

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

---

Library Philosophy and Practice (e-journal)

Libraries at University of Nebraska-Lincoln

---

2019

# Application of Cloud Computing in University Libraries: Case Study of Selected University Libraries in Gujarat

Pradipsinh Chudasma  
pradipchudasma@gmail.com

Atul Bhatt  
Associate Professor, Dept. of Library & Information Science, Gujarat University, Ahmedabad, dratulbhatt@gmail.com

Dharmendra Trivedi  
Gujarat University Ahmedabad, 1974dtrivedi@gmail.com

Follow this and additional works at: <https://digitalcommons.unl.edu/libphilprac>



Part of the [Library and Information Science Commons](#)

---

Chudasma, Pradipsinh; Bhatt, Atul; and Trivedi, Dharmendra, "Application of Cloud Computing in University Libraries: Case Study of Selected University Libraries in Gujarat" (2019). *Library Philosophy and Practice (e-journal)*. 2744.  
<https://digitalcommons.unl.edu/libphilprac/2744>

# **Application of cloud computing in university libraries: Case study of selected university libraries in Gujarat**

**Pradipsinh Chudasma**  
**Library Assistant**  
**Nirma University, Ahmedabad (India)**

**Atul Bhatt**  
**Associate Professor**  
**Dept. of Library & Information Science**  
**Gujarat University, Ahmedabad (India)**

**Dharmendra Trivedi**  
**Research Scholar**  
**Dept. of Library & Information Science**  
**Gujarat University, Ahmedabad (India)**

## **ABSTRACT**

The purpose of this paper is to determine the awareness and use of cloud computing services and technology among library personnel and library users in selected university libraries in Gujarat, India. A detailed survey was piloted using structured set of questionnaires among 210 library users which comprised of post graduate students, research scholars and faculty of the respective university and 15 senior library professionals participated in the survey. Study discovered that 78.57% of library users and 80% of library staff are aware about cloud technology. They are using multiple devices for cloud computing and 65.71% of library users using Laptop and 31.41% of them using smart phone, tablets and ipads. Majority of professional library staff use desktop and expressed that cloud technology is very useful in providing library services. Maximum 96% of respondents using Gmail services, 52.44% video service through YouTube, 65.78% using Google drive for file storage & sharing services. It is observed that library personnel used less of event calendar and online presentation. They are using cloud technology for acquisition and technical work data import and export purpose. 73.33% of library staff expressed that library services is improved by using cloud technology and overall 66.67% of them are satisfied with application of existing cloud technology in university library. It is also

perceived that majority of library professionals stated that basic training is required to use advanced cloud technology in university library. Study concluded with the recommendations to enhance library services with maximum utilization of available cloud technology in university library.

**Keywords: Cloud Computing Technology, Cloud Computing Models, Information and Communication Technology, University Library System, Library Services, India**

## **INTRODUCTION**

The core role of university library is to support the academic activities of the university by providing value added services to its users. University library is providing support to its user's community comprising post graduate students, research scholars and faculty members in terms of procurement of various kind of library resources related to curricular, co-curricular and extra-curricular in line with mission and vision of maternal university. In addition to core academic support, the university library also support in research and publication and extension activity of the university. Due to the technological innovation in teaching and learning activity, university library is adopting new challenges by taking care of application of information and communication technology by way of Initiating digitalization, developing institutional repository, training of library personnel to cope-up with the challenges from technology and provide up to date content to its users. In twenty first century library has to perform many challenging roles in addition to the traditional library services (**Dhanavandan and Tamizhchelvan 2014**). Library is dealing with many advanced operations and their resources are available not only in print format but also many resources procured, processed and to disseminate in digital or electronic format in network or cloud environment (**Mohsenzadeh, and Isafanyari-Moghaddam, 2009**). The significant application of cloud computing in the university library where library content can be used and transform with different universities which can help in maximum and operational utilization of library resources with the help of depiction data and software application. Cloud computing is beneficial for building up digital library, storing files, creating community and expand library automation (**Breeding, 2012**)

Application of cloud computing technology in university library has numerous benefits; mainly improving computing performance, increasing storage capacity, cultivating global accessibility of library content and most important is library can reduce the operational cost in IT investment. Moreover, library also can control the financial waste, enhance the tracking activity of library team and prevent technological headaches like computer virus attack, software crashes and damage of data (**Tuncay, 2010**). It increases effectiveness of library patron services, building of library collection and adoption of innovation and can improve ominously using cloud computing in university library (**Goldner, 2012**).

