Government Cloud Strategy 2023 - 2027

The Gambia

Commissioned by the Ministry of Communications and Digital Economy

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Document History

SN	Author	Version No	Release Date	Change Details
1	Consultant	1.0	9 April 2023	
2	Consultant	2.0	23 June 2023	Comments and suggestions from stakeholder validation session.

List of Acronyms

ACE	Africa-Coast-to-Europe
CapEx,	Capital Expenditure
CSP	Cloud Services Provider
ERP	Enterprise Resource Planning
GPPA	Gambia Public Procurement Authority
GICTA	Gambia ICT Agency
GoTG	Government of The Gambia
HVIA	High Value Information Assets
IaaS	Infrastructure As a Service
ICT4D	ICT for Development
ICT	Information Communication and Technology
IFMIS	Integrated Financial Management Information System
MDA	Ministries, Departments, and Agencies
MoCDE	Ministry of Communication and Digital Economy
NDP	National Development Plan
OpEx	Operational Expenditure
PaaS	Platform As a Service
PKI	Public Key Infrastructure
PURA	Public Utilities Regulatory Authority
RoI	Return on Investment
SaaS	Software As a Service

1. Background

Governments worldwide aim to reduce costs, improve efficiency, effectiveness, and offer comprehensive services to citizens and businesses by leveraging Information and Communication Technologies (ICTs). The outcomes of implementing ICTs in governance processes are encouraging, as it enables governments to establish a competent and efficient e-government framework, prompting them to develop national ICT strategies that are comprehensive, sustainable, and forward-looking. This, in turn, promotes a more sustainable and cost-effective e-governance processes.

As part of its e-Government agenda, the Government of The Gambia (GoTG) has adopted the national e-Government Strategy 2020 to 2024. The strategy outlines the processes and objectives for modernizing Government service delivery to its citizens by improving transparency, accountability, and good governance, with a focus on result-oriented service delivery. It aims to guide the achievement of broader objectives set out in the National Development Plan (NDP) and the ICT for Development (ICT4D) policy. To deliver on this strategy, the optimal use of technologies such as cloud-computing services, internet of things (IoT), big data, mobile innovations, and other related technologies will be required to realize e-Government in public services.

The delivery of Government services to meet citizen needs continues to drive a large range of ICT use cases amongst GoTG institutions, which must balance legacy platforms with more responsive services. To better address these needs, the e-Government 2020-2024 strategy recognises the need to make a strategic shift to cloud consumption through the use of public and private cloud services. To achieve this, GoTG will deploy a robust cloud computing infrastructure (private, public, or hybrid) that provides agility, scalability, cost savings, and enhanced security. Adopting cloud computing will help the GoTG maintain IT service excellence during a period of increasing demand for digital services and timely access to emerging technologies.

This document describes GoTGs strategy for adopting cloud services. It is intended to inform policy direction on the journey to cloud and the use of Government Cloud services in the Gambia.

2. Vision for Government Cloud adoption

The need for a common ICT infrastructure to realise e-Government in public services is central to the achievement of the objectives of the e-Government strategy (e-Govt 2024). It is important to use common infrastructure to reduce the repeated use of resources, ensure interoperability and to minimize critical infrastructure risks.

The vision

Adoption of cloud computing technologies is considered a desirable option for the operation of the common infrastructures. By adopting cloud computing, the GoTG will be able to exploit and share commodity ICT products and services more easily. The vision is to enable Cloud computing services through the deployment of a robust, scalable, reliable, secure and highly available Government Cloud computing infrastructure for The Gambia.

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3. Goals, Objectives, and Expected Outcomes

The main objectives of the GoTG Government Cloud include the following:

1. Rapid scaling of capacity – This technology allows the rapid provisioning of systems and shared resources allowing for elastic demand and capacity.
2. Cost reduction - Leveraging economies of scale in ICT acquisitions across government entities will lead to reduced overall ICT expenditure.
3. Enhanced security and continuity – Leveraging the opportunity to deploy an integrated security and business continuity framework, infrastructure, and services.
4. Standardization – The technology will create an opportunity to simplify systems and standardize solutions across government entities in The Gambia. This could help standardize information to facilitate “big-picture” based decision making and policy setting.
5. Interoperability and integration- A common infrastructure for Government, will enable integration of government applications and services. Interoperability will be easier, because of the use of a common platform and standardisation.
6. Enhanced transparency of usage via metrics - This technology allows for improved visibility over vendor management, contractual service level agreement as well as shared resources. These metrics are useful for reporting purposes.
7. Enhanced service delivery – The technology will bring government service delivery much closer to the citizenry. Access to government services will be available from different touchpoints at different time preferences

The expected outcomes of Government Cloud are listed below:

1. Improve citizen engagement and increase in transparency. This includes:
    a. Citizen interaction and increase in transparency (open data portal)
    b. Improve access to e-Government services
2. Enable and empower workforce
    a. Improve workforce productivity
    b. Enable remote working to ensure business continuity and resilient economy
3. Enable smart city applications and develop new services
    a. Deploy of smart city applications (deployment Security cameras)
    b. E-Services – e-Health, e-Payments, e-Parliament, e-Tax board, e-Id; e-Transport, amongst others

4. Source of revenue (cloud as-a-service)
5. Reinvent operating models
    a. Business Process Improvement
    b. Interoperability, collaboration, and agility among government institutions
    c. Single National portal for administrative Service (eGovernment – e.g., document management system)
6. Reduce Government IT expenditure
    a. Cost-effective and efficient cloud infrastructure and services

4. Cloud Adoption Guiding Principles

The guiding principles for the Government Cloud strategy is derived from the e-Govt 2020-2024 strategy and covers principles of efficiency (smarter and competent public services), public service improvement, transparency, innovation (improvement for growth) and shall guide the implementation of the Government Cloud strategy. The guiding principles shall enable the achievement of the following:

Enablement of interoperability and accessibility to multiple-choices -online service delivery

The Government Cloud shall form part of the government ICT infrastructure backbone that will enable both government and citizens have accessible, efficient, cost-effective, and seamless e-government services.

The cloud-service offering will be provided as a utility, and in a form that allows for multiple options for cloud services consumers to pick and choose, and dynamically scale, to achieve optimal utility.

All inclusive & compatible Government Cloud service delivery and utilization

The Government Cloud model will be all inclusive and encompass ecosystem players including institutions with existing resources, CSPs and cloud services consumers both in the public and private sector. The model must be structured to avoid duplications within the ecosystem.

Security, trust & confidence in Government Cloud service delivery

The model will emphasise continuous management of stakeholder security requirements, real and perceived and to ensure that key controls are in place to mitigate risks. It must incorporate appropriate security standards and best practice to foster trust and confidence.

Economies of scale, effective & efficient governance process

The model will reap meaningful benefits. Cloud computing has the potential to deliver savings for the GoTG. The journey to this outcome will require significant compromise and transformation including the decommissioning of IT assets and workforce reconfiguration, as this is where the real savings reside. The model incorporates a suitable Governance framework with associated guidelines for stakeholders to follow and abide by in relation to Cloud service and general IT system usage. The governance process will be centrally managed by a principal Government Cloud provider.

Partnership through collaboration and reliability

The cloud strategy will be all inclusive and promote strong collaborations amongst stakeholders. There should be collaboration by all stakeholders for the creation of a reliable Government Cloud model. This will drive uptake and use of Government Cloud services in The Gambia.

Digital Inclusion, Accountability & Responsiveness

The Government Cloud strategy will seek to bridge the digital divide essential to ensure an effective e-government and a thriving digital economy. The model must foster digital inclusion, equal access, and equal opportunity for all stakeholders to participate and benefit from the opportunities Government Cloud services provide.

5. Scope and Coverage

Scope

The Gambia Government Cloud Strategy has been developed through a cross-sector collaboration. It takes into account the strategic intents of ICT4D and the e-Government strategy (e-Govt 2024). The Strategy aligns the thinking within these strategies as well as emerging issues to provide centralised guidance and direction to enable a consistent, scalable, and aligned approach to the adoption of government cloud in The Gambia.

