud services providers and cloud systems support staff at universities in order to improve the services.

RECOMMENDATIONS

The research came up with a number of recommendations which can be considered to benefit further efforts of adopting cloud computing technologies in HEIs in rural South Africa. On strategies that can be used to promote effective usage of cloud technology at the University of Venda, the following strategies were identified:

The institution should adopt cloud computing in it's primary operations which would also provide the University with an attractive economic opportunity. The management of the university should be kept informed of the continuous developments and progress with regards to cloud computing technology which will enable the management to determine the significance of its usage. The University should clearly specify cloud computing issues in its IT Policy. It is recommended that HEIs should slowly migrate to the cloud entirely for applications that give competitive advantages to institution operations. Challenges by users should be adequately addressed timeously. Adequate support should be provided as and when required in order to improve the adoption of cloud computing. The university management should ensure that the strategic plans for IT administrative affairs should be inclusive of cloud computing technology adoption.

The staff should be given formal training in terms of programs with regard to the usage of cloud computing technology. All curriculum should in cooperate cloud computing issues in order to make students aware of related technological developments.

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