PROJECT TITLE

PERCEPTION OF CLOUD COMPUTING IN UGANDA

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# **Abstract**

This study examines the perception of cloud computing among businesses and individuals in Uganda, focusing on awareness, adoption rates, benefits, and challenges. Cloud computing, which involves the delivery of computing services over the internet, has been globally recognized for its potential to enhance efficiency, scalability, and cost savings. However, in Uganda, the adoption and perception of cloud computing remain underexplored. This research employs a mixed-methods approach, combining quantitative surveys with qualitative interviews across various sectors, including information technology, education, healthcare, and small and medium-sized enterprises (SMEs).

Preliminary findings indicate a moderate level of awareness about cloud computing, primarily driven by larger organizations and international collaborations. Benefits identified include cost reduction, improved data management, and enhanced collaboration. Nonetheless, challenges such as limited internet infrastructure, data security concerns, and regulatory uncertainties hinder broader adoption. Additionally, there is a notable gap in expertise and training related to cloud technologies, further complicating implementation efforts.

The study suggests that while cloud computing holds significant potential for technological and economic advancement in Uganda, concerted efforts are needed to address infrastructural and educational barriers. Policy recommendations include enhancing internet infrastructure, providing targeted training programs, and setting up clear regulatory frameworks to foster a more conducive environment for cloud adoption. Future research should explore longitudinal impacts of cloud computing adoption and investigate sector-specific strategies to maximize its benefits.

**Keywords:** Cloud Computing, Perception, Cloud Adoption

# **CHAPTER ONE**

## **Introduction**

Cloud computing, defined as the delivery of computing services such as servers, storage, databases, networking, software, and analytics over the internet, has revolutionized the way organizations manage and use information technology. Globally, cloud computing is lauded for its potential to drive efficiency, scalability, and cost-effectiveness, enabling businesses to innovate rapidly without the constraints of traditional IT infrastructure.

In developing countries like Uganda, cloud computing offers a promising avenue for technological and economic development. The country's growing digital ecosystem, characterized by an increasing number of internet users and a burgeoning tech-savvy youth population, presents a fertile ground for cloud adoption. However, despite these favorable conditions, the adoption and perception of cloud computing in Uganda remain underexplored and not fully understood.

This study aims to fill this gap by investigating the current state of cloud computing awareness, adoption, and perception in Uganda. It seeks to identify the benefits that users perceive, the challenges they encounter, and the factors influencing their decisions to adopt or reject cloud services. By employing a mixed-methods approach that includes both quantitative surveys and qualitative interviews across various sectors—such as information technology, education, healthcare, and small and medium-sized enterprises (SMEs)—this research provides a comprehensive understanding of the landscape.

The findings of this study are expected to shed light on the unique challenges and opportunities presented by cloud computing in Uganda. For instance, while larger organizations and those involved in international collaborations may prove higher levels of awareness and adoption, smaller businesses and local institutions might face significant barriers such as inadequate internet infrastructure, data security concerns, and a lack of regulatory clarity.

Understanding these dynamics is crucial for stakeholders, including policymakers, educators, and industry leaders, to devise strategies that can facilitate the broader adoption of cloud computing in Uganda. By addressing infrastructural and educational barriers, enhancing internet connectivity, and developing clear regulatory frameworks, Uganda can better harness the transformative potential of cloud computing.

This introduction sets the stage for a detailed exploration of cloud computing in Uganda, providing context for the next analysis and discussion of findings that aim to inform and guide future technological and policy developments in the country.

## **Background**

Cloud computing has appeared as a pivotal technology in the modern digital landscape, enabling organizations to store, manage, and process data more efficiently and cost-effectively. The global proliferation of cloud computing can be attributed to its numerous advantages, including scalability, flexibility, and reduced IT costs. Major cloud service providers such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud have driven widespread adoption across various industries, easing innovation and operational efficiency.

In developed economies, the integration of cloud computing into business and governmental operations is well-advanced, contributing significantly to economic growth and technological progress. However, in many developing countries, including Uganda, the adoption of cloud computing is still in its nascent stages. Understanding the factors influencing this adoption is critical for leveraging the potential benefits of cloud technologies in these regions.

Uganda, located in East Africa, has a growing digital economy supported by increasing internet penetration and mobile phone usage. According to the Uganda Communications Commission, internet penetration in Uganda was approximately 46% in 2021, a significant increase from previous years. This growth in internet usage, coupled with a youthful population and a burgeoning tech industry, presents a favorable environment for the adoption of cloud computing.

