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Sudhier K G Pillai Dr.

Assistant Professor, Department of Library and Information Science Central University of Tamil Nadu, Neelakudi Campus Thiruvavur- 610 005, Tamil Nadu, India, kgsudhier@gmail.com

seena s t

Research Scholar, Department of Library and Information Science University of Kerala, Thiruvananthapuram-695034, Kerala, India, seenast@gmail.com

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Library Professionals' Adoption of Cloud Computing Technologies: A Case Study on Kerala University Library, India

K. G. Sudhier^a and S. T. Seena^b

^aAssistant Professor, Department of Library and Information Science
Central University of Tamil Nadu, Neelakudi Campus
Thiruvarur- 610 005, Tamil Nadu, India
E-mail: kgsudhier@cutn.ac.in

^bResearch Scholar, Department of Library and Information Science
University of Kerala, Thiruvananthapuram-695034, Kerala, India
E-mail: seenast@gmail.com

Abstract

The purpose of this paper is to ascertain the awareness and use of cloud computing technologies among the library professionals in the Kerala University Library system, India. A survey was conducted using questionnaire among the 102 library professionals employed in the central and departmental libraries of the University of Kerala. The study revealed that 42.16% of the library professionals did not have much idea about cloud computing technology. Analysis showed that Facebook and Google Apps like Gmail, Google Doc etc are the cloud computing technologies used by majority of the respondents. It is also worth to note that the library professionals in Kerala University Library are using cloud computing technologies without being aware of doing so. Library professionals' awareness of cloud service models is relatively very low. Web OPAC and Journal Discovery Service are the areas known to the respondents in applying cloud computing technologies in libraries. Out of 102 respondents, 14.71% of the library

professionals in the University of Kerala have average skill in using these technologies. The findings of the study throw lights into the need of providing training for the library professionals in handling technology enriched library services to the users.

Keywords: Cloud Computing Technologies, SaaS, IaaS, PaaS, Library professionals, Kerala University Library system, India

1. Introduction

In the information age, everything is changing every minute and growing at a tremendous speed due to the emergence of the web-based technologies, globalization of networks and internet. Cloud computing is an emerging area within the field of Information Technology (IT). It represents the move from desktop applications towards web applications and services. The Gartner Group¹ defines cloud computing as “a style of computing in which massively scalable and elastic IT-enabled capabilities are delivered as a service to external customers using Internet technologies.” Practically cloud computing is synonymous with virtualization. When you are using cloud computing, you don't need to install the required application on your system. Instead use the application that runs on a remote location/datacenter which is called the 'cloud'. Any web application is a cloud application in the sense that it resides in the cloud. Moreover, through cloud computing instead of having own servers and employing personnel for its maintenance, libraries can hire a vendor on a monthly charge and enjoy the benefit of same server function. Cloud computing technologies enable libraries to stop dealing with technical issues that have nothing to do with their day-to-day mission and services². In India, cloud computing in libraries is in development phases. Libraries are trying to provide to users cloud based services but in real sense they are not fully successful owing to the lack of good service providers and technical skills of LIS

professionals in the field of library management using advanced technology. General awareness is still absent in India in this regard in general and in libraries particular. These issues make it sense to study the information professionals' adoption of cloud computing technologies in Kerala.

The Kerala University Library (KUL), established in 1942, is the oldest and biggest university library in the southern state of India. It comprises of the central library located at Palayam, the Campus Library at Kariavattom campus, and the Departmental libraries at Kariavattom and within the city, the Study Centre libraries at Alappuzha, Pandalam, Kollam and College of Engineering Library at Kariavattom. The library has over 3 lakh books and over 1000 bound volumes of journals. It is a depository of UN and World Bank publications and provides access to over 9000 on-line journals³. The library system follows a decentralized pattern with a Central library and departmental libraries attached to the teaching departments of the universities. The 42 departments in the university have now been reorganized into eleven schools. The teaching departments of the university have their own independent libraries managed by library professionals.