## **CONCEPTUAL OVERVIEW OF CLOUD COMPUTING**

In a simple term cloud computing is a substitute for the internet. In recent time, many institutions and organizations are using cloud services by uploading there projects on cloud based server on the internet in an extensively disseminate environment. Cloud computing is also known as “software as a service”, internet as platform”, “on-demand computing” and “information utilities” (**Hayes, 2008**). The National Institute of Standards and Technology has given concrete definition of cloud computing: 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. This cloud model is composed of five essential characteristics, three service models, and four deployment models” (**Mell and Gance, 2011**). The early implementation of cloud computing solution happening in the U.S., followed by the countries of the European Union, and now by some developing countries including the most advanced Asian and Latin Americas (**Etro, 2009**). According to James “The cloud is the content market of the web” that is “enormous” and “disregarding or omission the webs is to forbid electricity” (**James, 2010**). Yuvaraj mentioned the acronym CLOUD stands as C-Computing resources, L-that is Location independent, O-which is accessed via online means, U- used as a utility and D-on demand availability (**Yuvaraj, 2013**). Cloud computing denotes to the bigger picture using the internet to allow people to access technology-enables services. Cloud computing is mixture of data centers, infrastructure & services, innovation & technology which delivered through internet (**Tadwalker, 2009**). Cloud is a virtual server and very grim to find as end users are totally unaware that where the data is being stored (**Blokdijk and Menken,**

**2009; Kennedy, 2009).** Academic Libraries are using many cloud computing technology in its day to day operations. Web cataloguing tools offered by OCLC is the utmost bulging example where many library uploads their cataloguing records under shared resources service of OCLC under the web. Google Apps, OCLC Servies, Ex-Libris, OSS Labs, LibLime, Polaris, Dropbox and Dura space are the major examples of cloud service in academic libraries. **(Grant, 2012; Hosburgh, 2016; Adegbilero-Iwari, 2017).**

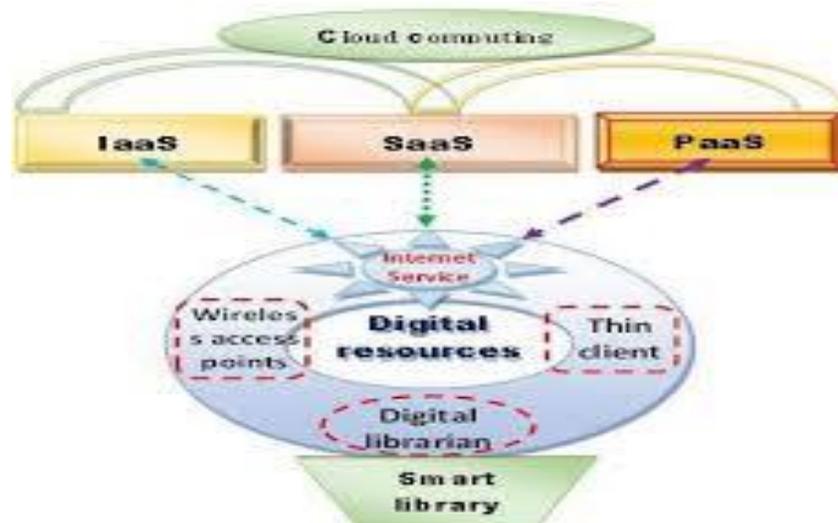
## **CLOUD COMPUTING MODELS**

As discussed by many researchers in their work regarding usefulness of cloud models in academic libraries, cloud computing services are broadly divided into the following three categories or models **(Makori 2016; Levy 2013; Fox 2009; Patel et al., 2011).**

1. **Software-as-a-Service (SaaS):** SaaS provides software or applications and associated services linking deployment and hosting of the application by the service provider to the serving clients or customers through the internet. Web-based applications like Hotmail, Google Apps and Skype and Web 2.0 solutions like Facebook, Twitter and Flickr are examples of SaaS useful in libraries and information centres.
2. **Platform-as-a-Service (PaaS):** The PaaS model offers services dealing with the development, creation, testing environment, deployment, hosting services and maintenance of software and Web-based applications. The best example of commercial cloud computing is Amazon's elastic compute cloud that allows clients to rent compute cycles on Amazon's infrastructure. This service is used in combination with the simple storage service that provides data storage services. In academic library, cloud computing applications offer free solutions such as Google Apps for information, a free online suite of tools that include Gmail for electronic mail (email) and Google Docs for documents, spreadsheets and presentations; and Microsoft's cloud service like SkyDrive. Google also provides the platform to develop and create Web applications

3. **Infrastructure-as-a-Service (IaaS).** IaaS is the best alternative for outsourcing that provides storage and computing power on scalable, flexible or elastic basis. IaaS is also known as Hardware-as-a-Service or utility computing. Google and IBM are the good examples of IaaS.

The basic structure of cloud computing with reference to smart library in contemporary information age is presented in the **figure I**. In recent information age, academic library is handling digital resources and the role of librarians has almost changed. The library needs to provide value added library services in a smart way using latest tools and techniques for maximum utilization of resources and better quality of services.



**Figure I**  
**Structure of smart library in information age (Source: Wada, 2018)**

Educational and academic institutions have a several benefit from cloud computing if implemented. As elaborated by Das, cloud computing technology can help academic institutions, particularly universities by opening their enormous research activities to businesses and industries for research improvements. The universities would be situated to handle their ever-growing resource requirements and energy cost. The university institutions would be able to teach students in new and different ways and help them manage projects and gigantic workloads; and therefore, students would be more familiar with world-wide workforce which would acquaint them to the importance of new technologies (Das, 2013).

## REVIEW OF RELATED LITERATURE

Numerous researchers/authors have contributed their research work in the area of cloud computing in library and information science profession. As a result, there are several literatures in these areas available in many forms of information resources like books, journal papers, thesis and dissertations, conference proceedings, etc. An attempt has been made to synthesize them in this paper.