This strategy is for all stakeholders whose participation will be critical to the success of Government Cloud adoption in The Gambia. It is specifically applicable to the following:

a. All levels of government (national and local)
b. All organs of State/GoTG Enterprises

6. Recognized Cloud Computing Service Models and Deployment Models

Cloud and internet hosted solutions may seem the same to the end user but are by nature different. Often, IT vendors may present their solution as cloud-enabled, or cloud based to benefit from the current interest in cloud but will not be able to display the basic Cloud characteristics – therefore limiting the potential benefits.

The characteristics identified in Table 2 serve as a mechanism to identify typified Cloud solutions:

Characteristics of Cloud				What this means
Reduced capital and operating expenditure	**Demand/capacity alignment**	Scales quickly	Capabilities scale rapidly commensurate with demand. To the consumer, the availability of capabilities appears to be unlimited and can be appropriated and released in any quantity at any time.	Unanticipated spikes in system demand caused by a policy change, emergency change or special events can easily be accommodated resulting in high solution availability.
		Elastic Demand	The provider's resources (people, processes and components and infrastructure) are highly leveraged and can be pooled to serve multiple consumers (depending on the Deployment Model). Resources can be dynamically assigned and reassigned according to consumer demand.	Economies of scale and reduced operating costs can be achieved by acquiring services from cloud providers without the trade-offs in operating unit agility imposed by traditional ICT consolidation strategies.
		Consumption-based	Mature Cloud capability providers charge exclusively on capability consumption. No	An operating unit pays only for capabilities it is using at a given time. The result is lower opportunity costs

Characteristics of Cloud				What this means
			consumption results in no charge. Higher consumption results in a higher charge. Resource usage is monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilised service.	when compared to systems with dynamic usage that run on fixed capacity infrastructure.
	Improved delivery velocity	Ubiquitous	Must be available to authorised users over the Internet and/or secure private networks and accessible by heterogeneous platforms (e.g., mobile phones, tablets, laptops, workstations)	Services are always available to consumers regardless of location or device (depending on application capability). This enables access by authorised users and personnel from anywhere at any time.
		Solution packaged	Customer can consume the capabilities without the need to own, manage or understand the underlying resources used to create and support the capabilities.	Significant reduction in the amount and complexity of technologies that agencies must consume resulting in reduced ICT implementation and operations effort and personnel.
		Provisioned quickly	A consumer can unilaterally provision and release capabilities as needed without requiring human interaction with each service provider often measured in minutes or hours.	Agencies can bring new capability online quickly and evaluate options without significant time and expense. Unneeded services and capacity can be shut down with no residual financial footprint.

Characteristics of Cloud				What this means
		Published Interfaces/API	Providers publish service-based APIs that allow customers and other vendors to access functionality within their offering.	Hybrid solutions can be easily integrated, cloud to cloud and cloud to on premise allowing selective replacement of legacy systems over time.

Table 2: Characteristics of Cloud services

6.1. Cloud service models

Cloud service models are progressive encapsulations of technology that deliver targeted "packages" of IT capability (operate, develop, use). Packaging contributes almost all of the effort reduction potential within the IT organization as the components within each package are fully managed and maintained by the Cloud service provider including upgrades, patches, enhancements, and refreshes.

Figure 2 shows the distribution of IT capability that exists within the Cloud service models.

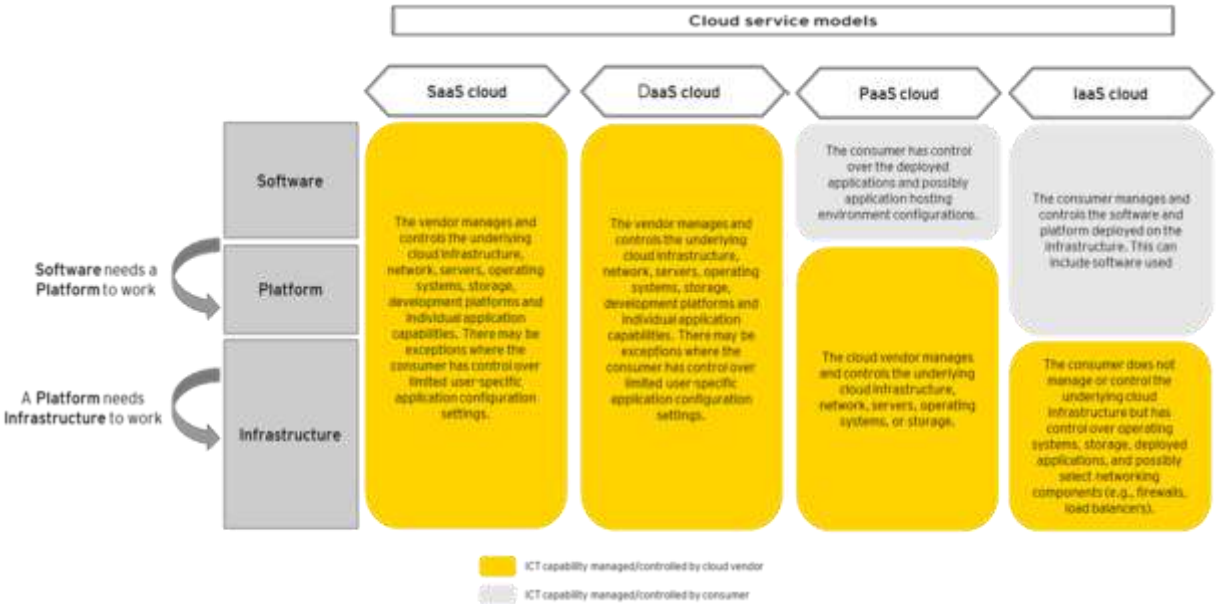


Figure 2: IT capability distribution within Cloud service models

There is a specific use for each service model and a process should be undertaken to identify what model is the most appropriate to adopt for a particular asset within the IT estate. The process starts by considering what ensues if a business process or application is customized, will there be a significant ROI? Where the response is limited or no ROI will be generated from

the customization, then the SaaS model should be adopted. Where an ROI is identified, then PaaS or IaaS can be considered for the service delivery model, depending on several factors including the cost-effectiveness of maintaining a suite of development tools, services, and libraries to support their in-house IT development capability. Table 3 describes the service models, when they are best adopted, what are examples of current vendor solutions and what this means for the beneficiary organization.

	Best use of model	**Examples of vendors solutions**	**What this means**
Software-as-a-Service (SaaS) The **capability** provided to the consumer is to use complete software applications provider's applications running one cloud infrastructure and accessible from various client devices through a thin client interface such as a Web browser (e.g., web-based email) The **consumption model** for SaaS is predominately unit based on users.	Used for business process and application areas that are viewed as commodity or generate little to no ROI when customised. Organisational processes must then be re-aligned to the SaaS capability.	This service model is widely used across application areas including: - Cloud9 (Analytics) - Google (Email, Collaboration, Productivity) - Oracle (CRM, HCM, Finance) - SalesForce.com (SFA, Marketing, CRM, Finance) - SAP (HCM, Finance, CRM, Marketing, Service Management) - Workday (HCM, Finance) - Cash and Treasury Management such as Kyriba Enterprise Software - IFMIS systems like Oracle Financials	Agencies have the opportunity to standardise and simplify their processes to leverage lower cost off-the-shelf solutions (e.g., Email and Collaboration, Salesforce Automation, Customer Relationship Management, Records Management). SaaS packages will also enable mobility and flexibility of the workforce as they are web-enabled. Finally, SaaS will significantly improve the opportunity for agencies to collaborate between each other, or with the community.

