Cloud computing in National Library and Archives of Iran: easiness, security and flexibility in distribution of knowledge for libraries, citizens and the society

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ABSTRACT:

The subject of cloud computing has been a hot topic for the past years. There are many implications regarding this service provisioning for libraries. The points of view of personnel and managers of each organization are vital for taking necessary steps for applying the new technologies. This paper examines the attitudes of the authorities of the National Library and Archives Organization of Iran towards using cloud computing facilities, its benefits and concerns. It investigates the effectiveness of cloud computing in terms of reducing cost of ICT and increasing the general productivity indices (time, energy and manpower) and related concerns including threats to information security and career of IT experts in the organization. Data gathering was done through questionnaire and in depth interviews. The research results showed that from the perspective of over half of the study population, the use of cloud computing will have a high impact on lowering costs and increasing the general productivity indices. The majority of respondents considered that the use of cloud computing has a relative threat for data security and career of IT experts in the organization

Keywords: cloud computing, the National Library and Archives Organization of Islamic Republic of Iran, information and communication technology, information security.

1 INTRODUCTION

The world has changed a lot in the past 10 years. The rapid development of new technology and the changing landscape of the online world has changed the way we work and, for many, from where we do our work. With the advancement of technology, it is required to perform computational tasks everywhere and all the time. There is also a need for people to do their heavy computational tasks without expensive hardware and software. Cloud computing is the latest response of technology to this need. Cloud computing is a relatively new business model in the computing world.

In 1960, John McCarthy, a computer scientist, noted that "computation may someday be organized as a public utility". It is here that the foundation of cloud computing was laid. (Abidi & Abidi, 2012) Cloud computing can be defined as 'a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned, and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider and consumers'. (Calheiros et al, 2010)

According to the official NIST definition, "cloud computing is 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."The NIST definition lists five essential characteristics of cloud computing: on-demand self-service, broad network access, resource pooling, rapid elasticity or expansion, and measured service. It also lists three "service models" (software, platform and infrastructure), and four "deployment models" (private, community, public and hybrid) that together categorize ways to deliver cloud services. The definition is intended to serve as a means for broad comparisons of cloud services and deployment strategies, and to provide a baseline for discussion from what is cloud computing to how to best use cloud computing (Mell and Grance, 2011). Ten major categories or patterns of cloud computing technology, including:
1. Storage-as-a-Service
2. Database-as-a-Service
3. Information-as-a-Service
4. Process-as-a-Service
5. Application-as-a-Service
6. Platform-as-a-Service
7. Integration-as-a-Service
8. Security-as-a-Service
9. Management/Governance-as-a-Service
10. Testing-as-a-Service (Linthicum, 2009)

2 CLOUD COMPUTING IN LIBRARIES

The use of cloud computing services and facilities has begun in libraries, leading to a new concept called cloud library. The use of cloud computing in libraries has transformed the

delivery of resources and services. It provides shared access and wider usability (Kaur, 2014). The main advantage of a cloud is its effect on reducing ownership cost in an organization and making use of organizational assets for innovating and expanding its services. Libraries began creating cloud services several years ago by creating cooperative cataloguing and online references sharing. The main use of cloud services by libraries is either taking advantage of freely available applications for internal use in the library or for social networking purposes within their own community. It did not reveal a move to use the cloud for building the larger library community into a force on the Web (Goldner & Pace, 2011). Cloud libraries include digital data of various libraries, and data maintenance and support rests with the cloud space service provider. Digital libraries naturally should be connected to cloud computing to obtain mutual benefits and enhance both perspectives. In this model, storage resources are provisioned on demand and are paid according to consumption. (Sosa-Sosa & Ramirez, 2012). Cloud software enables the library to use online applications for performing its duties. Cloud platforms enable the library to freely expand its activities and design and use its software. Despite interlibrary borrowing apps and services, library users can not yet access shared resources through a single platform. Using cloud infrastructures, the library buys server space and processing power at a low cost. The main benefit of libraries in the use of cloud space is to use software and hardware without buying them. In this method, the IT department of the library contracts with providers of necessary infrastructure in the cloud space and can operate quite flexibly. In this method, funding is maintained in the library. Cloud computing offers many advantages such as cost savings, flexibility, user-centric, pervasive and openness, transparency, mutual interoperability, availability at any time and place, and resources sharing for libraries.

