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The Benefits and Challenges of Cloud Computing Adoption on Iraqi Universities: Results from an Empirical Study

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ABSTRACT

Benefits and challenges are seldom investigated in previous studies. The purpose of this study to identify the benefits and challenges of using cloud computing in Iraq. Stratified sampling technique us employed. Data is collected from 312 respondents at Kufa University. Descriptive analysis was used for data analysis. The finding indicated that the main benefits of using cloud services are related to the accessing software and hardware, facilitating communication and collaboration between users, and enhancement of the productivity of users. However, the major challenges confronting the adoption are related to the electricity supply, cost of internet connection, quality of network communication and the speed of the internet connection. Suggestions for decision makers and for future works were given and discussed.

Keywords: Cloud computing, Higher education, Benefits, Challenges.

INTRODUCTION

Cloud computing technology has become essential for the development of information systems [1]. It is a powerful enabling tools for educational change and reform introducing new methods of teaching and conducting research as well as provisioning of educational facilities for online learning, teaching and research collaboration. It thus represents a potentially equalizing the strategy for developing countries. The great flexibility offered by cloud computing strongly facilities the acquisition and use of available knowledge to expand access to education, strengthen the quality of education and improve the quality of the classroom teaching-learning processes via access to electronic active teaching and learning, research, training and development resources on the global collaborative network of internet works and use of cloud computing services in education institutions. It can be said to be the bedrock for successful scientific research and development in education [2].

Previous studies have focused on the adoption of cloud in business organization at the organizational level [1,3,4]. In addition, most research regarding adoption of cloud computing by companies covers countries with highly developed IT infrastructures, cloud computing is actually used also in less IT-mature countries [5]. A survey showed that the majority of studies that are related to the challenges and benefits have been conducted in western countries [6]. It is found that few studies have investigated the cloud computing issues in developing countries [7-9]. However, due to technological gap between developed developing countries, more challenges are existed in the developing countries [10]. Thus, it is important to investigate the issues surrounding the adoption of cloud computing to ensure its success [11].

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Hashim *et al*. [12] pointed out that the studies related to the benefits and barriers of using cloud in developing countries are rare and called for more studies in this field. This view is similar to other researchers who indicated that benefits and challenges of using cloud computing are not clear in the developing countries and studies are needed to identify these benefits and challenges to ease the adoption by understanding the issues surrounding the adoption. Therefore, this study focuses on the benefits and challenges of using cloud computing services at Kufa University in Iraq. The university is using cloud computing since 2011 [13]. A set of cloud related services are provided by the universities. Nevertheless, the students' adoption of this technology is moderate. There is a need for studies in this regard to discover the benefits and challenges of using cloud-computing services by users at educational institutions in Iraq.

Recently, there has been calls from researchers to extend the literature regarding the benefits and barriers of using cloud computing in developing countries [12]. The present paper aims to investigate the benefits and challenges of using cloud computing services from users' perspective at Iraqi institutions in general and Kufa University in particular. The benefits assessment investigates the gains derived from the adoption of cloud computing in Iraqi Universities while the challenges assessment investigates the problems and constraining factors mitigating with the successful adoption and use of cloud computing in Iraqi Universities.

The paper consists of seven sections. First section presented the introduction and highlighted the issues and gaps in the literature along with the objectives. The second section integrates and analyzes the literature related to the topic. Third section discusses the research methodology. Fourth section presents the findings of the study. Fifth and sixth section discusses the findings and implications. The seventh section concludes the study, states the limitations, and highlights the direction for future works.

2. Literature review:

2.1 Cloud computing overview:

The most widely used and cited definition of cloud computing was given by The National Institute of Standards and Technology (NIST) 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"* [18]. It can be seen from the definition that cloud computing include on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service for business.

Generally, cloud computing has three service models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). In term of deployment, the technology can be divided into four types that includes public, private, hybrid and community clouds [17,18]. Public cloud are cheap and accessible but less secure than private. Whereas, the hybrid mixed between the affordability and the high security. Lastly, community cloud is an integration between some organization to use the cloud technology [14,20,17]. Each deployment model has its benefits and drawbacks [21]. The decision of choosing a proper cloud computing deployment model should consider technological as well as organizational factors.

2.2 Cloud Computing in Education:

Previous studies focused on business adoption of cloud, the education field received less attention. Higher education can benefit from the technology if they choose the right types along with the software and hardware [23]. The criteria that should be considered are the criticality of mission and the sensitivity of the educational activities [24]. Course delivery and distance learning applications are increasingly important application to be choson carefully by the educational institutions [25-29]. Further, applications that enable the communications between students and their lecturers are vital [30].