**Enefu et al. (2015)** investigated the basis for the implementation of cloud computing for National Open University of Nigeria (NOUN) library services. Researchers have adopted qualitative research methodology by formation of focus group consisting five members which included the university librarian along with four information technology professionals and gathered the data. The findings reflected that NOUN library is providing service using all kind of networks. It used cloud computing in services provided to their students, it did not cover the entire student community who are located across the country. Study recommended that NOUN library must provide services through Wide Area Network (WAN) so that users of all study centers can avail the library services under common umbrella. Further they proposed hybrid cloud deployment model for multiple application of cloud computing in university library. **Pillai and Seena (2018)** discovered the application and awareness of cloud computing technology in Kerala University. In their study, they have taken view points from total 102 professional and semi-professional library personnel and collected data through survey questionnaires. The findings of the study reflected that 42.16 percent of library professional has less idea about cloud technology and majority of the professionals used Google applications in their day to day operations. Study also found that mainstream of library professionals are not aware about cloud service models and only 14.7 percent of them are aware about Web OPAC and journal discovery services. Study suggested that majority of library staff need to be trained in line with cloud computing technology in library. In the study under taken by **Adegbilero-Iwari and Hamzat (2017)** reviewed the prospect of cloud computing technology at Nigerian academic library. They have proposed Library Service Platform (LSP) as the most important gate-way for implementing this technology at Nigeria. Study recommended that for successful adoption of LSP at academic libraries of Nigeria, library authority must form the research team for LSP, assess the library work flow, review current process and apply new innovation and technology in library

operations and explore open sources tools for maximum utilization of this technology for betterment of academic libraries. **Yuvaraj (2013)** explored the application and usage of cloud technology at libraries of total 29 central universities in India. The survey tool designed and collected data from total 407 library users from all the universities. Finding revealed that 32.4 percent of library professionals has core computer literacy in terms of professional certification in computer science in addition to professional degree of library science. Almost 87 percent of library team shows willingness to provide library services through cloud. Library professionals indicated the willingness to use layers of cloud computing mainly free software, platform and infrastructure as cloud services in central university. Data security and protection of personal data are the major concerns expressed by the library professionals. He also conducted the study entitled “Problems and prospects of implementing cloud computing in university libraries: A case study of Banaras Hindu University” (Yuvaraj, 2015). This study focused on implementing and sustaining cloud technology at Banaras Hindu University Library (BHUL). Findings revealed that BHUL is providing valued added cloud based library services to its users and with the help of social media and internet the library team prepared to clench the upcoming challenges towards cloud computing in university library. **Makori (2016)** expressed concern that library and information centres in Kenya faced abundant operation needs due to stiff economic situation. Further he suggested that cloud computing is progressively thrust as the best means to handle and support the delivery of services in library and information centres of the region. Similar study conducted by **Majhi et al., (2015)** of total 17 university libraries of Odisha state in India. Total 56 library professional contributed in the structure survey of these universities. The result indicated that usage of cloud in library operations and services were not significant. Total 75 percent the library professionals used basic cloud services for their personal purposes and 42 percent used this technology for providing library services. They have also shown deep interest to use this technology in library services and operations as they believed that by applying cloud technology it will reduce the overall cost of library and easy collaboration. The study accompanied by **Mavodza (2012)** discussed impact of cloud computing technology in future libraries. Findings emphasised that most of the libraries are using cloud technology in operations mainly library catalogues, WorldCat, Google, aggregated subject gateways, D-space, FEDORA and by using such services library can abridge many issues like storing space and several related challenges. **Han (2013)** addressed the gap in integrating IaaS level and discussed the Amazon

EC2 tools for monitoring library resources. Further he shared his experience of cloud storage services Amazon S3 and Google Cloud Service (GCS) in context to library services. In context of library instruction through cloud, **Koury and Jardine (2013)** emphasised that cloud technology can be useful for library in terms of sharing library content, forming tutorials, collaboration, scheduling and storage. Further they discussed various applications on cloud computing used at Idaho State University with reference to library instruction. **Okai et al. (2014)** discussed the reasons for the slow rate of implementation of cloud computing in the universities of developing countries. Study highlighted the major challenges and strategic guidelines in context to security and privacy, reliability of cloud service providers, and road map for successfully implementing cloud models. This model was successfully tested at renowned Asia Pacific University of Technology and Innovation (APU) in Malaysia. In the roadmap proposed by successful adoption of cloud computing in university library they have proposed seven stages which includes: planning, choosing the right deployment model, choosing the most suitable service models, vendor selection, negotiating the service level agreement, migration, and integration. **Wada (2018)** undertaken study on implementing cloud computing in libraries. In his study he emphasised that digital resources, internet service, thin client architecture, wireless access point and digital librarian are the major prerequisites for cloud computing deployment and transform library into smart library. **Wu et al. (2013)** proposed framework to explore the root causes of internal cloud services of university system. In the model they stress on decision making trial and evaluation laboratory (DEMATEL) with technology acceptance model (TAM). Study has tested this model in post-implementation period at university located in central Taiwan with regard to internal cloud services. Study suggested for staff training, organize workshop and prepare user friendly handbook for enhancement of cloud services in case university.