Advantages of Cloud computing in libraries:
1. Cost saving
2. Flexibility and innovation
3. User centric
4. Openness
5. Transparency
6. Interoperability
7. Representation
8. Availability anytime anywhere
9. Connect and Converse
10. Create and collaborate (Gosavi, Shinde & Dhakulkar, 2012)

The main benefit for moving to a cloud computing environment for a library is the ability to both try out new software without having to buy the hardware as well as being able to scale the computing power to meet the demand of users. A library's IT department can be more flexible in raising the amount of cloud computing they require by contacting their vendor instead of physically having to acquire new hardware to meet increased demands. (Padhy et al., 2012)

The National Library and Archives Organization of Iran consists of two divisions (the Library and the National Archives) using public funds. It has always had limited IT infrastructure and human resources funds. Therefore, cloud services for such an organization can lead to cost savings and using the fund for expanding services. This study seeks to obtain the perspectives of managers of the document library, the digital library and IT on the use of cloud computing in the National Library and Archives and provides the suggestions.

3 LITERATURE REVIEW

Yan Han (2013) studied the use of cloud computing infrastructure services in libraries. He studied the use of AMAZON S3 and Google Cloud Storage (GCS) as Amazon's and Google's cloud storage services for libraries. It was found that cloud computing services are usable in libraries, and that S3 is usable for running both local applications and cloud platform applications while GCS is compatible only with applications implemented in Google. Lingling Han and Lijie Wang (2011) investigated the possibility of using cloud computing in digital libraries, and provided a design model for a platform for digital library in the cloud platform. The model has four layers: infrastructure, data, management, and service. Using this model, the resources storage problems of digital libraries resource sharing and security decrease. Erik Mitchell (2010) studied and evaluated changing from current IT infrastructure to cloud computing in libraries. It was found that cloud services allow better server sharing and service delivery.

4 RESEARCH METHODS, DATA COLLECTION AND THE RESEARCH POPULATION

The research population includes general managers and deputy general agencies and heads of departments of the library, Archives deputy, digital resources administration, and ICT administration of the National Library and Archives. The population size is 45. The research method is analytical survey and the data gathering was done by using structured questionnaire and in-person interviews.

5 RESEARCH QUESTIONS

1. From the perspective of the research population, to what extent will the use of cloud computing facilities and services reduce the National Library costs?
2. From the perspective of the research population, to what extent will the use of cloud computing facilities and services motivate human resources for innovation in the National Library?
3. From the perspective of the research population, to what extent will the use of cloud computing facilities and services increase general productivity indices (time, labour, energy and capital goods) in the National Library?
4. From the perspective of the research population, to what extent will the use of cloud computing facilities and services threaten information security in the National Library?
5. From the perspective of the research population, to what extent will the use of cloud computing facilities and services endanger the career of IT experts?

6 RESEARCH HYPOTHESES

1. From the perspective of the National Library and Archives of Islamic Republic of Iran's authorities, there is a significant relationship between the reduced use of technical equipment and computers and their energy-saving using cloud computing in the organization.
2. From the perspective of the managers of the National Library and Archives, there is a significant relationship between energy-saving of technical equipment and computers and increased general productivity indices using cloud computing.
3. There is a significant difference between the perspective of the managers of the three areas of Archives, IT and the library of the National Library and Archives of Islamic

Republic of Iran on increasing general productivity indices using cloud computing in the organization.

7 RESULTS

Each of the main research questions is corresponding to some aspects or questions in questionnaire. In order to respond to the main questions, we analyzed means. For mean values less than 2.5, low scale, for mean values between 2.5-3.5, medium scale, and for mean values more than 3.5, high scale was used.

Question 1. From the perspective of the research population, to what extent will the use of cloud computing facilities and services reduce the National Library costs?

The results of the first main question which is demonstrated in the table 1 showed that supply and maintenance of data centre and software developing human resources were the highest and the lowest aspects of cost reduction due to applying cloud computing technology. The mean value of cost reduction (4.07 > 3.5), indicates that according to research population the effect of cloud computing on cost reduction is high.