	Best use of model	Examples of vendors solutions	What this means
Data-as-a-service The capability provided to the consumer is access to a wide range of data sets and data-related functionalities over the internet. It involves the outsourcing of data management and delivery to a third-party provider, who maintains and delivers the data to consumers on-demand. It can be a standalone service or a sub-service of IaaS, SaaS or PaaS. The **consumption model** for DaaS typically involves a pay-per-use or subscription-based approach (e.g. volume of data consumed, number of API calls, recurring fee arrangement etc)	The versatility and availability of diverse data sets make DaaS valuable for organizations seeking to enhance decision-making, gain insights, and leverage external data to drive innovation. Examples of use case include: Market research, geospatial analysis, social media and sentiments analysis, financial and risk analysis, healthcare analytics, IoT data integration, and regulatory reporting	This service model is fairly mature and readily available from global vendors including: Snowflake, Oracle Data Cloud, Salesforce Data Studio, Acxiom, Experian , and Dun & Bradstreet. Some traditional IaaS, SaaS, and PaaS services providers also provide DaaS, for example: Amazon Web Services (AWS) -provides DaaS through the Amazon Data Exchange; , Microsoft Azure provides DaaS offerings through services such as Azure Data Share; Google Cloud Platform (GCP) offers DaaS solutions through services like BigQuery, a fully managed data warehouse, and Cloud Data Fusion	Availability of DaaS offering in the market means agencies have the opportunity to scale their data access and usage based on their requirements in a cost-effective way. This scalability and flexibility will also enable institutions to adapt to changing institutional requirements faster. DaaS will also eliminate the need for institutions to spend time and resources on data collection, aggregation, cleaning, and maintenance. This will save time and resources

	Best use of model	Examples of vendors solutions	What this means
Platform-as-a-Service (PaaS) The **capability** provided to the consumer is to deploy onto the cloud infrastructure consumer-created applications using prior programming languages and tools supported by the provider (e.g., java, python, .NET) The **consumption model** for PaaS is unit based on users and resource consumption (e.g., number of records, number of reports etc.)	Used to develop and deploy areas of differentiation across business processes, custom applications, and integration. There must be a significant ROI identified to deliver a differentiated service in the manner instead of using SaaS.	This service model is the least mature and includes ERP vendors who have introduced partial PaaS offerings to create a migration path for existing customers: - Google App Engine - IBM BlueMix - NetSuite SuiteCloud - Oracle Cloud Platform - Salesforce.com - Heroku - SAP Hana Cloud Platform - Windows Azure	Agencies have the opportunity to deliver services by composing applications from platforms and components available in the cloud (e.g., Reporting and analytics, database management, development environment). One of the opportunities for instance would be for the agencies to increase its digital presence in the community by providing a one-stop-shop transaction platform that agencies could join over time to provide their services.
Infrastructure-as-a-Service (IaaS) The **capability** provided to the consumer is to provision scalable processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software. This can include software used to deliver PaaS and SaaS. The **consumption model** for IaaS is unit based on asset utilisation or sizing (e.g., compute, storage, network bandwidth, etc.)	Heavily customised production systems Fulfil temporary capacity needs. E.g. pre-production systems that are utilised for specific purposes. E.g. software development testing	This service model is fairly mature and readily available from global vendors including: - Amazon Web Services - Dimension Data (Public and ICON) - IBM SoftLayer Enterprise* - HP Helion	The maturity and breadth of the IaaS offering in the market means agencies have the opportunity to move to IaaS and start to derive benefits that can be realised immediately including improved disaster recovery scenarios, business continuity options and backup and retrieval. Key assets to target include non-production and non-mission critical systems in the immediate future, and highly customised, highly availability, steady demand applications in the longer term.

Table 3: Cloud service models and their use

While the majority of an MDA's IT estate can be delivered leveraging one of the three Cloud service models, there are instances where moving to a Cloud based service would not be considered a cost-effective option. On-premises systems running on fixed asset infrastructure that is fully depreciated, systems with a fixed workload or low maintenance costs are factors that may contribute to a system not being a suitable candidate for moving to the Cloud. As these factors can change over time e.g. infrastructure refresh, the consideration of whether an asset is Cloud-ready needs to be an iterative process.

6.2. Cloud deployment models

Cloud deployment models are instances of Cloud services that are made available to specific groups of consumers. There are two primary models – public and private – and two derived models – community and hybrid. Figure 3 describes the four deployment models and provides a transport analogy to further highlight the differences between the models.

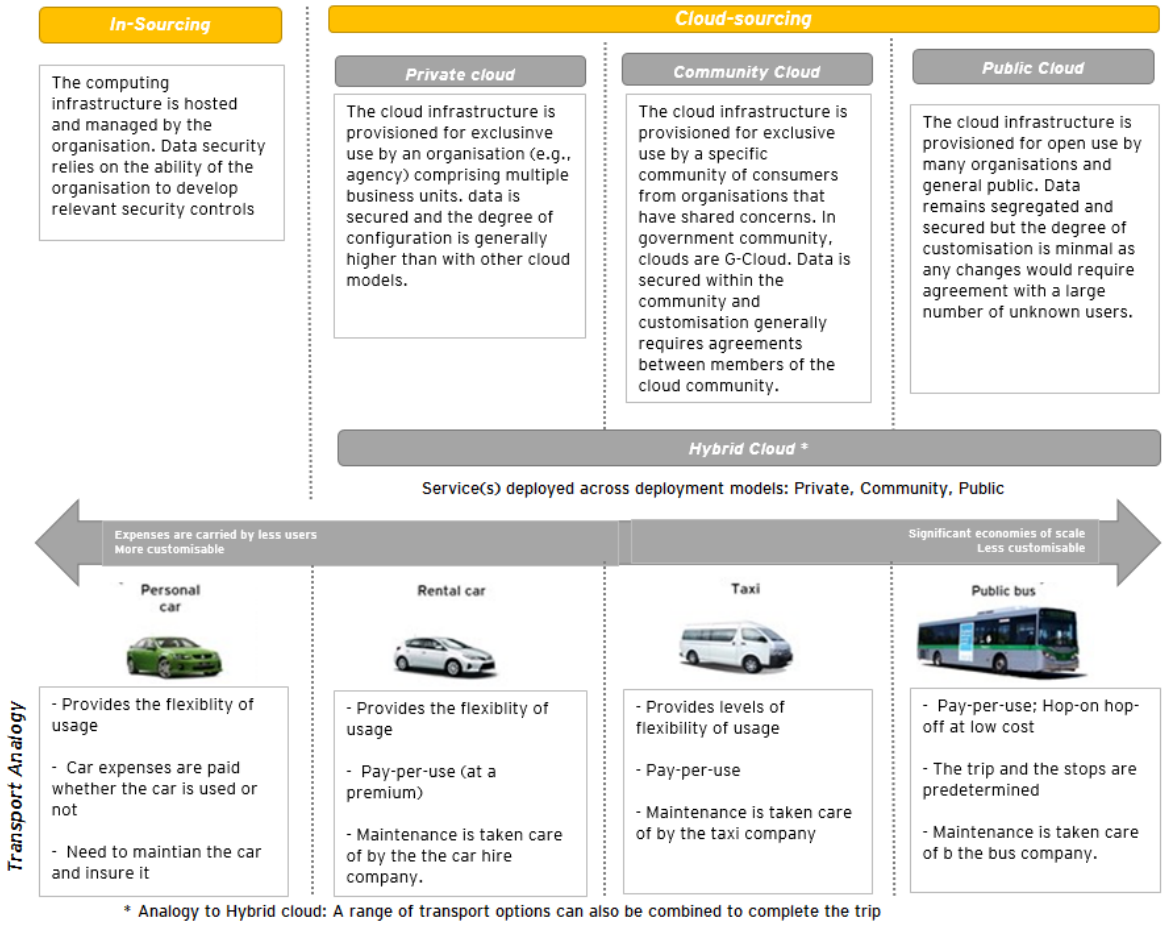


Figure 3: Cloud deployment models

Compartmentalization and customization concerns as outlined below drive deployment model decisions.

- **Compartmentalization**

There are circumstances where MDAs require high compartmentalization due to the extreme impact of sensitive information leakage and/or regulatory requirements. Compartmentalization may include separate virtual or physical instances of a service to be provisioned for the exclusive use of an organization. In extreme cases, such as the US CIA IaaS Centre operated by Amazon, physical compartmentalization may include separate facilities and personnel.

- **Customization**

There are circumstances where services that are developed for broad consumption lack a specific capability deemed critical requiring a unique version of the service to be deployed for the exclusive use of the organization. Customizations may necessitate the Cloud service provider to deploy and manage a separate instance of the service for a specific MDA or community of government institutions. They may also require the MDAs to take on the overhead and complexity of building and operating their own Cloud service.