2. Previous Studies

Cloud computing applications are significant as far as library and information centres are concerned. Yuvaraj⁴ examined the characteristic elements of various organizational factors to identify whether a favorable climate for implementing and sustaining cloud computing in Banaras Hindu University Library System (BHULS) existed. The questionnaire study results validate the fact that opportune time for the implementation of cloud computing existed in BHULS. Library staff showed high willingness toward the adoption of the cloud computing and were well prepared to grasp the challenges. In another study he⁵ gave the implication of the Theory of Planned Behaviour and the construct affect to more desirably apprehend the acceptance level of Google

Apps. Result demonstrated that the intentions of the librarians to use Google Apps are positively correlated with all the constructs of Theory of Planned Behaviour (Attitude, Subjective Norms, Perceived behavioural control) as well as affect. Yuvaraj⁶ used the technology acceptance model (TAM) in order to examine the librarians' behavioural intentions to use cloud computing applications. Results showed that librarians' perceived ease of use had significant impact on the attitude towards use. In another study he⁷ also reported that librarian's adoption of cloud computing technology in central university libraries of India using diffusion of innovation theory. Findings revealed that behavioural compatibility with cloud computing, relative advantage, compatibility, image, visibility, ease of use, results demonstrability and trial ability are positively associated with the intention to use cloud computing. As explained by Yuvaraj⁸ the areas of cloud computing which can be used in Indian libraries include mailing service, storage, information collection, file sharing, software applications, presentation, forums etc.

Choukimath, Agadi and Koganuramath⁹ investigated and designed reference architecture to digital library systems using cloud computing. The paper also discussed the possibility of cloud based technologies and feasible prospects for future of university library system. In a study of cloud computing applications in academic libraries, Joshi and Prajapati¹⁰ admitted that the real value of cloud computing is that it makes the library related software and data available everywhere but in India, digital divide and low bandwidth cause the main problem. Pandya¹¹ investigated the implication issues of cloud computing in libraries on the basis of SWOT analysis and pointed out the strengths, weaknesses, opportunities, and threats associated with cloud computing and libraries. Paul, Karn, and Chaterjee¹² described Cloud Computing and its application emphasizing in the field of Information Networks and Electronic Information Grids.

The conventional and latest issue and challenges regarding cloud computing emphasizing its possible integration and utilization in Indian scenario were also mentioned.

Goldner¹³ expressed the view with regard to cloud computing, how cloud computing is differed from the other computing and its advantages to libraries in three basic areas: Technology, data and community. Murley¹⁴ provided an overview of cloud computing and list of resources and services attached with cloud computing technology particularly in law libraries. In a study of impact of cloud computing on system librarianship, Liu and Cai¹⁵ suggested that System librarians must upgrade their knowledge and skills in using the technologies. Prince¹⁶ described the LibGuides as the most popular content sharing platform for libraries. Han¹⁷ identified the advantage of using cloud technologies including On-demand, Cost-effective services, Scalability, High availability etc. The areas in libraries in which the cloud computing technologies can be effectively applied are identified and explained by Luo¹⁸ with examples.

Analysis of ICT skills among the library professionals of Kerala University Library conducted by Seena and Sudhier¹⁹ revealed that the professionals have relatively average level of skills in handling ICT. In a paper by Singh and Veralakshmi²⁰ believed that cloud computing technology helps the users to maintain their personalized information. An overview of cloud computing technology and application of cloud service models such as SaaS, PaaS and IaaS in libraries are effectively demonstrated by Kroski²¹. There are several other studies on application of cloud computing technologies in libraries carried out in India and abroad by various authors²²⁻²⁸, however less on university libraries, especially in the Indian context.

3. Cloud Computing Initiatives in Indian Libraries

In India, Indian Institute of Technologies (IITs) played a pioneering role and is the earliest adopter of cloud computing solutions. IIT Delhi has developed Baadal 2011, which is a cloud orchestration and virtualization management software that can work with multiple virtualization technologies. Further, IIT Delhi is commissioned ownCloud, a file and document sharing utility similar to the popular dropbox, for use by the IIT Delhi community. The utility supports storing and sharing of files, images, music and documents, contacts, calendar, tasks etc.²⁹. OSS labs from India is using Amazon's elastic cloud computing platform owing to the various capabilities of Amazon such as high durability of data, strong information security based on ISO standards, scalability, and flexibility. Using Amazon's cloud services, it is offering Koha ILS and DSpace institutional repository hosting and software maintenance subscription services for libraries³⁰.