Table 1: Cost reduction at the National Library due to the use of cloud computing from the perspective of the research population

N=46	Mean	Std. Deviation
supply and maintenance of data center	**3.93**	**1.083**
software developing	**3.80**	**1.025**
human resources	**3.80**	**1.108**
software developing human resources	**3.48**	**1.150**
cost reduction	**4.07**	**0.998**

Question 2**:** From the perspective of the research population, to what extent will the use of cloud computing facilities and services motivate human resources for innovation in the National Library?

According to the second main question, the motivations for innovation aspects which are presented in table 2 were freeing up human resources, opportunity for creativity, and job satisfaction.
The mean value of motivation for innovation (3.89 > 3.5), indicates that the effect of applying cloud computing on motivation for innovation is high, as shown in Table 2.

Table 2: Effect of using cloud computing for increasing motivation for innovation

N=46	Mean	Std. Deviation
Freeing up human resources	**3.54**	**0.862**
Opportunity for creativity	**3.52**	**1.070**
Job satisfaction	**3.61**	**0.802**
Motivation for innovation	**3.89**	**0.706**

Question 3: From the perspective of the research population, to what extent will the use of cloud computing facilities and services increase general productivity indices (time, labour, energy and capital goods) in the National Library?

The general productivity indices are capital goods, energy, time, and labor. The mean value of general productivity indices (3.65 > 3.5), indicates that cloud computing will increase general productivity indices, highly, as shown in Table 3.

Table 3: Effect of using cloud computing on general productivity indices

N=46	Mean	Std. Deviation
Capital goods	3.33	1.055
Energy consumption	3.50	1.006
time	3.24	1.015
labors	3.30	0.916
Productivity indices	3.65	0.875

Question 4: From the perspective of the research population, to what extent will the use of cloud computing facilities and services threaten information security in the National Library?

The information security aspects are network independence, database privacy, and database integration. The mean value of information security ($2.5 < 3.11 < 3.5$) indicates that the threat to information security is medium, as shown in Table 4.

Table 4: Effect of using cloud computing on threats to information security

N=46	Mean	Std. Deviation
Network independence	2.78	1.381
Database privacy	2.98	1.325
Database integration	2.87	1.185
information security	3.11	1.215

Question 5: From the perspective of the research population, to what extent will the use of cloud computing facilities and services threaten the career of IT experts?

The threat of IT experts' career aspects includes the software developer staff career, and the data center human resources career. The mean value of career threat to IT experts is ($2.5 < 2.65 < 3.5$), and it indicates that the rate of career threat to IT experts is medium, as shown in Table 5.

Table 5: Effect of using cloud computing on Threats for career of IT experts

N=46	Mean	Std. Deviation
Software developer staff career	**2.59**	**1.107**
Data center human resources	**2.37**	**1.162**
Threats for career of IT experts	**2.65**	**0.971**

8 HYPOTHESIS TESTING

First hypothesis:

H1: From the perspective of the managers of the National Library and Archives, there is a significant relationship between reduced use of technical equipment and computers and their energy-saving using cloud computing in the organization.

H0: From the perspective of the managers of the National Library and Archives, there is not a significant relationship between reduced use of technical equipment and computers and their energy-saving using cloud computing in the organization.

Table 6. Correlation between reduced use of technical equipment and computers and their energy-saving

Correlations			h2	h22
Spearman's rho	h2	Correlation Coefficient	1.000	.792**
		Sig. (2-tailed)	.	.000
		N	46	46
	h22	Correlation Coefficient	.792**	1.000
		Sig. (2-tailed)	.000	.
		N	46	46
**. Correlation is significant at the 0.01 level (2-tailed).				

Given that the significant level of the null hypothesis is calculated zero, the alternative hypothesis is confirmed. This means that from the perspective of the managers of the National Library and Archives, there is a significant relationship between reduced use of technical equipment and computers and their energy-saving using cloud computing in the organization. According to the Spearman correlation test (0.792), the correlation level between these the two variables is high.

Second Hypothesis:

H1: From the perspective of the managers of the National Library and Archives, there is a significant relationship between energy-saving of technical equipment and computers and increased general productivity indices using cloud computing.

H0: From the perspective of the managers of the National Library and Archives, there is not a significant relationship between energy-saving of technical equipment and computers and increased general productivity indices using cloud computing.