Most of the above stated studies admit the importance of the cloud computing application in university or academic library for maximum utilization of library resources and also taking benefits from other digital resources where content is not located in local server but patrons of university library can access these resources using cloud technology.

## **OBJECTIVES OF THE STUDY**

Following are the major objectives of the study

1. To Study the awareness of cloud based library services among patrons
2. To explore the cloud based library services offered by respondent libraries
3. To identify the opinion about effectiveness of cloud computing from professionals and patrons
4. To determine the purpose of using cloud computing services of library among library patrons
5. To discover the areas of using cloud computing services within library operations by library personnel

## **SCOPE OF THE STUDY**

Under this study, researchers have identified total three private university libraries located in the Gujarat state of India. The purpose of selecting these universities mainly, are all thee universities offer major disciplines of programs and is renowned in the region. These university libraries have sound library ICT environment with facility of central library along with departmental libraries of each disciplines. These libraries operates with library management software, using wide-ranging information and communication technology and in addition to print resource libraries have subscribed various online digital databases, e-books & e-journals related to their core disciplines and also provide modern library services to their patrons.

Also these universities are assessed by National Assessment and Accreditation Council – NAAC (Govt. of India) and have received high score/grade under the evaluation criteria's of quality of teaching learning process, infrastructure & learning resources, innovation & research, and institutional values & best practice.

As there are few studies made on applications of cloud technology in university or academic libraries in south and central region of India, but did not find any concrete work in the western region of the country, hence the researchers have selected highly progressed Gujarat state situated in the western region of India to explore the status of cloud computing in university libraries.

The basic details/profile of these three university libraries considered under the study are shown in Table I.

**Table I**  
**Profile of Selected University library**

<b>Name of the University</b>	<b>Year of Est.</b>	<b>Discipline/program offered by the University</b>	<b>Collection</b>
Ganpat University	2005	Engineering & Tech.; Pharmacy; Management; Science; Computer Science; Humanities; Social Science; Skill Dev.; Architecture & Design (UG, PG, and Doctoral programs)	145000+
CHARUSET University	2009	Engineering & Tech.; Computer Sc.; Management; Applied Sc.; Pharmacy; Physiotherapy; Nursing, and Paramedical Science. (UG, PG, and Doctoral programs)	59000+
Marwadi University	2016	Engineering; Science; Architecture; Management; Commerce; Pharmacy; Law; Agriculture and Computer Science. (UG, PG, PG Diploma, Doctoral programs)	50000+

## **RESEARCH METHODOLOGY**

Researchers have selected three renowned university libraries under study. All the three universities have huge central library attached to department libraries which is devoted to each disciplines offered under each university. Central library is responsible for collection development & policy, using ICT and provide innovative library services. Considering the core objectives of the study, researchers have designed and prepared two sets of close ended structured survey questionnaires: one for library staff who are performing senior position in university library and second one for the library users who are post graduate, research scholars and faculty members of the university and regular users of the library and collected the data. Before collecting the data, researchers have discussed with fellow professionals about set of questions and incorporated their valuable inputs for getting right direction. The researchers visited the respective university libraries and physically distributed the questionnaires and

collected the data in the month of March 2019. After collecting the data from the survey, researchers have analysed/interpreted the data using MS-Excel program.

## **DATA ANALYSIS AND FINDINGS OF THE STUDY**

### **Distribution of questionnaires and response received**

Table II indicates that total 225 questionnaires were sent to library users who are the under graduate, post-graduate, research scholars and faculty members of the universities and frequent users of libraries and total 210 questionnaires were returned yielding response rate of 93.33 %. Total 15 questionnaires were distributed to professional library staff and all 15 questionnaires were received back with 100% response rate. Overall, out of total sample of 240 questionnaires distributed, 225 questionnaires were returned back with total response rate of 93.75%.

**Table II**  
**Distribution of questionnaires sent and response received**

<b>User's Category</b>	<b>No. of Questionnaires Sent</b>	<b>No. of Questionnaires received</b>	<b>Percentage (%)</b>
Library Staff	15	15	100%
Library Users	225	210	93.33%
<b>TOTAL :</b>	<b>240</b>	<b>225</b>	<b>93.75%</b>

### **Demographic details and library usage pattern**

Table III shows the brief detail of respondent's demographics in terms of gender, age, education qualification and professional experience. It also shows the library usage pattern in terms of frequency of visit and purpose of visiting university library. It is observed that majority of 145 (64.44%) are male and 80 (35.56%) are the female respondents under gender category. With regards to age group, total 174 (77.33%) of respondent fall under 20 to 30 years of ages, followed by age ranges 41 to 50 (9.78%) ; age ranges 31 to 40 (9.33%) and more than 50 years (3.56%) respectively. Library staff is professionally qualified and most of the staff (93.33%) has obtained master degree in LIS Professional and also it is found that almost 60% of the staff has received additional certification in computer science. Most of the library staff (53.33%) has up to

five years of library experience followed by 6-10 years (20%); 11-15 years (13.33%) and 12.34% of the staff has experience up to more than 16 years respectively.