In a recent study, the most commonly used cloud tool in higher education is Gmail [31]. Other application areas include learning management systems [33], library management systems [34,35], and document creation/storage. With so many cloud services available for education, it is difficult for users to find suitable services after considering factors such as scalability, licensing, curriculum, costing, and security [36-38]. Typically, users need to decide on issues such as service models, types of clouds, application areas, and service providers. Budgeting decision is also an indispensable component that directly affects hardware adoption and usage, software licensing and accessing fees, and network infrastructure and capabilities [40].

The various decisions listed above involve different groups of stakeholders. Within any university system, students, lecturers, researchers, universities administrators, and IT staff all play an important part in the adoption or use of cloud services. Outside the school system, there are the computer hardware vendors, computer software vendors, cloud service providers, local and national government agencies and regulators [39,40,38]. However, in the present study, the focus in mainly on the users of the cloud services assuming that the services are provided by the university and the users are only interested in using these services.

2.3 Benefits of Cloud Computing:

There are several benefits of cloud computing in educational field. Previous studies mentioned these benefits to include the ability to support learning processes: self-learning, peer-to-peer learning, classroom learning, distance learning, virtual laboratories, students with special needs, and assessment systems [32,41,27]. It allows teachers to create flexible learning environment such as virtual labs and it is expected to increase student participation and student satisfaction and eventually student performance [28]. The support for on-demand learning systems is particularly valuable to assist students in rural areas in developing countries to overcome the digital divide problem [42,43].

As the amount of data has exploded in the last decade [44], it is unsurprising that the large, flexible and scalable storage capacity of cloud computing is perceived beneficial to different types of organizations including universities [45]. In universities, the use of cloud computing facilitates sharing of learning materials and all sorts of data. Apart from data sharing, users of cloud computing can also benefit from sharing software provided there is Internet access [45,43]. In some cases, universities no longer need to purchase expensive software and have an increased choice of software such as learning management systems or teaching-related games [45-47]. The perceived benefits of cost savings are not limited to software costs. It includes savings of hardware expenses and IT operational costs by extending the useful life of computing equipment.

Another aspect of perceived benefits of cloud computing is its ability to improve the IT management process by centrally managing IT resources, reducing local IT staff, taking advantage of IT expertise of cloud service providers, enhancing IT security, and even enhancing transparency and reducing corruption.

Most of the studies that are related to the benefits of cloud computing were focusing on the perspectives of organizations. In addition, the majority of the studies have been conducted in Western countries. Few studies have looked into the benefits from users' perspectives in the developing countries.

2.4 Challenges of Cloud Computing:

Despite the benefits that can be generated by the technology, there are some obstacles that slow the cloud computing adoption. Internet access, cost of connections, and speed of the internet are among the widely recognized obstacles [49]. Further, previous studies identified the concern of security and privacy are among the obstacle of the wide spread of the use of cloud computing [50-52].

The extensive use of third parties in cloud computing, namely cloud service providers, adds extra risks. With the increasing reliance on cloud services from software to infrastructure levels and uncertainty related to cloud security, the associated risk of data sovereignty and privacy has become higher and sometimes unclear [53-55]. For example, cloud service users often do not know where the shared equipment and/or data are stored [56]. This is an important matter because the location of data storage directly affects the applicability of local privacy legislation. The matter gets even more problematic as many service providers subcontract part of their services to others. Hence, data are also vulnerable to abuse by sub-contractors [57]. This chain of cloud service providers complicates the trust issue and it is often unclear who is responsible for security breaches. A survey of 748 IT professionals in the US shows that only half the respondents have confidence in the security of cloud services. The use of cloud services have either stopped or slowed down in those companies [55]. Another source of obstacle comes from the lack of knowledge, lack of support from a variety of stakeholders including universities administrators, IT staff, lecturers, and students [58,59].

A recent study by Phaphoom *et al*. identified many barriers that are related to the use of cloud computing services. These include general security concern, data privacy, data loss, lack of trust, reliability and performance, and IT infrastructure complexity. The study showed that most of the studies that are conducted to identify barriers have been conducted in western countries. There is need to identify the challenges of using cloud computing services from users' perspectives in the developing countries. The present study is examining the challenges that could face the users of cloud computing at educational institution in Iraq.