Figure 4 below illustrates the inversely proportional relationship between the cost benefits of economies of scale and the need for high degrees of compartmentalization and/or customization.

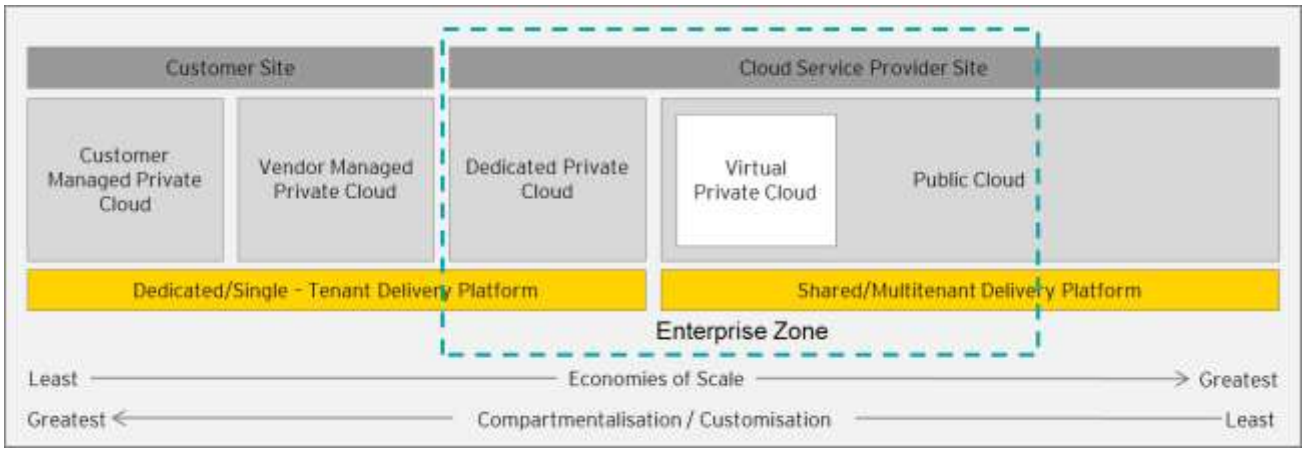


Figure 4: Levels of deployment model adoption (Original source: IDC Cloud Taxonomy 2012)

Most MDAs will choose to stay within the “Enterprise Zone” to maximize economies of scale. Public/private hybrid deployments are becoming common in organizations where they have adopted Cloud services for the majority of their IT estate.

It is worth noting that IT organizations with a “build your own” culture, or who errantly assume there is more absolute risk in a vendor managed Cloud, will naturally tend towards the left-most segments. ‘Essential Cloud’ policies must be implemented with methods to identify and avoid this pitfall. Customer managed private Clouds are options only for very large, diverse, and technically advanced enterprises for the following reasons:

1. Customer developed and managed services must conform to the characteristics (identified in Table 2) in order to be considered Cloud. Services that do not conform to the characteristics are traditional online ‘IT shared services’. While operating online shared services may be appropriate in certain circumstances, the economic and strategic benefits of Cloud will not be realized.
2. Advanced technology consumption is the responsibility of the internal provider who becomes the Cloud service provider. Capability packaging (IaaS, PaaS, SaaS) must be achieved for consumers to realize benefits (reduced realized complexity and improved velocity).
3. The consumer portfolio of the internal Cloud service provider must be diverse enough to mitigate the risk of having to acquire and operate fixed cost technology assets while offering consumption-based services to internal consumers (No consumption = No cost). Amortized economies of scale must be delivered in order to lower opportunity costs.

6.3. A market assessment of Cloud industry and future directions

According to a report by Gartner, global spending on public cloud services is forecasted to grow at 20.7% to total $591.8 billion in 2023. This includes spending on software as a service (SaaS), infrastructure as a service (IaaS), and platform as a service (PaaS) offering provided by cloud service providers.

Both in Gambia and globally, the Cloud market is changing rapidly as new vendors emerge and there will likely be several expansion and consolidation cycles over the next decade. This reality emphasizes the need for customers to develop strong vendor assessment and management processes in addition to enhanced contracting skills in order to mitigate risk and manage market churn.

Software companies including large, entrenched players like Amazon, Microsoft, Oracle, IBM and SAP are now driving the transition to Cloud. The delivery model improves their development productivity, increases business stakeholder satisfaction, and reduces value proposition erosion caused by misuse or misapplication of their products by IT practitioners and/or System Integrators.

Going forward, there will be fewer and fewer organizations that release new capability by traditional in-house IT delivery methods.

6.4. Market view of cloud service models

There are 3 primary cloud services models (further explained in section 7.1). The current market view of these service models in Gambia and globally is discussed below.

6.4.1. Market view of Software as a Service (SaaS)

Software as a Service (SaaS) is the most mature segment of the market and has seen the highest adoption of the Service Models globally. SaaS provides complete software applications that can be adopted by organizations with little or no IT delivery effort. SaaS solutions do offer a degree of flexibility by way of configuration that affords customers with the ability to specify presentation preferences, process exceptions, and some light workflow modifications. Configuration is done by the vendor making SaaS services easy to acquire directly by business stakeholders.

The SaaS market is growing significantly in the niche application market and will continue to see expansion as benefit awareness grows and Cloud becomes more mainstream. Typical SaaS service offerings currently being offered in Gambia are office productivity products such as word-processing and spreadsheet software, email and collaboration tools, Customer Relationship Management tools, marketing tools, Human Capital Management, Finance applications and some generic Enterprise Planning Resource (ERP) tools. Key providers of SaaS cloud services mainly include Microsoft in addition to numerous other global entities with a smaller presence in the Gambian market.

Typically, public sector adoption of SaaS lags the private sector largely due to the perception that heavy customization is required across all process areas or that SaaS solutions are inherently insecure. This is however changing rapidly. This market segment is dynamic and represents the biggest challenge to traditional tender-based procurement programs often used by governments. New methods that facilitate continuous and more agile qualification of vendors must be instituted to ensure that public sector agencies have access to a robust set of offerings.

6.4.2. Market view of Data-as-a-Service (DaaS)

Data as a Service (DaaS) is a relatively mature service model and has been in existence for several years. However, compared to other cloud service models like Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), DaaS has gained less widespread adoption and visibility in the market.

IaaS, PaaS, and SaaS have seen significant market growth and have a larger number of providers and offerings. On the other hand, DaaS has gained traction more gradually, with its adoption primarily driven by consumers seeking specific data-related solutions or aiming to leverage external data sources for analytics and decision-making.

The maturity of DaaS varies across sectors and use cases, with some sectors being more advanced in adopting DaaS than others. Adoption in the public sector is fledgling and mainly driven by the growing recognition of the value of data in informing policymaking, improving public services, and enhancing transparency. Governments worldwide have launched open data initiatives, making public data sets available to the public and businesses. DaaS is facilitating the sharing and dissemination of these open data sets, allowing access and utilization for various purposes, such as research, civic innovation, and development of public applications.

Whiles there is a strong case for DaaS adoption in the public sector, ensuring the privacy and security of data when utilizing external DaaS providers can be a significant concern. Also, integrating DaaS solutions with existing systems and ensuring interoperability can be complex, requiring careful planning, data mapping, and system integration efforts

6.4.3. Market view of Platform as a Service (PaaS)

PaaS is generally the least mature and most dynamic segment of the Cloud market. The primary use of PaaS is the development and deployment of custom applications, the implementation of differentiated business processes and integrations across mixed IT ecosystems. In short, if business needs cannot be addressed with SaaS, it will likely be done in PaaS.

Globally, ERP and traditional software vendors have created confusion in the space by introducing partial PaaS offerings. PaaS includes several sub-categories including Cloud ERP, Database as a Service, Identity as a Service and Analytics as a Service (e.g IBM Watson). Each sub-category addresses an application or functional area that requires customization to be put to use.

PaaS services are almost always acquired by IT and development teams but variants are emerging that can be acquired and used by typical organization end-users without IT intervention. The PaaS market segment is changing rapidly however care must be taken to acquire PaaS services that clearly meet the need and mission of the organization as changing PaaS vendors is no small feat. Currently in Gambia, there are no PaaS offerings.