**Table III**  
**Demographic details & library usage pattern**

<b>Demographic Details:</b>		<b>No. of Respondents</b>	<b>Percentage (%)</b>
Library Staff	Librarian	3	20
	Dy./Asst. Librarian	3	20
	Professional/Technical Assistant	3	20
	Library Assistant	6	40
	<b>Total :</b>	<b>15</b>	<b>100</b>
Library Users	UG Students	61	29.05
	PG Students	107	50.95
	Research Scholars	18	8.57
	Faculty members	24	11.43
	<b>Total:</b>	<b>210</b>	<b>100</b>
Gender	Male	145	64.44
	Female	80	35.56
Age	20-30 Years	174	77.33
	31-40 Years	21	9.33
	41-50 Years	22	9.78
	More than 50 years	8	3.56
Professional Qualification of Library Staff	M.L.I.Sc.	14	93.33
	Ph. D	1	6.67
	Additional Certification in Computer Science	9	60
Professional Experience of Library Staff	0-5 Years	8	53.33
	6-10 Years	3	20
	11-15 years	2	13.33
	16-20 years	1	6.67
	More than 20 years	1	6.67

<b>Library usage pattern:</b>			
Frequency of Library Visit	Daily	75	35.71
	Alternate days	60	28.57
	2-3 times in week	54	25.71
	Weekly	21	10
Purpose of Visit Library*	Improve knowledge	165	78.57
	Core study	123	58.57
	Job/Career enhancement	75	35.71
	Recreation	12	5.71
*multiple choices given by respondents (n=375)			

With reference to library usage pattern, most of the users (35.71%) visits the university library on daily basis followed by 28.57% on alternate days, 25.71% on 2 to 3 times in week and 10% on weekly basis. It is also witnessed that library users assess the library for multiple purposes. It is found that user visit the library for enhancing knowledge (78.57%) followed by for core academic study purpose (58.57%), for career enhancement (35.71%) and only few users visit the library for the recreation purpose.

### **Awareness of cloud computing:**

Table IV reflected the awareness of cloud computing technology in library among library personnel and library users. It is revealed that almost 80% library staff is fully aware about importance of cloud computing technology in library whereas only 20% library staff is not aware about this technology. Also it is observed that majority of library users are (78.57%) aware about usefulness of cloud and minor users (21.43%) are not fully aware about the importance of this technology. All the libraries under the study have developed and maintained website/web portal for library users. Overall 78.67% of respondents including library staff and library users are aware about cloud computing technology in library.

**Table IV**  
**Awareness of cloud computing**

<b>Response</b>	<b>Library Staff</b>	<b>Library Users</b>	<b>Total</b>
Aware	12 (80%)	165 (78.57%)	177 (78.67%)
Not Aware	3 (20%)	45 (21.43%)	48 (21.33%)
<b>Total:</b>	<b>15 (100%)</b>	<b>210 (100%)</b>	<b>225 (100%)</b>

### Cloud based library services

It is observed from the table V that both library personnel and library users are using multiple cloud base technology in library services.

**Table V**  
**Cloud based library services**

<b>Cloud Services*</b>	<b>Leading Service Providers</b>	<b>Library Staff</b>	<b>Library Users</b>	<b>Total</b>
E-Mailing Services	Yahoo	4 (26.67%)	30 (14.29%)	34 (15.11%)
	Gmail	12 (80%)	204 (97.14%)	216 (96%)
	Others	2 (13.33%)	12 (5.71%)	14 (6.22%)
Social Networking	Facebook	14 (93.33%)	201 (95.71%)	215 (95.56%)
	WahtsApp	14 (93.33%)	198 (94.29%)	212 (94.22%)
	Twitter	3 (20%)	51 (24.29%)	54 (24%)
Video Services	YouTube	10 (66.67%)	108 (51.43%)	118 (52.44%)
	Vimeo	5 (33.33%)	25 (11.90%)	30 (13.33%)
File storages & Sharing	Google Drive	10 (66.67%)	138 (65.71%)	148 (65.78%)
	Dropbox	6 (40%)	52 (24.76%)	58 (25.78%)
	SHAREit	2(13.33%)	9 (4.29%)	11 (4.89%)
Information & Data Collection services	SurveyMonkey	6 (40%)	57 (27.14%)	63 (28%)
	Google forms	9 (60%)	78 (37.14%)	87 (38.67%)
Event Calendar	Google Calendar	3 (20%)	57 (27.14%)	60 (26.67%)
	Doodle	2 (13.33%)	14 (6.67%)	16 (7.11%)
Online presentation	Slideshare	3 (20%)	48 (22.86%)	51 (22.67%)
Online file editing Service	Googledoc	10 (66.67%)	39 (18.57%)	49 (21.78%)
Online Image store	Picasa	2 (13.33%)	33 (15.71%)	35 (15.56%)
*multiple choices given by respondents				

Majority of the respondents are using Gmail service (90% of library staff and 97.14% of library users) offered by Google in mailing services. It is observed that maximum respondents in both categories are using Facebook and WhatsApp social networking platform. For data storage and sharing 65.71% of library users and 66.67% of library staff is using Google drive followed by Dropbox and Shareit. It is found that for data collection library staff preferred to use Google Form (60%) and 40% of them are using Survey Monkey, whereas library users are not much aware of both the tools and 37.14% and 27.14% using Google forms and Survey Monkey respectively. Both categories of users are not much aware about online image storage. 22.67% of total respondents are using Slideshare for online presentation.