Council of Scientific and Industrial Research (CSIR) is planning to create a cloud computing to store the research articles, databases created by different laboratories and make them accessible to other CSIR laboratories. One of the biggest areas of concern for both cloud vendors and customers alike is strong authentication, authorization and encryption of data to and from the cloud for authorized access of data. And, the data itself needs to be segmented to ensure there is no leakage to other users or systems³¹. Knimbus is a cloud based research platform facilitates to discover and share the scholarly content. Knimbus stands for Knowledge Cloud which is dedicated to knowledge discovery and collaborative space for researchers and scholars. Information and Library Network (INFLIBNET) Centre has been incorporated Knimbus cloud service into its UGC INFONET Digital Library Consortium in order to search and retrieve scholarly contents attached therein. Some services such as digital libraries, web documentation and using web2.0 technologies are running on successful modes. Some good examples of successful cloud computing libraries include Dura cloud, OCLC services and Google based cloud services³².

There are also examples of availability of hosting platforms like INFLIBNET's OJAS for a variety of subjects (Open Journal Academic System) ³³. University of Mysore WebOPAC hosted on the Cloud is an example using ILS in Cloud Computing environment³⁴. Mendeley (Reference Management Software), a cloud based library service, is a free reference manager and academic social network that can help to organize research, collaborate with others online, and discover the latest research. Cochin University Science and Technology (CUSAT) are using Mendeley Reference Manager for knowledge management³⁵.

4. Objectives of the Study

The objectives of the study are:

- To study the awareness of cloud computing technologies among the library professionals in university of Kerala.
- To assess the awareness of the cloud computing service models.
- To find out the extent of awareness of application of cloud computing technologies among the library professionals.
- To assess the competency level of the library professionals in using cloud computing technologies.

5. Methodology

The research design of the study is the survey method using a questionnaire, circulated among the library professionals employed in the central and departmental libraries of the University of Kerala. The library system follows a decentralized pattern with a central library and department

libraries attached to the teaching departments of the universities. To elicit the necessary information, a structured questionnaire was designed to collect data keeping in mind the objectives of the study. The questionnaire consisted of both optional type and statements in five point Lickert scale. Out of 112 questionnaires distributed 102 responses were received. The collected responses were analysed using latest version of MS-Excel for appropriate statistical analysis and description. The study was confined to the library professionals of the central, campus, college of engineering and departmental libraries in the University of Kerala.

6. Data Analysis and Findings

6.1. Demographic Information

Data about respondents' demographic details were collected and the analysis is presented in the Table 1. Designation-wise analysis showed that majority of the respondents were Assistant Librarians (31.37%) followed by Technical Assistants (29.41%). Gender-wise analysis showed that the majority of library professionals in the University of Kerala are females (60.78%) and 39.22% are males. Most of the library professionals fall in the age group between 36 and 45 years (42.16%) at the time of survey.

SI No	Profile of Respondents		Response	Percent (%)
1	Designation	Assistant Librarians	32	31.37
		Reference Assistants	17	16.67
		Technical Assistants	30	29.41
		Library Assistants	23	22.55
		Total	102	100
2	Gender	Male	40	39.22

		Female	62	60.78
		Total	102	100
3	Age group	25-35 years	29	28.43
		36-45 years	43	42.16
		46-55 years	30	29.41
		Total	102	100
4	Basic Educational qualifications	BA	22	21.57
		BSc	10	9.80
		BCom	7	6.86
		MA	38	37.25
		MSc	18	17.75
		MCom	7	6.86
		Total	102	100
5	Professional qualifications	BLISc	10	9.80
		MLISc	59	57.84
		MPhil	24	23.53
		PhD	9	8.82
		Total	102	100
6	Professional experiences	Below 5 years	15	14.71
		6-15 years	50	49.02
		16-25 years	34	33.33
		Above 26 years	3	2.94
		Total	102	100

Table 1. Demographic information of respondents

A total of 70.59% of the professionals fall below 45 years of age which showed that young professionals were dominate in Kerala University Library. Analysis also showed that 61.76% of the respondents have post graduate degree and 38.24% has degree in their basic subject. Out of 102 respondents, 38 (37.25%) possessed MA as basic qualification. A few the professionals also have additional technical qualifications like DCA (18.63%), and PGDCA (9.80%), in addition to the basic qualifications. Table represents the high average of professional qualification of the LIS professionals in the University of Kerala. The basic qualification for entry cadre as a library professional in Universities being Degree with BLISc, it can be seen that professionals having only BLISc degree were very low (9.80%). In considering the professional experience of the respondents, most of them have experience ranges from 6-15 years (49.02%). It is also worth to notice that there were only three professionals who have above 26 years of professional experience in KUL.