Despite these positive indicators, several challenges impede the widespread adoption of cloud services in Uganda. Limited internet infrastructure, particularly in rural areas, remains a significant barrier. The cost of internet access is relatively high, and bandwidth is often insufficient for the reliable use of cloud services. Additionally, data security concerns and a lack of robust regulatory frameworks contribute to hesitancy among potential adopters.

Furthermore, there is a notable skills gap in cloud computing expertise. Educational institutions and training programs in Uganda are gradually incorporating cloud technologies into their curricula, but there remains a substantial need for professional development and capacity building in this area. Without adequate training and awareness, businesses and individuals may be unable to fully exploit the advantages of cloud computing.

Given these challenges, it is essential to explore the current perception and adoption of cloud computing in Uganda. This research aims to identify the benefits recognized by early adopters, the obstacles they face, and the broader socio-economic factors influencing cloud computing adoption. By understanding these dynamics, stakeholders can develop targeted strategies to promote cloud adoption, enhance digital literacy, and create a more supportive infrastructure and regulatory environment.

In conclusion, while cloud computing holds great promise for driving economic and technological advancement in Uganda, realizing this potential requires addressing significant infrastructural, educational, and regulatory challenges. This study provides a comprehensive examination of the current state of cloud computing in Uganda, offering insights that can guide future efforts to harness its benefits for national development.

## **Problem Statement**

Despite the global trend towards cloud adoption, there is limited empirical data on how cloud computing is perceived in Uganda. Factors such as internet infrastructure, cybersecurity concerns, cost implications, and awareness levels could significantly influence the perception and adoption of cloud services in the country. This study aims to bridge the gap by investigating the current perception of cloud computing among businesses, government institutions, and individual users in Uganda.

## **Purpose of the study**

The primary purpose of this study is to comprehensively assess the perception and adoption of cloud computing among various stakeholders in Uganda, including businesses, educational institutions, healthcare providers, and government agencies. This research aims to understand the current landscape of cloud computing adoption, identify the factors influencing its uptake, and explore the challenges and barriers that hinder its widespread implementation.

* + 1. **Specific Objectives**
* To evaluate the level of awareness and understanding of cloud computing technologies among different stakeholder groups in Uganda.
* To investigate the key factors that influence the decision-making process for adopting or rejecting cloud computing services, including cost considerations, data security concerns, regulatory challenges, and technical expertise.
* To examine the perceived benefits and advantages of cloud computing among early adopters in Uganda, such as improvements in operational efficiency, scalability, data management, and collaboration.
* To identify and analyze the primary barriers and challenges that impede the adoption of cloud computing, including limitations in internet infrastructure, skills gaps, regulatory uncertainties, and cultural factors.
* To provide evidence-based recommendations for policymakers, industry leaders, and educational institutions on strategies to promote cloud computing adoption in Uganda, addressing infrastructure development, regulatory frameworks, educational initiatives, and capacity building.

By achieving these objectives, the study seeks to contribute valuable insights that can inform policy decisions, guide strategic interventions, and foster a more supportive environment for cloud computing adoption. The Ultimate goal is to leverage the transformative potential of cloud computing to drive technological advancement and economic growth in Uganda.

# **CHAPTER 2**

## **Literature Review**

Literature Review will focus on the following:

* + 1. **Global Trends in Cloud Computing**

*According to* Ameer Danave A Senior Director of Marketing, *MSys Technologies,* there are five trends that are expected to witness significant traction in the forthcoming years.

* + 1. **AI As A Service (AIaaS)**

In the forthcoming years, significant growth is foreseen in the integration of AI services into cloud solutions. Cloud infrastructure plays a crucial role in opening up AI’s economic and social benefits to enterprises. Training AI models, such as the robust large language model (LLM) powering ChatGPT, demands extensive data and substantial computing resources.

Enterprises are shifting away from constructing their own AI infrastructure and opting for AI-as-a-service provided by cloud platforms. This transition allows them to harness the transformative power of AI without the constraints of managing resources. AI as a Service offers pre-built AI models, tools, and APIs hosted on cloud platforms, enabling enterprises to seamlessly implement AI functionalities, even without specialized AI expertise and infrastructure (Danave, 2024).

* + 1. **Hybrid & Multi-Cloud Strategies**

Multi-cloud and hybrid solutions have become incredibly popular among enterprises across the globe. The hybrid multi-cloud approach incorporates public cloud services from multiple providers, enabling portability across diverse cloud infrastructures. This enhances flexibility and reduces dependency on a single vendor, thus mitigating the risk of vendor lock-in.