Table 7. Correlation between energy-saving of technical equipment and computers and increased general productivity indices

Correlations			h33	productivity
Spearman's rho	h33	Correlation Coefficient	1.000	.731[**]
		Sig. (2-tailed)	.	.000
		N	46	46
	productivity	Correlation Coefficient	.731[**]	1.000
		Sig. (2-tailed)	.000	.
		N	46	46
**. Correlation is significant at the 0.01 level (2-tailed).				

Third hypothesis:

H1: There is a significant difference between the perspective of the managers of three areas of Archives, IT and the library of the National Library and Archives on increasing of general productivity indices using cloud computing in the organization.

H0: There is not a significant difference between the perspective of the managers of three areas of Archives, IT and the library of the National Library and Archives on increasing of general productivity indices using cloud computing in the organization.

Table 8. Difference between the perspective of the managers of three areas of Archives, IT and the library on increasing of general productivity indices by using cloud computing in the organization.

Ranks			
	Expert Area	N	Mean Rank
Productivity	Archives	8	27.63
	IT	7	13.79
	Library	31	24.63
	Total	46	

Test Statistics	
	productivity
Chi-square	5.771
df	2
Asymp. Sig.	.056

The difference between the views of managers of three areas of Archives, IT and library of the National Library and Archives on increasing the general productivity indices using cloud computing at the National Library was tested by the Kruskal-Wallis test. Given that the significant level of the test is 0.056 (greater than 0.05), the null hypothesis is confirmed and the alternative hypothesis is rejected. Thus, it can be stated that there is no significant difference between the perspectives of the three groups in this area.

9 DISCUSSION AND CONCLUSION

Cloud computing is a recent phenomenon and has brought up many advantages for the organizations. Analysis of findings indicates that managers of the National Library and Archives of Islamic Republic of Iran are optimistic towards the possibility of using cloud computing services. This represents development-oriented approach of managers of the National Library and Archives of Iran on the use of new technologies. The possibility of using cloud computing in libraries has also been reviewed and approved by the research of Han (2013), and Han and Wang (2012). One of the most important advantages offered by cloud computing is the reduced costs, the results showed that the authorities of the National Library of Iran believed that the use of cloud computing will have a great impact on reducing costs and increasing efficiency indices. It has been among the positive results approved in numerous studies in the field of cloud computing in libraries and other organizations (Avram, 2014). On increasing motivation for innovation in human resources due to higher convenience by using cloud computing in the IT field, most views of the research population are evaluated positive. One goal for using cloud computing in organizations is to release the staffs from routine tasks in IT area and create opportunities for innovation in organizations. In the study of Han and Wang (2012), motivation is shown on the cloud platform by proposing a model for digital library. On reduced threat of cloud computing including information security threats for the National Library and Archives, most managers have relatively little concern in this case, and as Han (2013) and Mitchell (2010) have acknowledged, the use of cloud computing in libraries will lead to positive results and benefits.

Testing the research hypotheses revealed that there is a significant relationship between declining of the use of IT equipments locally, reduction of energy consumption and increasing efficiency by using cloud computing. Moreover, it was found that there is not a significant relationship between the views of the managers of library, documents and IT fields of the organizations on the threats of cloud computing and its impact on general efficiency indices.

In general, as in other studies, the results of this study also show that the authorities of the National Library and Archives of Islamic Republic of Iran are optimistic towards using cloud computing, based on the research results the following guidelines are presented.

The mission of national libraries is distributing the knowledge in the societies. In the strategic plan document of national Library and Archives of IR IRAN, the main vision of this organization is to achieve national knowledge Hub position. Using cloud computing facilities, national Library and Archives of IR IRAN, could achieve to this vision, and become a confluence of knowledge in society, for citizens and, by librarians.

10 SUGGESTIONS:

Given the study results and a positive perspective of managers of three areas of documents, library and IT in the National Library and Archives on the use of cloud computing in this organization, the following suggestions are presented:
1. Studying the feasibility of cloud computing application in the National Library and Archives of Iran.

2. Holding workshops on the application of cloud computing in the National Library and Archives for experts and managers.
3. Implementation of research projects using cloud computing services at the National Library and Archives of Iran.
4. Using implemented cloud computing models of other national libraries in the world, such as the Library of Congress and National Library of Australia for the National Library and Archives of Iran.
5. Agreements with organizations and companies providing cloud services in Iran for delivering cloud services to the National Library

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