6.4.4. Market view of Infrastructure as a Service (IaaS)

Infrastructure as a Service (IaaS) is also a relatively mature segment and is the most used service in the public sector. This is largely due to the ability of government agencies to leverage IaaS to mitigate performance and reliability risks. Non-production and temporary environments are the most common early targets as these are clearly much lower risk. IaaS is almost always acquired by the IT function within an organization.

IaaS can also be used by niche or specialty software developers to create highly customized Cloud based applications for their customers. Netflix's Video Streaming Service (available locally in The Gambia) re-developed their platform to run on Amazon Web Services (AWS) in order to gain rapid scale of compute and storage. In very rare cases, IaaS is used by enterprise customers to develop custom Cloud applications however, most organizations forgo the complexity, effort and expense of bespoke Cloud applications in favour of deploying directly on PaaS.

IaaS is available from a number of global vendors and a growing number of national, regional and local companies in Gambia. Notable names in this space within the Gambian market include Gamtel amongst other global service providers. Amazon is the largest global vendor with international government customer experience. Their AWS offering is used by government agencies across the UK and the US (including the US Central Intelligence Agency).

IaaS vendors can be managed via traditional tender-based procurement processes. However, methods that facilitate continuous qualification will allow for the inclusion of the increasing pool of local and regional providers as they mature.

Generally, pricing of IaaS has been dropping steadily as vendors realize amortized economies of scale and competition in the segment increases, but also as the core inputs (storage and compute power) also continue to fall. Packaged and modular offerings (Integrated Systems) have become the focus of major hardware vendors as IaaS providers seek turn-key expansion options and lower operating costs. This will also translate into further cost-savings for consumers.

a. Pricing

Globally, IaaS pricing has been dropping steadily as vendors realize amortized economies of scale and competition in the segment increases. Amazon has continually passed lower prices on to customers without provocation to do so.

Pricing of SaaS solutions is also dropping as higher use creates more competition and the customers become more educated. Marketplaces are emerging that give customers the ability to compare offerings from multiple vendors creating higher visibility and greater negotiating power.

PaaS pricing varies widely largely due to the number of permutations and options involved. It is too early to make accurate predictions about future directions on pricing.

The growing number of DaaS providers in the market has intensified competition, leading to competitive pricing strategies. Providers are adjusting their pricing models to attract customers, differentiate themselves, and gain market share. This competition can result in more competitive pricing, innovative pricing structures, and potential cost savings for organizations.

Aside from storage and compute power costs, IaaS, PaaS DaaS, and SaaS pricing are also influenced by the administrative cost of physical data centre facilities. Cost of power and utilities for cooling and other data centre amenities are comparatively higher in Gambia. Cloud services based in Gambia may then tend to struggle with more competitively priced options who may have achieved even further economies of scale beyond other base costs.

Care must be taken when comparing pricing across all service models as contractual terms relating to SLAs, service throttling, scaling thresholds, and custom services can vary widely across the consumer base (See Appendix 3).

b. Interoperability considerations

Cloud deployments will likely include offerings from multiple vendors and will include capabilities provided through multiple Service and Deployment Models. While standards to ensure interoperability across vendor offerings are emerging, they are not yet adopted. Pragmatic mechanisms must be put in place to ensure system cohesion and to mitigate vendor lock-in risk. Vendor lock-in-risk is a major concern for public sector entities such as MoCDE and various MDAs, because of the size and scale of Government administration. GoTG will be prudent to consider open-source solutions where feasible to maximize interoperability and also lighten the burden on the public purse.

c. Security considerations

Cloud adoption rates continue to soar, yet some executives remain sceptical that the benefits of endorsing a predominantly Cloud approach outweigh the risks.

Some of the more pervasive concerns in the Gambian context gathered as a result of both Public and Private sector engagement include:

- Belief that communicating information over a public network will increase the risk of cyber-attack resulting from a lack of awareness on cloud operational models and the benefits that cloud services offer the typical consumer
- Conviction that providers offering the same infrastructure to multiple clients in multiple locations will be unable to maintain segregated confidentiality
- Anxiety that transmitting their information across international boundaries will expose them to diverse legal and regulatory requirements in jurisdictions with which they are unfamiliar and hence the preference to have in-house or at least within Gambia deployments

These concerns are understandable, particularly given one of the traditional principles that have served as the foundation of information security: take control of your environment. It may feel counterintuitive for a government organization to surrender control of its IT infrastructure and information to a third party; however, it may be one of the most effective ways to rapidly secure the ecosystem.

Cloud security for both government and private managed infrastructure can be assured through adherence to cloud security standards. These standards are a set of guidelines, best practices and regulations that aim to ensure the security of data stored on the cloud. The security measures and controls are designed to protect unauthorised access, disclosure and alteration of data stored on the cloud. Common examples include ISO 27001/27002, National Institute of Standards and Technology (NIST) SP 800-53, SOC 2 auditing standards developed by the American Institute of Certified Public Accountants, and the General Data Protection Regulation (GDPR) developed by the European Union (EU) to govern the processing and protection of personal data. Adherence to these cloud security standards can help the GoTG evaluate the security of its own cloud infrastructure and other CSPs to ensure that data is protected in the Government Cloud.

- **Trusted design** – A Cloud ecosystem with trusted design has the right controls in place to safeguard and protect the underlying computing and information assets. The controls are designed to address the key areas of risk and are strong enough to match the threats to the environment. Both the provider and consumer are responsible for designing effective Cloud controls to manage risk in their respective environments.

- **Trusted execution** – A Cloud ecosystem with trusted execution has the right controls in place and is operating effectively per the trusted Cloud design. The controls are working as intended and are strengthened when risk indicators rise. The provider generally has responsibility for control execution while the consumer is accountable for governing and verifying the control objectives are met.
- **Trusted certification** – A Cloud ecosystem with trusted certification has been independently tested and verified that the controls are in place, functioning as designed, operating effectively and have been attested to by a certifying body. The provider has responsibility for attaining the trusted certification status while the consumer reviews and understands the scope and relevance of the certification on the consumed service.

Vendors have become even more sensitive to concerns over privacy due to recent revelations of widespread collection and interrogation of data on internet systems but also by incidences of security breaches. Customers realise that all online systems, whether Cloud based or on premise, are at risk. Security conscious consumers are taking steps to encrypt confidential information across their entire IT ecosystem, be they in-house or cloud based. Advances in end device security including on device encryption are becoming common place as manufacturers respond to the growth of online enterprise ecosystems.

d. Impact on general IT management practices and organization

Economies of scale that once justified consolidating IT services and operations within and across agencies have been dwarfed by the massive economies of scale and lower usage costs available from Cloud providers. Guiding organizations, CTOs and CIOs must shift focus to helping businesses and institutions leverage Cloud to operate more effectively and become the facilitators of new opportunities enabled by Cloud. Going forward:

1. New governance methods are needed to proactively enable evaluation, procurement, consumption and management of capabilities in the Cloud. Processes that strike the right balance between agency/operating unit autonomy, benefits realization, and risk mitigation are essential.
2. New lifecycle management processes are needed especially for PaaS and SaaS. Rapid application development and integration leveraging PaaS is the mission of the new Cloud-IT organization.

Mixed IT systems will exist for some time. Strategies must align ongoing business initiatives with a rapidly changing Cloud landscape.

6.5. Mobile Cloud Computing (MCC)

As technology evolves, there is a growing trend towards mobile technology which offers enormous convenience and flexibility. Mobile cloud computing offers the ability to access and utilize cloud-based resources and services through mobile devices such as smartphones and tablets. It leverages the power of cloud computing to store, process, and retrieve data and applications on the go, without being limited by the capabilities of their mobile devices.

The general use cases of MCC range from social media, interactive experiences, healthcare, security, commerce etc. Common use cases in in the government sector include the following:

Mobile Government Services: Government agencies can provide mobile applications that allow citizens to access government services and information conveniently from their mobile devices. This includes services like submitting forms, paying bills, accessing public records, scheduling appointments, and receiving real-time updates from government agencies etc

Mobile Workforce Enablement: Government employees are able to access cloud-based applications, data, and collaboration tools from their mobile devices. This empowers them to work remotely, access critical information on the go, and collaborate with colleagues and stakeholders from anywhere.

