

## INFORMATION SERVICE DELIVERY IN UNIVERSITY LIBRARIES: THE ROLE OF CLOUD COMPUTING APPLICATIONS

**Ali Ibrahim MAFI**

Department of library and information science  
Federal University of Technology, Minna  
[mafii1992@gmail.com](mailto:mafii1992@gmail.com) +2348061694773

**Fatimah Jibril ABDULDAYAN (PhD, CLN)**

Department of library and information science  
Federal University of Technology, Minna

AND

**Amina Gogo TAFIDA (PhD)**

General studies Department, Federal University of Technology, Minna  
[tafidagogo@gmail.com](mailto:tafidagogo@gmail.com) +2348030408982

### **Abstract**

*The advent of cloud computing has revolutionised information service delivery in university libraries thereby offering unprecedented scalability, flexibility, and cost-effectiveness. This paper explores the concept of and types of information services delivery in university libraries, the concept of cloud computing applications, and cloud computing service models such as software-as-a-service (SaaS), platform-as-a-service (PaaS), and infrastructure-as-a-service (IaaS) models. In addition, its benefits such as scalability and cost efficiency, data management and preservation, collaborative tools and resource sharing, as well as digital preservation and archiving, were highlighted. By analyzing existing literature and empirical studies, the research identified significant benefits, including reduced financial wastage on IT investments and improved user experiences. However, challenges such as security, privacy, and limited accessibility remain prevalent. This study aims to bridge the knowledge gap regarding the integration of cloud computing in university libraries, where traditional practices often hinder effective information service delivery. The findings underscore the necessity for strategic implementation of cloud technologies to optimize resource utilisation and enhance user satisfaction. Ultimately, this paper contributes to the ongoing discourse on technological integration in academic libraries by providing insights that can inform future research and development initiatives.*

**Keywords:** Information, information service delivery, University libraries, and cloud computing application.

### **Introduction**

Information service delivery encompasses the process of distributing targeted content or applications to users through a range of systems or devices. Information service delivery is central to library operations and services. Therefore, it involves the processes and activities libraries use to provide users with information services and resources, ultimately aiming to support and improve their activities and productivity (Haruna, 2022). This process ensures that users receive relevant information in an accessible and efficient manner. Information itself can be understood as processed data that offers meaning and context, guiding actions and decisions (Abduldayan, 2021). Within the context of university libraries, information includes a wide range of resources such as books, journals, databases, and multimedia materials. As user needs

evolve and technological advancements progress, university libraries face the challenge of adapting their information services to remain relevant and effective.

A significant advancement in this realm is the integration of cloud computing. Modern university libraries are increasingly leveraging cloud computing to enhance their information services by offering improved scalability, flexibility, and cost-effectiveness. Cloud solutions streamline operations, reduce IT costs, and facilitate remote access to resources, addressing issues like system crashes and data loss (Okwoli *et-al.*, 2016). However, challenges such as security, privacy concerns, and limited accessibility remain significant barriers. This paper explores how cloud computing applications are transforming information service delivery in university libraries by highlighting both the potential benefits and ongoing challenges.

### **Problem Statement**

The rapid evolution of technology has fundamentally altered the landscape of information acquisition, processing, access, utilization, and dissemination within library settings. In university libraries, the efficacy of information service delivery hinges upon the seamless integration of technology and the availability of diverse resources tailored to meet users' information needs. While the potential of cloud computing applications in enhancing information service delivery is recognized, there exists a notable gap in understanding how these technologies can be effectively implemented to address existing challenges.

This research aims to investigate the role of cloud computing applications in improving information service delivery in university libraries, by identifying both the benefits and challenges associated with their implementation.

### **Literature Review**

Information service delivery is multifaceted, encompassing various strategies, technologies, and resources to address the diverse information needs of their users. Traditionally, services such as reference assistance, circulation, and interlibrary loan have been foundational components, with reference librarians providing expert guidance in information retrieval and research. These services are outlined by Dalia (2018); Adamu, Babalola, and Saka (2019); Alabi and Sani, (2021) also include circulation services, interlibrary loan services, and others like Current Awareness Services (CAS) and Selective Dissemination of Information (SDI). According to Ranjan (2023), information services encompass a broad scope with a central focus on delivering information to users. The author categorizes these services into two main types. Responsive information services include reference services, which help users locate and utilize information sources; referral services, which direct users to additional resources or experts; and literature search services, which involve systematic searches for relevant literature. Anticipatory information services, on the other hand, comprise current awareness services, which keep users updated on recent developments; document delivery services, which provide access to specific documents upon request; and selective dissemination of information, which delivers tailored content based on users' predefined interests.