### **Use of devices for cloud computing**

The table VI shows the devices used by library personnel and library users for using cloud technology in library. Data reflected that respondents used multiple devices for cloud computing, majority of 80% of library staff is using Desktop followed by Laptop, mobile phones, smartphones, tablets & iPads. Whereas 65.71% of library users use Laptop, 60% of desktop and 31.43% of library users used smartphone, tablet & ipads.

**Table VI**  
**Use of devices for cloud computing**

<b>Response*</b>	<b>Library Staff</b>	<b>Library Users</b>	<b>Total</b>
Desktop	12 (80%)	126 (60%)	138 (61.33%)
Laptop	3(20%)	138 (65.71%)	141 (62.67%)
Mobile phones	3(20%)	54 (25.71%)	57 (25.33%)
Smartphone, Tablets & iPads	3(20%)	66 (31.43%)	69 (30.67%)
*multiple choices given by respondents (n=405)			

### **Usefulness of cloud based library services**

The table VII indicates that library personnel agreed that application of cloud base technology are useful in providing library services and total 95.71% of library users also expressed same opinion about usefulness of cloud based library service. Few library users stated that cloud technology is not helpful in library services.

**Table VII**  
**Usefulness of cloud based library services**

<b>Response</b>	<b>Library Staff</b>	<b>Library Users</b>	<b>Total</b>
Yes	15 (100%)	201 (95.71%)	216 (96%)
No	NIL	9(4.29%)	9 (4%)
<b>Total:</b>	<b>15 (100%)</b>	<b>210 (100%)</b>	<b>225 (100%)</b>

**Purpose of using cloud computing services by library users**

Table VIII revealed that library users are using library for multiple purposes of cloud services. Total 72.86% of users use reference services offered by library and 70% and 65.71% of the library user’s use for reading journals articles and accessing online databases for research reports, thesis respectively. It is also observed that 48.75% of the library users accessed current literatures through federated search engine. Few library users use cloud service for knowing about up-coming publications.

**Table VIII**  
**Using cloud computing services by library users**

<b>Services*</b>	<b>Library Users Response</b>
Reading articles from global journals	147 (70%)
Search current literatures using federated search Engine	102 (48.57%)
Reference service offered by library	153(72.86%)
Forth coming publications	27 (12.86%)
Getting latest information from academic world	75(35.71%)
Accessing online databases for research articles, reports, thesis etc.	138 (65.71%)
*multiple choices given by respondents (n=642)	

## Areas of using cloud computing services by library staff

Researchers have explored with library personnel and examined few questions about areas where cloud computing services they are using in the library operations. Table IX indicates that majority of 80% of library personnel use cloud technology in technical work mainly in classification and cataloguing of library resources. Data import and export is also one of the important areas where 66.67% of library staff use this technology followed by 60% each for acquisition, online resources and back-up areas respectively. It is expressed by library personnel that 53.33% of them are using cloud technology in storage data files and 33.33% use in working with LMS.

**Table IX**  
**Areas of using cloud computing services by library staff**

<b>Areas*</b>	<b>Library Staff Response</b>
Classification and Cataloguing	12 (80%)
Acquisition	9 (60%)
Clouse based on online resources	9 (60)
LMS – Library Management Software	5 (33.33%)
Storage of Data & Files	8 (53.33%)
Back up	9 (60%)
Data import and export	10 (66.67%)
*multiple choices given by respondents (n=62)	

## Overall satisfaction from cloud computing services

Researchers have attempted to take fair opinion in terms of improving services and overall satisfaction by using cloud technology in the university libraries. Table X depicts that preponderance of 73.33% of library personnel and 94.29% of library users expressed that implementation of cloud computing in university library enhanced library services. With regards to overall satisfaction, most of the library users (87.14%) are satisfied and 12.86% expressed that they need more from library in terms of cloud technology. Total 66.67% library personnel are satisfied with existing cloud technology used in the library.

**Table X**  
**Overall satisfaction from cloud based library services**

<b>Response</b>	<b>Library Staff</b>	<b>Library Users</b>	<b>Total</b>
<b>Enhanced Lib. Services:</b>			
Yes	11 (73.33%)	198 (94.29%)	209 (92.89%)
No	4 (26.67%)	12 (5.71%)	16 (7.11%)
<b>Overall Satisfaction:</b>			
Yes	10 (66.67%)	183 (87.14%)	193 (85.78%)
No	5 (33.33%)	27 (12.86%)	32 (14.22%)

### **Training needs & IT support for cloud computing services**

Researchers have explored and examined library personnel about availability of specific IT team for managing and supporting cloud based technology in library. Table XI indicates that almost 73.33% of respondent expressed that university authority deputed skilled IT team for this task. Training is a significant bustle for enhancement of professional skill. Majority of library staff (93.33%) expressed the opinion about requirement of training for improvement in delivering value added cloud services to library users.