3. Research methodology:

3.1 Population and Sampling:

The population of this study are all the universities in Iraq. However, due to the fact that Kufa University is the only university that uses the cloud computing technology, it was chosen to be the target population. Thus, the university was taken as a case study. It has multi programs that include diploma, bachelor, master and Ph.D degree in its 21 colleges. First time the cloud was used in the university in 2011 provided by public telecommunication company in the country. According to the university, there are 26066 students, 1876 academic staffs, and 2525 non-academic staff [60]. Due to the differences between the three groups, a stratified sampling technique was used in this study. In each group a randomly selected sampling technique is used. According to Krejcie and Morgan [61], the sample size of this study is 379 respondents divided as 324 students, 23 academic staff, and 32 non-academic staff.

3.2 Research Instrument:

The research instrument is a questionnaire adapted from other researchers. It consists of two parts. First part is related to the demographic background information. The second is related to the benefits and barriers. Five point Likert scales was used where (1) is strongly disagree and (5) strongly agree. Table 1 shows the measurement and their sources.

Table 1: Source of Measurements.

Variables	No. of Items	Sources
Benefits of cloud computing	9	Lim et al. (2015)
Challenges of cloud computing	7	Lim et al. (2015)

3.3 Validity and Reliability:

The validity of the questionnaire was checked by asking three experts to evaluate and pretest the content of the questions. Their feedbacks and comments were considered for correcting and adjusting the instrument. Reliability of the measurements were examined by asking 38 students to answer the questionnaire. The Cronbach's alpha for the reliability study and for final data collection was acceptable. Table 2 shows the reliability for pilot and field study.

Table 2: Reliability of Pilot and field Study.

Variable	Number of items	Cronbach's Alpha of Pilot study (38)	Cronbach's Alpha of Field study (312)
Benefits of cloud computing	9	0.98	0.75
Challenges of cloud computing	7	0.80	0.72

3.4 Data Collection:

Data of this study was collected from student, academic, and non-academic staff at Kufa University, Iraq. The contact details of the respondents were obtained from the university. A total of 379 questionnaires was emailed to users. The respondents were given three weeks to answer the questionnaires. A reminder was sent in second and third week to remind the respondents to fill in the questionnaires. A total of 312 questionnaires were received complete and usable.

4. Findings:

4.1 Demographics of respondents:

A total of 312 respondents has participated voluntarily in this study. They are mainly in the age between 21 and 30 years (159 or 51%). The respondents included 188 (60.3%) males and 124 (39.7%) females. Mainly the respondents are students (264 or 84.6%) and they have bachelor degree (212 or 67.9%). A total of 226 (72.5%) have accessed the cloud of the university at least once a week. Table 3 shows the demographic information of the respondents.

Table 3: Demographic Information of Respondents.

N= 312	Label	Frequency	Percent
Age	Less than 20 years	50	16.0
	21-30 years	159	51.0
	31-40 years	61	19.6
	41-50 years	40	12.8
	More than 50 years	2	0.6
Gender	Male	188	60.3
	Female	124	39.7
Occupation	Student	264	84.6
	Academic staff	19	6.1
	Non-academic staff	29	9.3
Education	Diploma	6	1.9
	Bachelor	212	67.9
	Master	66	21.2
	Ph.D	28	9.0
Usage	Never	39	12.5
	Once a week	130	41.7
	2-3 times a week	96	30.8
	4-5 times a week	26	8.3
	Everyday	21	6.7

4.2 Benefits and Challenges:

The objective of this study was to find the benefits and challenges of using cloud computing services in educational institutions in Iraq. The findings are presented in the following sections.

4.2.1 Benefits of using Cloud computing:

Table 4 shows the benefits of using cloud computing services. The table shows that the respondents have placed their strong agreement on all the benefits of using cloud computing. The overall mean score value of benefits is 4.35 with strong agreement on all the items. However, based

on the mean score value, the most three important benefits are the ability of accessing software and hardware regardless of time and place (Mean= 4.46). This is followed by facilitating the communication and collaboration with users (Mean= 4.43) and lastly, the enhancement of the productivity of users by using cloud computing (Mean= 4.39). This shows that the users at Kufa University perceived the cloud as a service that enables them to access software and hardware from any places at any time. They also considered the cloud as a method to improve communication and collaboration with each other. The cloud for users at Kufa University is potentially able to boost their productivity.

Table 4: Benefits of Using Cloud Computing.