With technological advancements, these services have transitioned into digital formats, leveraging electronic databases, e-journals, and integrated library systems (ILS) to enhance accessibility and discoverability. Furthermore, online reference services have emerged and are facilitating remote access to reference assistance, while instruction and information literacy programme empower users with critical research skills.

Cloud computing is the latest revolution in the field of information and communication technology (ICT) which brings some unimaginable services that ease people's transactions and extremely enhance information services delivery. Cloud computing is defined as the provision of various services over the Internet, including servers, storage, databases, networking, software, and analytics (Microsoft Azure, 2019). Swapna and Biradar (2017) breaks down the elements of cloud computing as follow: C for cloud computing resources for information service delivery, L for location independence, O for online accessibility, U for utility usage, and D for on-demand availability. Pillai and Seena (2018) emphasized the necessity for cloud computing services to be massively scalable to qualify as true cloud computing. The authors further expressed the view with regard to how cloud computing is different from other computing and its advantages to libraries. Academic libraries are using many cloud computing technologies 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 (Hosburgh, 2016; & Adegbilero-Iwari, 2017). Librarians find cloud computing as helpful enough in protecting and preserving their data and privacy thereby improving information service delivery. Libraries adopt cloud technology for easy access to e journals by hosting sister digital libraries tracking statistical data among others (Suman and Parminder, 2016). In cloud computing, shared resources, software, and information are provided to remote clients over a network.

### **Cloud Computing Services Models**

Cloud computing services in academic libraries are broadly categorized into “Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and Infrastructure-as-a-Service (IaaS) models” (Makori, 2016 and Suman *et al.*, 2023).

**Software-as-a-Service (SaaS)** - delivers software applications and associated services to users over the internet eliminate the need for local installation and maintenance. Examples include, web-based applications like Hotmail, Google Apps, and Skype, as well as Web 2.0 solutions like Facebook, Twitter, and Flickr (Chudasma *et al.*, 2019). Moreover, Microsoft Office365 and Salesforce are also part of the example (Patel & Kansara, 2021). In the context of libraries and information centres, SaaS facilitates accessibility and usage of various software tools and platforms. Characteristics outlined by Mohammed and Zeebareec (2021) include continuous access to services, hosting applications in third-party premises, and availability of services through web interfaces. SaaS prioritizes end-user convenience, while PaaS suits application development needs.

In the vast landscape of software as a service (SaaS), Facebook, Twitter, Instagram, YouTube, and WhatsApp emerges as a fascinating examples, not only as a messaging apps but as a paradigm of cloud-based service delivery. The integration of cloud-based applications like Facebook, Twitter, Instagram, YouTube, and WhatsApp into university libraries exemplifies the transformative impact of cloud computing on information service delivery. Cloud-based social apps can be applied to university libraries in three ways which include, “Information distribution, Knowledge organization and Information communication” for effective service delivery (Agu, *et al.* 2022). These platforms, operating under the SaaS model, facilitate a range of activities from real-time communication to multimedia content sharing thereby enhancing the library's ability to engage with its community and deliver effective support.

**Platform-as-a-Service (PaaS)** - Provides a comprehensive suite of services for the development, testing, deployment, and maintenance of software and web-based applications. Notable examples include Amazon's Elastic Compute Cloud (EC2), which allows clients to lease computing resources and Google Apps, which offer a range of productivity tools such as Gmail and Google Docs. PaaS offerings support academic libraries by furnishing cost-effective solutions for information management and collaboration. Platform as a Service (PaaS) provides all the resources necessary for building applications and services over the internet without requiring users to download or install software. PaaS services encompass application design, development, hosting, collaboration, web service integration, database integration, security, and scaling (Okike and Omali, 2023). Users manage applications and data, while the vendor manages runtime, middleware, operating system, virtualization, servers, storage, and networking (Nazir *et al.*, 2020). PaaS offers advantages such as flexibility in software installation and scalability. However, interoperability and portability among providers are limitations of PaaS.