Besides, hybrid cloud solutions offer a flexible approach to managing data storage complexities. By integrating public and private cloud environments, organizations can leverage existing infrastructure while gaining scalability, security, and redundancy. This approach optimizes storage resource allocation, strengthens disaster recovery capabilities, and fosters agility in response to evolving business requirements (Danave, 2024).

Moreover, hybrid cloud solutions provide enhanced control over IT infrastructure and bolstered security compared to alternative cloud options. Cloud vendors employ expert security professionals to ensure data protection, adhering to stringent protocols and compliance measures (Danave, 2024).

* + 1. **Edge AI Computing**

The edge computing landscape is expected to witness significant traction in the forthcoming years. In the traditional cloud model, data transfers to a remote server for processing. In contrast, edge computing establishes a compact computing environment near the data source.

This reduces latency and enables real-time analysis and decision-making. The deployment of advanced networks like 5G, along with energy-efficient processors and algorithms, is expected to further bolster edge computing’s viability for evolving application needs by 2024 (Danave, 2024).

* + 1. **Sustainable Cloud Computing**

Sustainable computing is expected to experience significant growth in the years ahead. This trend is fueled by the understanding that approximately [**1.8% to 3.9%**](https://www.sciencedirect.com/science/article/pii/S2666389921001884) of global greenhouse gas emissions stem from the information and communication technology (ICT) sector (Danave, 2024).

Green computing encompasses environmentally conscious practices across the lifecycle of computers, chips, and other technology components, spanning from design and manufacturing to usage and disposal. Its objective is to mitigate environmental impact by decreasing carbon emissions and energy consumption across all stages, including production, data centers, and end-user operations (Danave, 2024).

Additionally, green computing involves the selection of sustainably sourced materials, minimizing electronic waste, and promoting sustainability through the use of renewable resources (Danave, 2024).

* + 1. **Serverless Computing**

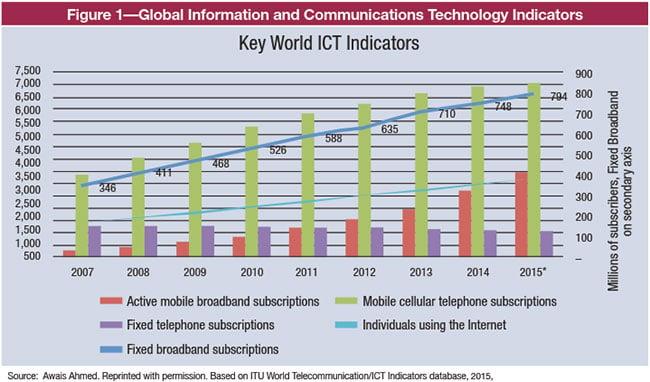
Expected to see significant expansion with a Compound Annual Growth Rate (CAGR) of [**23.17%**](https://www.mordorintelligence.com/industry-reports/serverless-computing-market) between 2023 and 2028, serverless computing brings forth novel methods for creating and operating software applications and services. This emerging paradigm eradicates the necessity of infrastructure management, empowering users to write and deploy code devoid of the complexities of underlying systems (Danave, 2024).

This transition offers numerous benefits for developers, including quicker time-to-market, improved scalability, and decreased deployment costs for new services. As a result, developers can focus on innovation rather than the intricacies of managing infrastructure (Danave, 2024).

* + 1. **Cloud Computing in Developing Countries**

According to Awais Ahmed, the number of fixed and mobile broadband subscribers, Internet users and cellular service consumers is on the rise globally.

**Figure 1** indicates positive trends in the use of broadband and mobile phone technology, while subscriptions for fixed telephone lines are decreasing (Awais Ahmed, 2017).



According to Mohammed Razi and Ali Batan, Cloud computing presents developing nations with a multitude of options, including enhanced access to technologies and services, higher productivity, and cost savings, as well as the possibility of increased economic development and the creation of new jobs. It is possible for companies to have access to enterprise-grade software and tools if they have improved access to technology and services. This may assist the organizations increase their productivity and efficiency. The delivery of essential public services like healthcare, education, and social welfare may be improved via increased efficiency and cost reductions, which can also assist bring down overall prices. The formation of new industries and enterprises, in addition to the expansion and improvement of existing ones, may help to boost economic growth and the production of new jobs. However, cloud computing presents developing nations with several obstacles, including inadequate internet infrastructure, a lack of available technological skills, and concerns over the privacy and security of stored data. Because of limited internet infrastructure, accessing cloud services, transferring data, and implementing security measures might be challenging, which can restrict the usage of cloud-based services. When it comes to setting up and maintaining cloud-based systems, as well as selecting the appropriate cloud service providers and solutions, it may be challenging for businesses that lack the technical experience. Concerns over data security and privacy may be a significant obstacle to the widespread adoption of cloud computing. This is because businesses may lack confidence in the safety of their data if it is housed on servers located in other countries (Razi & Batan, 2023).