Mobile Citizen Engagement: Through mobile apps or cloud-based platforms, citizens can provide feedback, report issues, participate in surveys, and engage in discussions on public policies

Mobile Emergency Management: Mobile applications can provide real-time alerts and updates to citizens, enable two-way communication between emergency responders and affected individuals, provide access to emergency resources and evacuation routes, and facilitate coordination and collaboration among response teams through cloud-based platforms.

Mobile Analytics and Decision Support: Mobile cloud computing enables government agencies to access cloud-based analytics and decision support tools from mobile devices.

The high mobile phone ownership (93 per cent of households)[1] rain The Gambia creates a unique opportunity for GoTG to exploit the potential of MCC in the adoption of cloud services. Special MCC initiatives may be necessary to drive cloud adoption and usage whiles improving internet service delivery and effectively managing the risks associated with mobile computing.

[1] World Bank, The Gambia Digital Economy Diagnostic Report

7. Cloud Adoption Challenges, Opportunities and Benefits

Gambia's IT Services industry's strengths are its resources and capabilities that can be used as a basis for developing a competitive advantage. In relation to Government Cloud, this competitive advantage is viewed as creating an enabling environment where GoTG operates optimally with modern technologies. Ideally, government should foster an incubating economic environment (regulation, subsidization, protections and security, etc) at minimal cost to the taxpayer. The absence of certain strengths may be considered the definition of weaknesses as discussed here. The external environmental analysis may reveal new opportunities for fulfilling GoTG's IT related imperatives. Changes in the external environment may present threats for MoCDE to recognize and mitigate as they may possibly subvert the Government Cloud strategy and delay realization of the pre-identified benefits.

7.1. IT Landscape Strengths

- **Availability of a National Data Centre to host cloud-based infrastructure**
- **Availability of network infrastructure**
- **IT service management and support capacity**
- **Conducive location & time-zone. Potential for external demand for Gambian-based Cloud services**

Availability of NBN Data Centre to host cloud-based infrastructure.

The Government of Gambia recently deployed a Tier-2 data centre managed by Gamtel. The data centre provides a common infrastructure within an established security framework which has the capacity to provide integration and scalability of applications across government as well as provide business continuity, improved efficiency and reduced costs for all government institutions on migration to the cloud. Deployment of a Tier-4 data centre is currently being contemplated.

Availability of network infrastructure

The delivery of effective Government Cloud solutions hinges on efficient and effective network infrastructure. Gambia has a diverse network infrastructure, straddling the National Backbone - ECOWAN Network that covers not less than 947 Kilometres; and a National Broadband Network covering about 420 kilometres. The country is also connected to the

international broadband network through the Africa-Coast-to-Europe (ACE) submarine fibre optic cable. These fibre optic networks are vital to the deployment of cloud services in the country, while also providing avenues for international patronage. A second fibre optic cable is being contemplated due to a recent cable cut.

IT service management and support capacity

A majority of GoTG institutions have IT units that support end-users. The availability of this support structure can ease the positioning of a principal Government Cloud service provider as an IT Services management oriented institution and may be leveraged by other participating Cloud services providers (CSPs) to optimise responsiveness to Government Cloud and IT support needs and reduce turn-around times for stakeholder problem resolution.

Conducive location & time-zone. Potential for external demand for Gambian -based cloud services

Large populations across the continent with low infrastructure capacity are opportunities for commercialization of cloud resources based in The Gambia. Business process outsourcing services such as the provision of a geographically remote data centre and back-up as a service are typical examples of services that can be rendered to various countries, particularly countries who share a common language with Gambia and are within the same time zone.

7.2. IT Landscape Weaknesses

- Sub-optimal national Wide Area Network
- Internet Exchange Point (IXP) is under-resourced and insufficiently connected
- Limited Access to Broadband Infrastructure
- Limited and expensive internet connectivity hindering both the demand for and supply of digital services
- Regulatory and enforcement landscape playing catch-up
- IT Governance and oversight of IT initiatives to stave off uncoordinated procurements
- Redundancies in government IT-related procurements leading to higher GoTG IT expenditure
- Data services market and quality of service
- Insufficient visibility of baseline IT expenditure, assets, skills, capabilities, and project portfolio
- Underutilisation of existing IT infrastructure assets

Sub-optimal national Wide Area Network

Currently, although GoTG institutions enjoy some level of last mile connectivity via variable mediums, the current national wide area backbone network in the Gambia is not optimal and does not have adequate redundancies to bridge connectivity gaps and provide high bandwidth access to central shared service centres (data centre facilities).

Internet Exchange Point (IXP) is under-resourced and insufficiently connected

Gambia's internet connectivity issues also stem from limited capacity of the Serekunda IXP (SIXP). The IXP has a current capacity of 1GB which is not adequate to host members of the SIXP and usually has systematic technical difficulties. Internet service providers such as Africell are connected directly to the ACE instead of exchanging traffic locally, making internet exchange exponentially expensive.

Limited Access to Broadband Infrastructure

Access to the international capacity through the ACE Submarine Cable is currently limited to GSC members (Gamtel). This can limit innovation by restricting access to broadband resources and information. Open access to cloud services is important to ensure a competitive and innovative cloud market, and to promote the security and privacy of cloud users.

Limited and expensive internet connectivity hindering both the demand for and supply of digital services

Unreliable internet connectivity remains a dominant weakness of the Gambia. Internet infrastructure in both the first mile (international submarine cable), middle and last mile is still a challenge affecting access to connectivity. Internet subscribers experience low internet speeds and frequent downtimes hindering both the demand for and supply of digital services. To optimise the benefits of Cloud infrastructure and services, it is important for government to ensure that the country has reliable internet connectivity. Again, high costs of internet usage is hindering access by the poorest segments of society.

Regulatory and enforcement landscape playing catch-up

Although the foundational regulatory environment exists for telecommunications, digital services and data handling, both law makers and enforcement agencies are constantly playing catch-up. This could impact confidence and trust in cloud services thereby stifling its adoption. A number of initiatives are underway to streamline the regulatory landscape as it pertains to ICT in general. Various policies and bills including National Data Protection and Privacy Bill and Cybercrime Bill are at different stages of development. The details of these policies and bills under development must be made relevant to Government Cloud. As The Gambia matures in its cloud maturity, development of a Cloud Computing Act must be considered.

IT Governance and oversight of IT initiatives to stave off uncoordinated procurements

Although a set of guidelines and directions exist for the ICT ecosystem, its enforcement, monitoring, and general adherence is low. The ICT Agency Act, 2019 establishes The Gambia ICT Agency (GICTA) with the responsibility to play a significant role in defining the institutional arrangement and a governance framework required for intersectoral coordination. The agency has appointed its board of directors and has started the recruitment process for the Director General; however, it is yet to be operational.

Ideally, the portfolio of IT projects should be centrally reported at all times and are available to the ICT Agency to make sure that progress (performance, costs and adoption) is known and under control. This helps to avoid the current incidence of uncoordinated IT related procurements amongst various GoTG MDAs. A project portfolio dashboard should exist and may even be exposed for public scrutiny. As is typical of most government procurement cycles around the world, the goods and services acquisition processes can be long winded and may result in the implementation of dated solutions due to the short intervals of technology refresh cycles. Challenges within the current procurement processes include the lengthy process for

establishing panels and procuring services under the existing Gambia Public Procurement Authority ACT, 2014, and the length of contract (usually medium or long term) and lock-in clauses, which do not provide the flexibility to adapt to a changing ICT service provider market as they rapidly mature their offerings. This limits the opportunity to take advantage of market competition.

Contractual requirements over minimum users means landed systems do not provide a cost-effective solution for agencies to adapt to fluctuating demand.