**Table XI**  
**Training needs and IT support for cloud based library services**

<b>Response</b>	<b>Library Staff</b>
<b>Availability of skilled IT team:</b>	
Yes	11 (73.33%)
No	4 (26.67%)
<b>Training needs for library personnel:</b>	
Yes	14 (93.33%)
No	1(6.67%)

## **Data security and privacy of cloud computing services**

Data security and privacy are the major concerns while using cloud technology. It is found that majority of total 46.67% of library personnel and 95.71% of library users suggested that online data storing is safe in cloud and major library staff (53.33%) stated that data storage is unsafe and there is a possibility of misuse of stored data in cloud computing.

## **FINDINGS AND RECOMMENDATIONS**

As an outcome of careful examination of data obtained for the current study, the researchers observes the following facts about the Application of Cloud Computing in selected university libraries of Gujarat:

- Total 225 respondents comprised Library staff and Library user's i.e PG Students, research scholars and faculty members of the target universities participated in the structured survey.
- Majority of total 78.67% of the respondents are aware about cloud technology whereas still 21.33% may use this technology but are not fully aware about it.
- It is observed that respondents are using more of social networking and email service of cloud, and less of professional services of cloud like data collection services offered by Google forms and SurveyMonkey, File sharing services from Dropbox and SHAREit etc. Here, we must note that university library authority need to focus more to create awareness of such professional services available through cloud technology.
- From the data analysis, it is found that respondents used multiple devices and majority of them are using Laptop and Desktop devices for cloud services. 30.67% of the respondents using smartphones, tablets and iPads. University library continue to update its workstations in terms of required application software and related configuration.
- Data analysis shows that total 96% of the respondents expressed that cloud based technology are useful in library services.
- Library users visit library for multiple purposes for using cloud services. 65.71% of them used for accessing online databases, 70.86% of the library users visit the library for reference and information services. The university library continue to provide such services which must be appreciated by library users.

- Library personnel are using cloud service in their routine operations. Majority of the staff is using for classification and cataloguing work followed by acquisition and federated online search of resources. Library staff must be trained with latest cloud technology and benchmark their library with similar library who are performing efficient library services with help of cloud technology.
- Total 85.78% of the respondents are overall satisfied with cloud services provide by library and majority of them agreed that cloud technology enhanced library services.
- Library staff expressed that they received positive IT support from their authority and skilled manpower is available for providing and continuing cloud based services. It is revealed that total 93.33% library staff stated that professional training or workshop is required for updating latest trends in cloud technology for maximum utilization of library resources and provide library services based on the expectation from library users.
- University library must prepare and deliver detailed orientation on cloud based library electronic services for all the users. Also library must organize periodic workshops/talk/demonstration on cloud services with help of leading service providers/experts for effective use of such technology.

## **CONCLUSION**

As due to global change and challenges, the library users are expecting more from the university library. The ICT has been changed many accomplishments of the academic libraries from the digital contents providers than print resources. Certainly, technology helped the library professionals and transformed contents in to the digital form and made it available through networked environment. Cloud computing are more helpful for the easy storage and can access it globally in the networked environment. Application of cloud technology in academic library will reduce the cost and users precious time. It is our prime responsibility to work pro-actively and acquire new technology and skill to enhance library service. We have to make sure to transform our library users and library personnel to use wide variety of cloud services from personal to professional level.

Researchers have considered only three private university libraries in Gujarat, India. Further research can take with wide scope to add federal/government aided universities in the state with special reference to problems face by the library professionals in application/adoption of cloud technology in university libraries.

## References

Adegbilero-Iwari, I. and Hamzat, S. A. (2017). Library Services Platform Path to Cloud Computing Adoption in Nigerian Academic Libraries: A Review. *Library Philosophy and Practice (e-journal)*. 1658. <https://digitalcommons.unl.edu/libphilprac/1658>

Adegbilero-Iwari, I. (2017). Library services platform: Are Nigerian libraries ready for change? [Blog post] Retrieved from <https://goo.gl/7VsUId> (Accessed on 17<sup>th</sup> July 2019)

Blokdijk G. and Menken I. (2009). Cloud Computing - The Complete Cornerstone Guide to the Cloud Computing Best Practices: Concepts, Terms, and Techniques for Successfully Planning, Implementing and Managing Enterprise IT Cloud Computing Technology. Brisbane: Emereo Retrieved from: [http://www.ebooksx.com/Cloud-computing-The-CompleteCornerstone-Guide-to-Cloud-Computing-Best-Practices-Concepts-Terms-&Techniques\\_312071.html](http://www.ebooksx.com/Cloud-computing-The-CompleteCornerstone-Guide-to-Cloud-Computing-Best-Practices-Concepts-Terms-&Techniques_312071.html) (Accessed on 17<sup>th</sup> July 2019)

Breeding, M. (2012). Cloud computing for Libraries. Chicago: *ALA Tech source*, 1–8

