

Effect of Cloud Computing Systems in Terms of Service Quality of Knowledge Management Systems

Hamed Rezaei, Behdad Karimi, and Seyed Jamalodin Hosseini

Abstract—Nowadays, information Systems play effective role in the organizations in a way that they cannot be imagined without these systems. On the other hand knowledge value of organizations are increasing and they prefer to take care of this knowledge. Accordingly, having a knowledge management system that can handle this task is very important. Based on one of the successful models of information systems, management system includes such major factors each one focusing on a part of the system. Meanwhile cloud computing technology has created a revolution in software and hardware processing. So in this paper we try to evaluate the success rate of “Quality of Service” which is one of the major factors of management system based on cloud computing on a higher education system.

Index Terms—Knowledge management systems, cloud computing, service quality.

I. INTRODUCTION

Nowadays, the new technologies play a widespread role in the world. That is because of its ability to solve everyday problems of many people in addition to decreasing living expenses. As [1] mentions in his article, technology has managed to release IT based companies from exorbitant costs. One of these technologies is cloud computing which has been officially established since 2006. The improvement of this technology has been in such a way that [2] considers it as one of the most important concepts in information technology field. To define the cloud computing in a right way, the best definition is the one that United States National Standards Institute presents [3]: cloud computing is a safe and accurate framework to access different sources of network, such as servers, functional applications, etc. Which could be provided for the users so fast and with minimum costs and efforts.

On the other hand [4] claims that the cloud computing and online social networks are suitable platforms to set up the knowledge management systems. Therefore, by expansion of knowledge based organizations, many different studies have been done on the knowledge management systems. According to [5]’s definition, knowledge management systems play a basic role in the system which is defined as: providing an intelligent backup of different users in the organization that play important roles in organizational knowledge graph. One of the most important benefits of these knowledge management systems is to cause the company to obtain a

competitive advantage. Moreover, it can cause an increase in work and system quality and speed up the knowledge manufacturing cycle [6]. Therefore, knowledge management systems need a software platform to present their services to company employees for producing, modifying and maintaining of knowledge.

In this article we are to investigate the uploading result of a knowledge management system using the cloud computing technology. The main question is whether this new knowledge management system can cause a proper result on the quality of services or not? In the next section we will take a short look at the history of the study, then we will hint the successful model of information systems and in the next part a general introduction will be presented about cloud computing technology and finally we will describe the results.

II. BACKGROUND OF RESEARCH

Delone and Mclean [7], [8] in 1992 and 2003 presented reference model for evaluating and measuring the success of the information system, many researches have been done on their reference model. Most of researchers measured their work based on accuracy of Delone and Mclean model or according to their model examine various examples of information systems. One of the dimensions of this model is quality of service that can play the most important role in the information system success. Accordingly [9]-[12] mention this point that success of information system can lead to success of organization. In order to assess this presented model, extensive researches have been done. For example [13] in his research, has extended this model to E-learning system and evaluated the success of system with 6 major factors. In this paper the researcher has precisely used the presented model by [8] and test the accuracy of the model in E-learning system by designing many hypotheses. The results show that the entire early model works correctly. On the other hand various researchers focused their attention on one of the presented model by [8]. For instance, [14] only focused on assessing the satisfaction of customers of the institute. Also tried to extend the success of entire information system to customer satisfaction. The research is based on this hypothesis that relationships seen in figure 1 which either lead to or predicated from user satisfaction, are true or false. At the end the result confirms the validity of the hypothesis. In this regard, other researches could be outlined [15], and [16].

Due to the extensive focus on the aspects of success in information systems, unfortunately there is no special attention to quality of service factor. Meanwhile evaluating of this factor is important. Although knowledge management systems will have many benefits for organizations, [17]

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however knowledge management systems as well as many computer systems might be in trouble. May this problem root in poor user interface or other defects [18], the researcher have decided more thorough discussion of this issue and analyzed a real sample.