6.2.Awareness of cloud computing technologies

Table 2. Awareness of cloud computing technologies

Response	Response	%
Aware	37	36.27
Not aware	43	42.16
Little aware	22	21.57
Total	102	100.00

Table 2 indicates the awareness of cloud computing technologies among the library professionals. As seen from the table, majority of the library professionals (42.16%) were not aware of the technology. This inference throws light into the view that most of the qualified library professionals in University of Kerala don't get an opportunity to be familiar with the cloud services to manage in techno savvy environment.

6.3.Use of cloud computing technologies

The respondents were asked to indicate whether they ever tried the cloud computing technologies for personal information needs or not. As shown in Table 3, small percentages (33.33%) of the library professionals gave a positive respond regarding its use. The fact observed was that many professionals did not know that they were using the technologies which are in the cloud.

Table 3. Use of cloud computing technologies

Response	Response	%
Using	34	33.33
Not using	68	66.67
Total	102	100.00

6.4. Cloud computing technologies ever tried

Table 4 reveals the cloud technologies tried by the LIS professionals for personal information management. It was observed that out of 102 respondents, 85 per cent library professionals tried at least one cloud computing technologies. Facebook (33.33%) and Google Apps like Gmail, Google Doc etc (24.51%) were the technologies used by majority of the respondents under study. The result is somehow in line with the findings of Alhamdi and Khaparde³⁶ who revealed that webmail and social networking as the popular collaboration service in the cloud by the library community especially students. Dropbox was the least used (3.92%) cloud computing technology by the library professionals. The main advantage of using cloud technologies is that it can be accessed from anywhere in the world on multiple platforms. The findings of the present study revealed that many professionals have used cloud products such as Gmail, Facebook, Google Docs etc without being aware of doing so.

Table 4. Cloud computing technologies ever tried

Sl.No	Cloud computing technologies	Response	%
1	YouTube	24	23.53
2	Dropbox	4	3.92
3	Facebook	34	33.33
4	Hotmail or Windows Live Mail	15	14.71
5	Google Apps(Gmail, Google Doc)	25	24.51

6.5.Awareness of cloud computing service model

In order to gain effective utilization of cloud technologies awareness of cloud computing service models are very essential and library professionals will need to be trained in these applications. According to Mavodza³⁷ libraries are using the cloud for putting together user resources, i.e. using Software as a Service (SaaS), such as in library catalogues, WorldCat,

GoogleDocs, the Platform as a Service (PaaS) as in the use of GoogleApp Engine and Infrastructure as a Service (IaaS) as in the use of D-Space, FEDORA, and others. With a view to identify the respondents' knowledge of cloud computing service models, data were collected and presented in Table 5. Analysis showed that the library professionals in University of Kerala have relatively very low level of knowledge about the cloud computing technologies especially the cloud service models. Out 102 library professionals under study only 33.3% of the professionals were aware of the service models.

Table 5. Awareness of cloud computing service model

Sl.No	Service models	Response	%
1	SaaS	12	12.75
2	PaaS	10	9.80
3	IaaS	11	10.78

6.6.Awareness of cloud computing applications in libraries

As libraries are having service-oriented mission they are in a position to adopt cloud computing technologies. Libraries worldwide are using cloud computing in number of areas starting from federated search, resource sharing, website hosting, digital libraries, library automation etc. Table 6 illustrates the respondents' awareness of cloud computing application in libraries. It was found that only 32.35% of the respondents were aware of the cloud computing applications in libraries.

Table 6. Awareness of cloud computing in libraries

Response	Response	%
Aare	33	32.35
Not aware	69	67.06

Total	102	100.00
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6.7. Use of cloud computing in libraries

Table 7. Use of Cloud computing in libraries

Response	Response	%
Using	18	17.64
Not using	84	82.35
Total	102	100.00

Data were collected to know whether the professionals' ever tried the cloud computing technologies in his/her libraries and the response is shown in Table 7. The analysis revealed that most of the library professionals in University of Kerala (82.35%) have not used cloud computing technology in the library. Eventhough 32.25% of the professionals were aware of these technologies in libraries, only 17.64% have tried it in the library.