Redundancies in government IT-related procurements leading to higher GoTG IT expenditure

Currently, across GoTG, there is significant duplication of effort and asset investments in institutions that can be cut with proper direction/sponsorship, architecture and governance. GoTG entities independently engage third party vendors to implement their infrastructure, e-business Suite (ERP), Database Management System (DBMS) etc. When moving to the Cloud, MOCDE has the opportunity to review processes, assets, portfolio of projects and existing SLAs of GoTG institutions with the objective to standardize and reduce costs. An example of this is its service level agreements (SLAs) and enterprise agreements (EAs) with major software vendors, the most dominant in the Gambia being Microsoft.

Data services market and quality of service

Despite the number of operators in the telecom industry, dominance by the leading provider - Gamtel, impacts competition within the sector. Additionally, there is low broadband penetration outside major cities and towns by both key and non-key players in the industry.

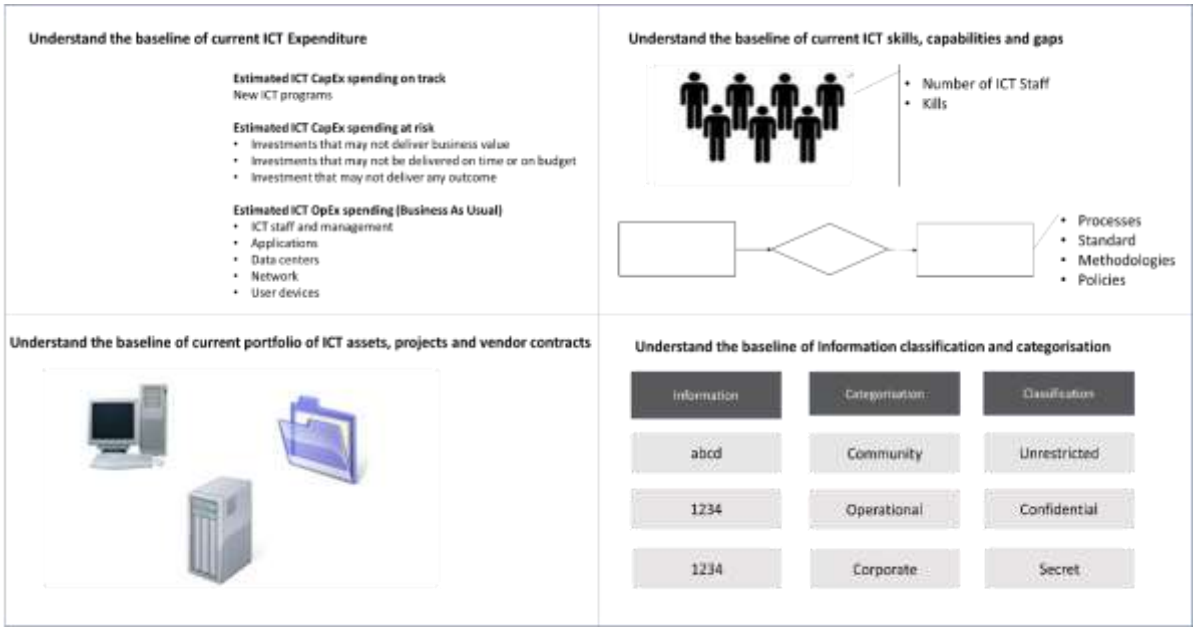
Power generation and distribution challenges spell higher operational costs

Gambia experiences higher costs of generation as compared to other parts of the world as well as frequent power outages. Power connectivity is not sufficient and reliable to support existing data centres. Gamtel is currently investing in the purchase of power generators to serve as a backup at the data centre.

Insufficient visibility of baseline IT expenditure, assets, skills, capabilities, and project portfolio

There are several challenges that currently exist for GoTG and MOCDE that will need to be addressed to draw on the full benefits from Cloud. The first one is to better understand the current baseline of the various IT assets and capabilities that each institution across Government. The following critical questions need to be addressed in order to establish the baseline:

7. What is the current IT expenditure - CapEx, OpEx (personnel, application, data centres, network, user devices) per government institution?
8. What are the current IT skills, capabilities, and gaps within the various government institutions?
9. What is the current baseline for the IT asset portfolio, in-flight IT projects, vendor contracts? What information classification and categorization is established by MoCDE and what interventions have institutions made in this regard?



As part of the process of developing a government Cloud strategy and Policies for GoTG, a stocktake of current IT assets held by key institutions in Gambia was undertaken. The exercise yielded a limited data set with material gaps. The outcome is in part attributable to non-existence of a national IT asset register, unavailability of data, poor quality of existing data and unavailability of key personnel with adequate knowledge on institutional IT asset landscape. In view of this scenario, it is imperative for MoCDE or the principal Government Cloud provider to establish a process that will continually collect data on the portfolio of IT assets existing within GoTG and as a minimum, have a catalogue of critical IT assets.

Underutilisation of existing IT infrastructure assets

The National Data Centre managed by Gamtel is yet to achieve appreciable levels of utilization. The initial intention was for the data centre to host all critical government platforms overtime.

The problem of low asset utilization could spell further challenges ahead for GoTG as it will fail to recoup returns on investment (ROIs), especially in cases where loans were advanced, or donor funds were secured under strict conditions.

7.3. IT Landscape Opportunities

- **ICT4D initiatives, and Increasing demand for services**
- **Economies of scale in government institutions**
- **Public Private Partnerships (PPP) can be utilized to provide cloud services to consumers**
- **Value Added Services and Digital Disruption may lead to an organic affinity for cloud services**
- **Definition of a coordinated roadmap for the digital transformation of the government**

ICT4D initiatives, and increasing demand for services

MoCDE is currently undertaking several projects under the ICT4D program. The Ministry's aim is to manage the convergence of communications and technologies to promote a viable integrated national development process within a global setting. There are several key initiatives under the program including enhancing connectivity for the last mile network connectivity; refining regulatory policies; fortifying e-governance and cybersecurity; expediting the establishment of regional ICT hubs for communities and schools; augmenting digital literacy among both the general public and civil servants; and fostering a favourable climate for producing local digital content.

The implementation of the ICT4D is required to provide the foundation to support future digital initiatives such as smart card-based authentication and device-based authentication to meet the future requirement for e-governance initiatives like National ID Card (Gambian Card), e-Services, e-Workspace, e-Passport etc. The effective implementation of ICT4D could provide the supporting structures and create an enabling environment for the launch of Government Cloud services / marketplace in the Gambia.

Standardized and efficient business processes

The standardization of business processes is widely cited as one of the key benefits of migration to Cloud. This is underpinned by the requirement to review and standardize existing processes as the adoption of applications in the Cloud provides less flexibility to customize software.

In legacy environments, common processes such as records management that could be standardized across users within an organization, evolves to have multiple business processes and different systems and databases of record. This is in part due to the organic nature in which business processes and systems evolve as well as 'siloed' IT operating models. With cloud computing, GoTG has the ability to move away from traditional siloed IT operating models towards a more efficient government-wide IT architecture and to capitalize

on the operational efficiencies of standardized business processes across government institutions.

Cloud computing will offer a solution to challenges, some of which are often cited as barriers to attempts to standardize processes and systems:

- **Location**
  Where to set up and store on-premise infrastructure is resolved as infrastructure and applications are available "as a service" in the Cloud.
- **Budget ownership and administration accountability**
  Who would be responsible for capital and operations expenses for a shared service is resolved because Cloud offers 'pay-per-use' or licensing payment models and traditional costs associated with hosting, maintenance, upgrades and administration are passed on to the Cloud vendors.

High speed procurement

Further evidence of Cloud's transformational ability for efficient and integrated services across the Government and private sector is evident in the opportunity Cloud offers to deliver high speed procurement processes[2].

GoTG can benefit from more agile procurement of ICT resources in the long-term and should begin to see IT savings through pockets of adoption.

[2] As far back as 2012, the UK Government launched the "Government Cloud" initiative. This comprised a framework for Cloud suppliers and the first CloudStore, allowing organizations from local council to health authorities to browse pre-approved Cloud products and services. The Government Cloud framework provides the due diligence and procurement framework to enable high speed procurement, it also has the benefit of providing support for democratization in the marketplace enabling better participation of the SME sector in government IT contracts.
MoCDE has the opportunity to benefit from more agile procurement of IT resources in the long term and should begin to see IT savings through pockets of adoption.