* + 1. **The ICT Landscape in Uganda**
    2. **Cloud computing Definition**

Cloud computing is the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the internet (“the cloud”) to offer faster innovation, flexible resources, and economies of scale. You typically pay only for cloud services you use, helping you lower your operating costs, run your infrastructure more efficiently, and scale as your business needs change (Microsoft, 2024).

* + 1. **Top benefits of cloud computing**

Cloud computing is a big shift from the traditional way businesses think about IT resources. Here are seven common reasons organizations are turning to cloud computing services:

* **Cost**

Moving to the cloud helps companies optimize IT costs. This is because cloud computing eliminates the capital expense of buying hardware and software and setting up and running onsite datacenters—the racks of servers, the round-the-clock electricity for power and cooling, and the IT experts for managing the infrastructure. It adds up fast (Microsoft, 2024).

* **Speed**

Most cloud computing services are provided self service and on demand, so even vast amounts of computing resources can be provisioned in minutes, typically with just a few mouse clicks, giving businesses a lot of flexibility and taking the pressure off capacity planning (Microsoft, 2024).

* **Global scale**

The benefits of cloud computing services include the ability to scale elastically. In cloud speak, that means delivering the right amount of IT resources—for example, more or less computing power, storage, bandwidth—right when they’re needed, and from the right geographic location (Microsoft, 2024).

* **Productivity**

Onsite datacenters typically require a lot of “racking and stacking”—hardware setup, software patching, and other time-consuming IT management chores. Cloud computing removes the need for many of these tasks, so IT teams can spend time on achieving more important business goals (Microsoft, 2024).

* **Performance**

The biggest cloud computing services run on a worldwide network of secure datacenters, which are regularly upgraded to the latest generation of fast and efficient computing hardware. This offers several benefits over a single corporate datacenter, including reduced network latency for applications and greater economies of scale (Microsoft, 2024).

* **Reliability**

Cloud computing makes data backup, disaster recovery, and business continuity easier and less expensive because data can be mirrored at multiple redundant sites on the cloud provider’s network (Microsoft, 2024).

* **Security**

Many cloud providers offer a broad set of policies, technologies, and controls that strengthen your security posture overall, helping protect your data, apps, and infrastructure from potential threats (Microsoft, 2024).

In Uganda, Cloud computing comes with various benefits i.e. reduces infrastructure costs and levels the ground for SMEs. Secondly, unlike traditional computing that necessitates installation and configuration of software and constant updates, software on the cloud would be easier to install, maintain and update. This benefit covers the users who have less IT training. Thirdly, cloud services provide the user with the flexibility of scaling up the use if the demand increases. This approach requires a low upfront investment which is ideal for SMEs. Fourthly, software is available and free in Software as a Service (SaaS). This implies that software piracy is likely to reduce. Fifth, in developing economies with poor broadband, cloud computing can overcome these barriers. Finally, with the issue of cloud security, cloud computing allows having a business model in which third parties can provide cost-effective security for SMEs. Nonetheless, these observations underscore how institutional and economic problems remain central to the diffusion of cloud computing among SMEs in the developing world (Kalinaki, Mukuuma, & Mwase, 2022).

#### **Cloud computing Deployment Models.**

* **Public cloud**

Public clouds are owned and operated by third-party cloud service providers, which deliver computing resources like servers and storage over the internet. Microsoft Azure is an example of a public cloud. With a public cloud, all hardware, software, and other supporting infrastructure is owned and managed by the cloud provider. You access these services and manage your account using a web browser (Microsoft, 2024).

* **Private cloud**

A private cloud refers to cloud computing resources used exclusively by a single business or organization. A private cloud can be physically located on the company’s onsite datacenter. Some companies also pay third-party service providers to host their private cloud. A private cloud is one in which the services and infrastructure are maintained on a private network (Microsoft, 2024).

* **Hybrid cloud**

Hybrid clouds combine public and private clouds, bound together by technology that allows data and applications to be shared between them. By allowing data and applications to move between private and public clouds, a hybrid cloud gives your business greater flexibility and more deployment options and helps optimize your existing infrastructure, security, and compliance (Microsoft, 2024).