6.8. Areas of application of cloud computing technologies in libraries

Table 8. Familiarity of cloud computing applications in libraries

Sl.No	Areas in libraries	Response	%
1	Acquisition and technical	3	2.94
2	Circulation	4	3.92
3	Web OPAC	11	10.78
4	Reference Service	7	6.86
5	Journal Discovery Service	11	10.78
6	Content Management	2	1.96
7	Website hosting	5	4.90

8	Integrated Library Management System	5	4.90
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The areas in which cloud computing technologies can be applied in libraries are identified. Realizing the importance of these technologies, the data were collected for the areas which are familiar with the professionals and tabulated in Table 8. The table shows the areas in libraries which are used by the eighteen professionals who tried the technology in libraries. Analysis showed that a considerable number of respondents were familiar with the areas like Web OPAC (10.78%) and Journal Discovery Service (10.78%) in libraries. Relatively low number of response was given for acquisition and technical areas (2.94%). It should be noted that the emerging concept of content management was the least familiar area (1.96%), for which cloud computing technologies can be used effectively.

6.9.Competency level in cloud computing technologies

The respondents were asked to indicate the overall rating of their skills in using the cloud computing technologies in libraries and the result is presented in Table 9. It was observed that the library professionals have low level of skill in using these technologies. Majority of the respondents (47.06%) indicated that they are extremely poor in using the technology. Lack of

technology orientation and skill development programme was the main cause of this poor rating as quoted by some professionals as an issue that hindered their interest in cloud computing technology applications. It was also observed that there is no adequate infrastructure facility for staff in the library.

Table 9. Competency in cloud computing technologies

Response	Response	%
Extremely Poor	48	47.06
Below Average	39	38.24
Average	15	14.71
Above Average	0	0
Excellent	0	0
Total	102	100

7. SUGGESTIONS

In recent times, strategies for facilitating the adoption and effective utilization of cloud computing are an issue of central importance for organizations around the world. Utilization of cloud computing in the library depends upon the efforts of library professionals. Keeping in view of the results obtained in the study, the investigators offer some suggestions for the effective use of cloud computing technologies in libraries.

- Evidence of the library's active online or digital clients can be observed in the growing online social networks. Community-focused applications including social networking/ social tagging allow libraries to build a service together resulting in a wide range of user participation without even knowledge of the underlying internet's infrastructure. Social

networking platform can be used to increase library profile via event announcements, updates about library resources and services, and other promotional activities.

- Libraries have great possibilities for sharing its resources through cloud computing. By establishing a cloud-based resources sharing tool at national level via web browser, the knowledge assets of the nation can be accessed by just a mouse click.
- By establishing a public cloud among many university libraries, libraries can influence the collaborative efforts of the library community. It will help not only to conserve library resources but also can improve its user satisfaction³⁸. This will certainly help to enhance the efficiency of libraries by enabling them to access information through large global network of cooperating libraries. The university administration needs not to pay for infrastructure in a cloud system thus reducing a huge budget.
- Looking into the benefits of cloud computing and storage services, universities of India should pool resources. This will help the universities in cutting down the cost by reducing the need for software licensing, updating and maintenance. In order to secure the data, a combination of techniques can be used like Encryption technique (A complex algorithm is used to encode information), authentication process and authorization practices provided by cloud storage provider³⁹.

8. Conclusion

A user of recent years is highly aware of their specific information needs and continuously changes their expectations. Most of the users prefer to get the library services through internet instead of visiting the library. In the technological era, it is inevitable for libraries to keep pace with the changing needs of users and provide them with the best services using ICT. Cloud computing technology is relatively new in the field of library. Enough awareness is still absent in the field of cloud in University library of Kerala. So now it is time for librarian to concentrate on providing pro-active services and move from general service to personalize information services to the users for the benefit of academic community. Hopefully libraries could focus more directly on services and materials for patrons if their computer hardware and software were handled by IT companions of the cloud. The paper concludes with the suggestions that sufficient funds should be made available by the authorities for developments of ICT infrastructure and application of technology enabled services in university libraries. Libraries should also promote awareness programmes to the professionals as well as users by providing short-term courses, in-house training programmes, organizing workshops and seminars etc.

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