Das K.C. (2013). Impact of Cloud computing in library services. Retrieved from: [http://library.kiit.ac.in/pdf/pdf\\_presentation/Impact\\_of\\_Cloud\\_Computing\\_on\\_Library\\_Services.pdf](http://library.kiit.ac.in/pdf/pdf_presentation/Impact_of_Cloud_Computing_on_Library_Services.pdf), (Accessed on 17<sup>th</sup> July 2019)

Dhanavandan, S. and Tamizhchelvan, M. (2014). Role of Information Technology in Academic Libraries: Personal Computer to Cloud Computing. *International Journal of Advanced Library and Information Science*, 2(1), 62-71

Enefu O. M.; Gbaje E. S. & Aduku B. S. (2015). The Adoption of Cloud Computing Technology for Library Services in the National Open University of Nigeria Library. *The Information Manager*, 15(1-2), 22-32

Etro, F. (2009). The economic impact of cloud computing on business creation, employment and output in the E.U. *Review of Business and Economics*, 54 (2), 179-208

Fox, R. (2009). Library in the clouds. *OCLC Systems & Services: International digital library perspectives*, 25 (3), 156-161

Grant, C. (2012). The future of library system: Library services platform. *Information Standards Quality*, (24)4, 1-13

Goldner, M. (2010). Winds of Change: Libraries and Cloud Computing. *Multimedia Information and Technology*, 37 (3), 24-28

Han, Y. (2013). IaaS cloud computing services for libraries: cloud storage and virtual machines. *OCLC Systems & Services*, 29 (2), 87-100

Hayes, B. (2008). Cloud computing. *Communications of the ACM*, 51 (7), 9-11

Hosburgh, N. (2016). Approaching discovery as part of a library service platform. **In** K. Varnum (Ed.), *Exploring Discovery: The Front Door to your Library's Licensed and Digitized Content*. (pp. 15-25). Chicago, IL: ALA Editions

James, R. (2010). Records management in the Cloud? *Business Information Review*, 27(3), 179-189

Kennedy, D. (2009). Working in the Cloud: Tips on success With Online Software Services. *ABA Journal*, Technology Column, 31

Koury, R. and Jardine, S. J. (2013). Library instruction in a cloud: Perspectives from the trenches. *OCLC Systems & Services*, 29 (3), 161-169

Levy, R. (2013). Library in the Cloud with Diamonds: a critical evaluation of the future of library management systems. *Library Hi Tech News*, Number 3, 9-13

Majhi S; Meher S. & Maharana B. (2015). Awareness and usage of Cloud Computing Application among LIS Professionals: A case study of 17 Indian University Libraries. *Library Philosophy and Practice (e-journal)*. 1280. Retrieved from: <http://digitalcommons.unl.edu/libphilprac/1280>

Makori, E. O. (2016). Exploration of cloud computing practices in university libraries in Kenya. *Library Hi Tech News*, Number 9, 16-22

Mavodza, J. (2013). The impact of cloud computing on the future of academic library practices and services. *New Library World*, 114, (3-4), 132-141

Mell, P. and Gance, T. (2011). The NIST definition of cloud computing. Retrieved from: <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf> (Accessed on 17<sup>th</sup> July 2019)

Mohsenzadeh, F. and Isafanyari-Moghaddam, A. (2009). Application of information technologies in academic libraries. *The Electronic Library*, 27(6), 986-998

Okai S.; Uddin M.; Arshad A. and Shah A. (2014). Cloud computing adoption model for universities to increase ICT proficiency. *SAGE Open*, July-September, 1-10 Retrieved from: <https://journals.sagepub.com/doi/full/10.1177/2158244014546461>, (Accessed on 16<sup>th</sup> July 2019)

Patel A.; Seyfi A.; Tew Y. & Jaradat, A. (2011). Comparative study and review of grid, cloud, utility computing and software as a service for use by libraries. *Library Hi Tech News* Number 3, 25-32

Pillai, S. K. G. and Seena, S.T. (2018). Library Professionals' Adoption of Cloud Computing Technologies: A Case Study on Kerala University Library, India. *Library Philosophy and Practice (e-journal)*. 1832. <https://digitalcommons.unl.edu/libphilprac/1832>

Tadwalkar, S. (2009). Cloud Computing- still a long way to go. Retrieved from: <https://www.fibre2fashion.com/industry-article/4552/cloud-computing-still-a-long-way-to-go> (Accessed 27<sup>th</sup> July 2019)

Tuncay, W. (2010). Effective use of cloud computing in Educational Institution. *Procedia-Social and Behavioral Sciences*, 2, (2), 938-942

Wada, I. (2018). Cloud computing implementation in libraries: A synergy for library services optimization, *International Journal of Library and Information Science*, 10, (2), 17-27

Wu W.; Lan L.W. & Lee, Y. (2013). Factors hindering acceptance of using cloud services in university: a case study. *The Electronic Library*, 31(1), 84-98

Yuvaraj, M. (2013), Cloud computing applications in Indian central university libraries: a study of librarians' use. *Library Philosophy and Practice (e-journal)*, 992  
<http://digitalcommons.unl.edu/libphilprac/992>

Yuvaraj, M. (2015). Problems and prospects of implementing cloud computing in University libraries: A case study of Banaras Hindu University library system. *Library Review*, 64 (8-9), 567-582