A. Success Model of Information Systems

As stated in background of research this research is based on Delone & Mclean model. In this model 6 important factors are assessed to determine the success of an information system as follows:

- 1) System Quality
- 2) Information Quality
- 3) Service Quality
- 4) System Usage
- 5) User Satisfaction
- 6) net benefits

These 6 factor are connected to each other as presented in figure one [7]. As can be seen in Fig. 1, service quality is one of the factors of organization measurement that somehow other factor can be derived from. To verify this issue, we can mention the research that is done before by [19] which considers service quality factor as an important factor for organizations that work in the field of business and e-commerce. Other factors are also important but in today's world quality service is the main criteria for assessing a system. For example in this regard USE factor in contrast of Service Quality is ineffective and declares that the Quality Service is one of the most important success factors. The use of knowledge management system is significantly related to the success of the factor in ensuring high quality of the information system. On the other hand the system is mostly depended to the same quality of service. One of the researches that can be done is measuring the success model of information systems. In the other words, whether your model is correct or not many researches have been done about this topic [20]. Also from the second page different factors can be assessed one by one [21]. Totally, if one information system that is measured by all 6 factors could pass in each factor measurement, that system would be a successful system.

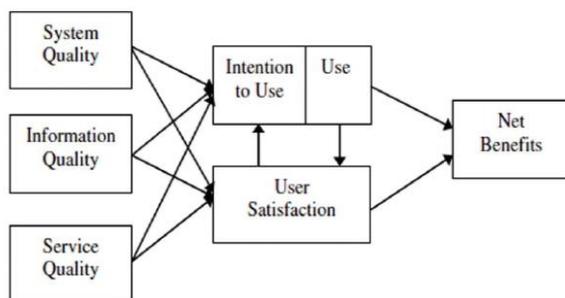


Fig. 1. Success model of information system.

B. Cloud Computing

According to the introduction, cloud computing is a successful new technology. This technology can be explained as follows: Paying to an external company to run applications and store their results rather than running these application locally on the systems of the company. It is called cloud computing. [22]

Almost all the international reliable sources divide the

cloud services into 3 categorizes [22] - [24].

- 1) Software as a Service (SaaS)
- 2) Platform as a Service (PaaS)
- 3) Infrastructure as a Service (IaaS)

Software as a Service (SaaS): SaaS refers to systems that can receive, process, and then deliver applications and system software via network (Internet/Intranet/Extranet). Examples of SaaS include: Email systems and business data processing systems such as CRM / ERP. This section is an important part of cloud technology.

SaaS Production Platform: Providing all required resources of an organization on a server to run its applications without the need to download or install the software is called Platform as a Service (PaaS) [24]. This section is most commonly used by programmers and developers. Obvious examples of this service is Google Gears.

Infrastructure as a Service: When it comes to the discussion of software technologies, of course a suitable hardware infrastructure is required on which the software could be run properly. Taking possession of or renting processor time, storage media, network capacity, and other critical requirements of an organization, from an external server is known as “using the infrastructure of the executing company “ which is available to the company as a service [24].

III. HYPOTHESIS

The main hypothesis of this research is that after loading the appropriate cloud server to provide a comprehensive knowledge management system, the system quality will get acceptable score by users. To be more precise, our main hypothesis is that if using a cloud server system increases the quality of service of a knowledge management system or not. We will continue to investigate the validity of this hypothesis.

IV. DISCUSSION

A. Case Study

As mentioned in the previous section, the purpose of this research is to evaluate the quality of a knowledge management system based on cloud technology. To achieve this goal, we have examined one of the higher education institutions that works in the field of network engineering.

In this institute, we have considered 30 students, which is 2 classes of 15 members. The students first used the traditional knowledge management system so that they tried to solve their own or their organization problems through sending email or making phone calls to the experts. At this stage, a questionnaire was provided to these 30 participants in order to measure the system's quality of service. After collecting the questionnaires, a knowledge management system (KMS) is designed and produced in which users do not need to install any applications, but the applications are only run on the server and the users can leave comments and express their problems and questions and store the results for further applications.