#### **Cloud computing Service Models.**

Most cloud computing services fall into four broad categories: infrastructure as a service (IaaS), platform as a service (PaaS), serverless, and software as a service (SaaS). These are sometimes called the cloud computing "stack" because they build on top of one another. Knowing what they are and how they’re different makes it easier to accomplish your business goals (Microsoft, 2024).

* **IaaS**

The most basic category of cloud computing services. With [infrastructure as a service (IaaS)](https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-iaas/), you rent IT infrastructure—servers and virtual machines (VMs), storage, networks, operating systems—from a cloud provider on a pay-as-you-go basis (Microsoft, 2024).

* **PaaS**

[Platform as a service (PaaS)](https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-paas/) refers to cloud computing services that supply an on-demand environment for developing, testing, delivering, and managing software applications. PaaS is designed to make it easier for developers to quickly create web or mobile apps, without worrying about setting up or managing the underlying infrastructure of servers, storage, network, and databases needed for development.

* **SaaS**

[Software as a service (SaaS)](https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-saas/) is a method for delivering software applications over the internet, on demand and typically on a subscription basis. With SaaS, cloud providers host and manage the software application and underlying infrastructure, and handle any maintenance, like software upgrades and security patching. Users connect to the application over the internet, usually with a web browser on their phone, tablet, or PC (Microsoft, 2024).

* **Serverless computing**

Overlapping with PaaS, [serverless computing](https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-serverless-computing/) focuses on building app functionality without spending time continually managing the servers and infrastructure required to do so. The cloud provider handles the setup, capacity planning, and server management for you. Serverless architectures are highly scalable and event-driven, only using resources when a specific function or trigger occurs (Microsoft, 2024).

#### **Awareness and Perception of Cloud Computing**

#### **Benefits and Challenges of Cloud Computing Adoption**

#### **Regulatory and Policy Considerations**

#### **Conclusion**

# **CHAPTER 3**

## **Research Methodology**

Research methodology is a way of explaining how a researcher will carry out research. It is a systematic, rational approach to resolve a research issue. A methodology outlines a researcher's approach to the research to ensure reliable, valid results that address their aims and objectives. It encompasses what data they are going to collect and where from, as well as how it is being analyzed (Indeed, 2024).

## **Research Design**

This study will employ a mixed-methods approach, combining quantitative and qualitative research methods to gather comprehensive data on the perception of cloud computing in Uganda.

## **Data Collection Methods**

* **Surveys**. Structured questionnaires will be distributed to businesses, government institutions, and individual users to collect quantitative data on their awareness, usage, and perception of cloud computing.
* **Interviews**. In-depth interviews with key stakeholders in the ICT sector, including policymakers, IT professionals, and business leaders, will provide qualitative insights into the challenges and opportunities of cloud computing in Uganda.

## **Sample Size and Sampling Techniques**

A stratified random sampling technique will be used to ensure representation across different sectors and user groups. The sample will include:

* Businesses (small, medium, and large enterprises).
* Educational institutions (universities and colleges).
* Government institutions (National and local)
* Individual users

## **Data Analysis**

Quantitative data will be analyzed using statistical tools to identify trends and patterns. Qualitative data will be analyzed thematically to uncover underlying perceptions and attitudes.

# **CHAPTER 4**

## **Outcome of the study**

1. A comprehensive understanding of the current perception of cloud computing in Uganda.
2. Identification of key barriers and enablers for cloud adoption in Uganda.
3. Recommendations for policymakers and stakeholders to enhance the adoption of cloud computing in Uganda.

# **CHAPTER 5**

## **Significance of the Study**

This study will provide valuable insights into the state of cloud computing in Uganda, informing policymakers, businesses, and ICT stakeholders about the necessary steps to promote its adoption. By understanding the perception and challenges, strategies can be developed to leverage cloud computing for economic growth and technological advancement in Uganda.

# **CHAPTER 6**

## **Timeline**



# **CHAPTER 7**

## **Budget**

A detailed budget will be prepared outlining the costs associated with research instruments, data collection, data analysis tools, and potential travel expenses for conducting interviews.

# **CHAPTER 9**

## **Conclusion**

This research proposal highlights the urgency of understanding the perception of cloud computing in Uganda to unlock its full potential for national development. By investigating stakeholder perspectives and identifying key challenges, this research aims to provide valuable insights for promoting wider cloud adoption in Uganda.

# **CHAPTER 8**

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