**Infrastructure-as-a-Service (IaaS)** - furnishes scalable and flexible computing resources, including storage and processing power, on a pay-per-use basis sometimes referred to as hardware-as-a-Service or utility computing. IaaS enables organizations to outsource their infrastructure needs to third-party providers. Notable examples of IaaS providers include Google and IBM cloud, DSpace and Fedora, whose offerings empower academic institutions with the necessary computational resources for research and educational endeavours. According to Okike and Omali (2023) infrastructure as a Service (IaaS) is a cloud computing model that provides virtualized computing and network resources to users. In this model, users construct their own virtual clusters and are responsible for managing and executing their own software stack. However, users may have control over some selected network components while not having control over the entire cloud infrastructure.

### **Benefits of cloud computing associated with information service delivery**

The following are benefits offered by cloud computing application in university libraries

1. Scalability
2. Cost Efficiency
3. Flexibility
4. Interoperability
5. Collaboration
6. Data Management
7. Data Preservation
8. Resource Sharing
9. Digital Archiving and
10. Digital Preservation of information resources

The adoption of cloud computing in university libraries not only streamlines operations and reduces costs but also promotes a more collaborative, flexible, and sustainable approach to information service delivery

### **Role of Cloud Computing Application on Information Service Delivery**

Cloud computing has emerged as a transformative technology offering scalability, flexibility, and cost-effectiveness to various sectors, including academic institutions. University libraries, serving as pivotal information hubs, are increasingly adopting cloud computing applications to enhance their services, streamline operations, and improve accessibility to resources thereby making information dissemination easier. Cloud computing offers a range of services,

including data storage, resource sharing, and collaborative tools, which can significantly improve information services in university libraries. According to Ekhaguosa *et al.* (2022), the utilization of cloud computing applications among university librarians in the Niger Delta region of Nigeria has been widespread, indicating a growing awareness of its benefits. The study found that librarians frequently use cloud applications for accessing, storing, and sharing electronic resources, underscoring the importance of adequate internet infrastructure to facilitate these services. Furthermore, research by Chudasma *et al.* (2019) assessed the awareness and utilization of cloud computing services among library personnel and users in selected university libraries in Gujarat, India. The findings revealed that a significant majority of library users and staff were aware of cloud technology, with laptops being the predominant device used for accessing cloud services. This suggests a positive trend towards the adoption of cloud computing in academic libraries, although challenges related to user training and infrastructure remain.

According to Okwoli *et-al.*, (2016), with cloud computing in libraries, all sorts of financial wastages on IT investment, careless attitudes of users and technological headaches such as computer virus, system crashes and loss of data will be drastically monitored and avoided. There will likely be a significant improvement when cloud computing is adopted in delivering information services.

### **Conclusion**

The integration of cloud computing applications in university libraries represents a transformative opportunity to enhance information service delivery. By facilitating remote access to resources, reducing financial wastage, and promoting collaboration among library staff and users, cloud computing can significantly improve the overall academic experience. However, the successful implementation of these technologies requires addressing critical challenges related to security, infrastructure, and staff training. As university libraries continue to evolve in response to technological advancements, the strategic adoption of cloud computing will be essential for optimizing resource utilization and enhancing information service delivery.

### **Recommendations**

To maximize the benefits of cloud computing in university libraries, the following recommendations are proposed:

1. Invest in Infrastructure: Libraries should prioritize investments in reliable internet connectivity and IT support to facilitate seamless access to cloud-based resources.
2. Enhance Training Programmes: Comprehensive training initiatives should be implemented to improve the technological competencies of library staff by ensuring that they are equipped to support users effectively.
3. Develop Security Protocols: Libraries must establish robust security protocols to protect user data and address privacy concerns associated with cloud computing.
4. Foster Collaboration: Fostering collaboration among library staff and users can enhance information service delivery and improve the overall academic experience.
5. Establish Feedback Mechanisms: Libraries should create platforms for user feedback to continuously improve service delivery and address any challenges faced by users.
6. Promote Awareness Campaigns: Promoting awareness among library users about the available cloud services can enhance utilization and engagement.

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