After about 60 days, the second questionnaire was given to the same statistical population. The two classes were chosen

in such a way that they were continued by the time the second questionnaire was distributed. This questionnaire included several questions related to the user comments and their satisfaction level of the system and the answers were categorized in 5 response options from strongly agree to strongly disagree. In the next section we will examine the statistical results obtained from these questionnaires.

B. Statistical Results

A situation summary of the participants in this study is shown in Table I.

TABLE I: RESPONDENTS ACCORDING TO SEX, OCCUPATION AND EDUCATION LEVEL

Description	Frequency	Frequency Percentage
Sex		
Male	24	80%
Female	6	20%
Occupation		
Student	8	26.6%
Engineer	10	33.33%
Manager	0	0.0%
Employee	6	20%
Other	6	20%
Education		
Associates Degree	11	36.6
Bachelor's Degree	17	56.6%
Master's Degree	2	6.6%
PhD	0	0.0%

To obtain the desired result and to get the answer whether our investigate hypothesis was correct or not, we compared the first and second questionnaire responses. The results of this comparison have been evaluated through the T-student test. This gives us the ability to prove or reject the effectiveness of cloud computing technology on quality of service enhancement. This test is based on the variable D_i which is calculated by the difference between X_i and Y_i (X_i and Y_i are our pair variables here that X_i is the answer of a

question in the first questionnaire distribution and Y_i is the answer of a question in the second questionnaire distribution).

$$D_i = Y_i - X_i \quad (1)$$

Now, D_i is a random variable and assuming a normal distribution of data and an unknown variance, it has t-distribution. So our test statistic will be as follows:

$$sd = \sqrt{\frac{1}{(n-1)} \sum (D_i - \bar{d})^2} \quad (2)$$

where Sd is the standard deviation of " d ", $d = X - Y$, is the mean of " d ", and " n " is the sample size.

As seen in the table below, with a bivariate t-test on the questions of the first and the second questionnaire, clear results are obtained. As can be seen, totally, the zero assumption which states that using the new system does not have any effect on improving quality of service is rejected. And we can say that the initial hypothesis has been proven.

One of the important things that draws anyone's attention is that the third question of the questionnaires which is about how easy working with the new system is, has been slightly ignored from the users meaning that they often said that learning how to use this system is not so simple, because typically it is far easier to learn how to use traditional knowledge management systems rather than learning cloud-based systems. That's because nowadays each student uses many email addresses and certainly knows well how to work with them, but it takes time to learn a new system. However, as it is illustrated in Table II, other questions which are the next variables of the problem show significant progress, so it can be clearly seen that the new technology has a more impact on the quality of service through the users rather than before.

TABLE II: PAIRED T-TEST RESULT ON QUESTIONNAIRES

Paired Differences	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
				Pair 1 serq11 – serq21	1.933			
Pair 2 serq12 – serq22	1.767	1.382	.252	1.251	2.283	7.003	29	.000
Pair 3 serq13 – serq23	.467	1.525	.278	-.103	1.036	1.676	29	.105
Pair 4 serq14 – serq24	1.467	1.332	.243	.969	1.964	6.030	29	.000
Pair 5 serq15 – serq25	1.800	1.126	.206	1.379	2.221	8.752	29	.000

V. RESULTS AND FUTURE ACTIVITIES

As mentioned before, quality of service is an important factor in measuring the success of an information system. Therefore, it was decided to explore this topic in a knowledge-based organization. The main hypothesis of this study was to know whether setting up a knowledge management service based on cloud technology can satisfy users in terms of quality of service or not. After some investigations we found that the users observed significant differences after the implementation of this service.

Other studies can be conducted later on other aspects of information systems success model and interesting results can

be found. For example, an evaluation of user satisfaction factor can be made on knowledge management systems on different platforms.

APPENDIX

Questions provided to the users [25]:

- 1) Are the software and the hardware up to date?
- 2) Is the stability coefficient high in different hours?
- 3) Have users gained the knowledge of using the system easily?
- 4) Is this service considering users?
- 5) Do the knowledge management service providers perform their task well?

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