Items	Mean	Interpretation
Cloud computing supports self-learning.	4.34	Strongly agree
Cloud computing supports virtual laboratories.	4.24	Strongly agree
Cloud computing supports work flexibility.	4.36	Strongly agree
Cloud computing allows easier installation of large size software on the cloud.	4.29	Strongly agree
Cloud computing facilitates sharing of learning materials and data.	4.36	Strongly agree
Cloud computing provides accessibility to software anywhere and at any time.	4.46	Strongly agree
Cloud computing facilitates communication and collaboration between users.	4.43	Strongly agree
Cloud computing enhances users' openness to new technologies.	4.28	Strongly agree
Cloud computing enhances productivity of users.	4.39	Strongly agree
Overall mean score value of benefits of using cloud computing services.	4.35	Strongly agree

4.2.2 Challenges of using Cloud computing:

Table 5 shows the challenges of using cloud computing services by the respondents. The table shows that the respondents have placed their disagreement on almost all the items with overall mean score value of 2.42. The main challenges of the respondents are the cost of internet connection followed by the electricity supply and quality of network communication such as the speed of connection.

Main issues for the users at Kufa University are related to the electricity supply at the university (Mean= 1.92), cost of connecting to the Internet (Mean= 1.99), and the quality of Internet connection and communication (Mean= 2.15). The electricity supply, which enables the continuity of the use of cloud services, is one of the main issues. In addition, the cost is considered as a barrier for the respondents to utilize the cloud computing services. Lastly, the quality of internet connection is one of the difficulties that hinder the use of cloud computing services. This is due to the slow connection of internet.

Table 5: Challenges of Using Cloud Computing.

Items	Mean	Interpretation
Internet connection costs are cheap.	1.99	Disagree
Electricity supply at university is stable.	1.92	Disagree
The quality of network communication, bandwidth, and connection speed, at university is good.	2.15	Disagree
I have full control over my data on cloud computing.	2.66	Moderate agree
I trust in cloud service providers.	2.90	Moderate agree
Users support cloud computing.	2.49	Disagree
Users have knowledge of cloud computing.	2.42	Disagree
Overall mean score value of challenges	2.36	Disagree

5. Discussion:

This study investigates the benefits and challenges of the adoption of cloud computing by Iraqi universities. The finding indicated that benefits of using cloud services include the access of software and hardware, facilitating communication and collaboration between users, and enhancement of the productivity of users. This findings is in agreement with the findings of other researchers who have investigated the benefits. Ab Aziz *et al*. [45] pointed out that users can share the software between each other using the cloud technology. It was also found by other researchers that cloud computing enhances the communication between student and lecturers. Cloud reduce the cost of using software and hardware, and it support students in rural area which increase their productivity.

In term of challenges, the most prevalent challenge are the electricity supply, cost of internet connection, quality of network communication and the speed of the internet connection. These challenges might be specific for the country of Iraq where the IT infrastructure is the best obstacle of the country. Most of the challenges are related to the IT and non-IT infrastructure. In the literature, researchers found that that internet access, cost of connection and speed of the internet are among the challenges. However, there is no literature to support the claim that electricity supply is one of the challenges. This is exceptional for Iraq where people are suffering from the shortage of electricity supply and must work needed to establish the network and the supplies of electricity.

6. Implications:

Decision makers are strongly advised to deal with the problem of infrastructure in general and IT infrastructure in particular. In the twenty first century, electricity is an essential need for the all industries and daily lives. The existence of electersity could solve lots of issue. However, electricity without IT infrastructure might not be make big changes in the adoption of cloud. Thus, the government are advised to work simultaneously to solve the issue of electersity and IT infrastructure. Cloud could solve the need for IT infrastructure but it is disable to solve the issue of electricity supply.

7. Conclusion, Limitations, and Future work:

This study was conducted to identify the benefits and challenges of using cloud computing in Kufa University in Iraq. Data was collected from 312 respondents. The findings indicated that access software and hardware, facilitating the communication and collaboration with users, and the enhancement of the productivity of users by using cloud computing are the benefits of using cloud computing. Challenges included electersity supply, cost of internet connection, speed, and quality of network communication. The findings of the study are generalized for the universities in Iraq, which share with Kufa University similar characteristic. This is because, the study is based on the perception of Iraq respondents and the situation in Iraq.

Benefits and the challenges are inclusively for users at the educational institution. Business organization are not part of this study. In addition, the organizational aspects of benefits and challenges as well excluded from this study.

For future work, it is recommended that a detail study conducted on the effect of electricity supply and IT infrastructure on the technology adoption in general and on cloud computing adoption in particular. In addition, future work could extend the findings of the study and conducted another study in different fields such as from citizen perspective, or businesses perspective to generalize the finding of the study. Lastly, due to the fact that studies are few regarding benefits and barriers, a qualitative studies are needed to understanding better the audience and identify the benefits and barriers. This could be conducted by using focus group of five to ten experts from different field.

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