Staff, MDA and community collaboration

A key benefit from standardizing business systems and solutions is that Cloud technologies support more effective and efficient collaboration. Cloud solutions along with changing user behaviours influenced by social media experiences (e.g. LinkedIn, WhatsApp) in their personal lives improves organizations by breaking down silos, contracting geographical regions and removing traditional hierarchies as people at all levels of the business are able to interact with each other via corporate social networks, search and find subject matter experts in the organization and reach out to engage and collaborate.

Citizen focused services

Cloud adoption has the potential to deliver innovative citizen-centric services. Aside enabling rapid service delivery through automation of IT infrastructure services provisioning and iterative prototyping, Government Cloud services will simplify user on-boarding, making it easier for citizens and stakeholders to leverage government services.

Stakeholder interactions will also be standardized helping to ensure a consistent client experience, especially in competitive markets where GoTG may compete with other cloud-service providers.

Economies of scale in government institutions

The establishment of a national data centre is envisaged to reduce cost for the government, improve efficiency and provide business continuity for government information systems.

Cloud will deliver savings for GoTG

Cloud computing has the potential to deliver savings for the GoTG. The journey to this outcome will require significant compromise and transformation including the decommissioning of IT assets and workforce reconfiguration, as this is where the real savings reside.

Reduced upfront capital spending (CapEx) & Reduced costs of operations (OpEx)

Based on a recent survey of organizations who have adopted Cloud solutions, Computer Economics estimates that cloud computing adoption can generally save an average of 15% of the total IT related expenditure.

This translates into an expected reduction of data centres, network and staff costs and an increase in delivery of more value to the business and customers from application investments.

It is also estimated that the adoption of Cloud will have a positive effect on CapEx on two fronts:

1. Reduce the overall upfront capital expenditure requirements; and
2. Reduce the portion of capital projects at risk.

A number of governments and private sector organizations are reporting savings from Cloud adoption[3].

Public Private Partnerships (PPP) can be utilized to provide cloud services to consumers

With the current low utilization level of the Gamtel data centre, GoTG may consider going into a business partnership with the private sector for the delivery of cloud services. The government may leverage the existing Tier 2 data centre to provide infrastructure-as-a-service (IaaS) to consumers and public institutions.

New business models and new opportunities for the Gambian economy

New business models and transformation, both between organizational departmental units and between the patron and the organization, are often enabled by Cloud adoption.

In-house IT staff are reported to invest on average 10% less time on keeping systems up and running (high availability) and are able to shift this time to business value-adding activities when IT is outsourced to the Cloud. With Cloud adoption, the IT paradigm shifts from commodity IT services such as delivery, operation, support and infrastructure to managing IT "as a business". Cloud enables IT to focus on higher value-add services.

The benefit of the shift away from operational non-value adding tasks by both IT and operations staff is that it creates an opportunity for innovation around business development and growth. However, prior to the advent of the Cloud, testing, prototyping and development was characterized by long lead times, and large upfront capital expenditure. Cloud offers low-cost entry and agility in terms of quicker provisioning of a development environment and increased development throughput. It also enables low-cost experimentation with short

[3] -The UK National Audit Office reported that the UK Government's efforts to cut government IT costs are succeeding with IT reforms and spending controls having previously saved the taxpayer £316 million in a single financial year. 'Government Cloud', the UK's Cloud marketplace, was credited with being fundamental to public service and IT reform in creating a friction-free commissioning point for government IT services, and facilitating the move away from dependence on an oligopoly of large suppliers and lock-ins to long contracts. -Her Majesty's Revenue and Customs (HMRC) is saving £1m a year in running costs including £750,000 on energy costs. Prior to its public Cloud infrastructure and Public Service Network (PSN) adoption, HMRC struggled with a large IT estate featuring 4,493 data centre servers, 78,305 desktops, 6612 laptops, more than 11,100 interfaces and 344 m email transactions in a year.

turnaround times to trial new concepts and provides the confidence that costs can be controlled because it is 'pay-per-use'.

These benefits of Cloud adoption coupled with the Cloud characteristic of being "ubiquitous" are what stimulates innovation and testing of new business opportunities.

For Gambia as a whole, this means that there's an opportunity to shift current paradigms. Traditional cost centres could be turned into revenue centres, previous constraints that favoured large enterprises over small and medium-sized enterprises (SMEs) can be removed and previous processes for stimulating innovative thinking and testing of ideas can be reviewed and re-engineered in support of a more agile, experiment-based business models.

Value Added Services and digital disruption may lead to an organic affinity for Cloud services

Mobile and smart phone penetration as well as the availability of internet capabilities has led to the expansion of digital service offerings in most industries: on-demand ride sharing and video streaming. Financial service and non-financial services alike are providing digital services to customers (e.g. Mobile money).

Increased reuse of existing assets

There is significant duplication of effort and asset investments in GoTG agencies that can be reduced with proper direction/sponsorship, architecture and governance. With GoTG adopting Cloud, MoCDE has the opportunity to review processes, assets and portfolio of projects across GoTG institutions with the objective to standardize and reduce costs.

New revenue streams

Cloud computing has the potential to develop new revenue opportunities and optimize IT returns on investments for GoTG. As agencies implement IT solutions for themselves, there are opportunity to package elements of these solutions and sell it as-a-service to businesses in The Gambia and beyond. On-selling of these new solutions need not generate profit but may support Government institutions to maintain sustainable internal operations with Internally Generated Funds (IGF) and also lighten the burden on the public purse.

Agile development and prototyping

Cloud considerably shortens development processes, increasing the overall agility of the organizations:

Try fast: One of the key advantages of most SaaS Cloud solutions is the ability to test and use solution before committing to long term contracts.

Improved "brand" perception for MoCDE and its capabilities

MoCDE has the opportunity to capitalize from a renewed value proposition for both public sector entities and the citizenry as a whole, it has the opportunity to reinvent itself to establish a modern IT paradigm.

Definition of a coordinated roadmap for the digital transformation of the government

The implementation of the ICT4D programme and the current digital transformation of the public sector will lead to an alteration in the way government institutions operate. The digitization of the operations of government institutions would create an obvious demand for Government Cloud services across the GoTG entities. The migration to cloud in this case would lead to the optimization of hardware infrastructure expenditure and will create the opportunity for financial resources to be used for the procurement of relevant software services.

Increased delivery success

The adoption of applications in the Cloud provides less flexibility to customize software and therefore reduces the risk of delivery failure. Cloud solutions are also more rapid and agile to implement.

A by-product of agile development is that prototyping is more accessible and easier to provide early in the software development lifecycle Cloud. Early testing of applications by business users reduces the risk of applications not adequately meeting business requirements which can frequently occur for GoTG institutions and gives users the opportunity to test whether the application will be able to deliver the intended business benefits. This is a key differentiator of Cloud versus traditional development methods[4].

Cloud will provide MoCDE the confidence of up-to-date, reliable and secure computing

GoTG with the MOCDE's leadership has the opportunity to follow in the steps of other governments within the subregion and beyond and to capitalize on their learnings. MoCDE can define Cloud service performance requirements with respect to privacy, security, confidentiality, reliability, record keeping and auditing for other agencies and institutions to

[4] **His Majesty's Revenue & Customs** in the UK, an early adopter of Cloud services, has provided evidence that Cloud helps with increasing the success rate of IT projects. Andrew Bull, director of delivery and operations in information management services at HRMC, speaking at a Cloud World Forum provided his organization's results; "*in the last couple of years, our IT failure has dropped by 90%. Adding new servers to back up data from ageing file and printer servers used to be problematic and the failure rate kept growing. However, Cloud services offered a long-term, efficient solution*." This is particularly relevant for MoCDE which is currently overseeing a number of high-profile public sector ICT transformation initiatives as part of the e-Government strategy 2020-2024.

leverage. In case MoCDE enables a Cloud marketplace (highly recommended), vendor risk assessments and certifications could be offered “as-a-service” providing a potential alternative revenue stream while at the same time streamlining risk management investment overall.

Reliability and redundancy

Cloud services have become synonymous with both reliability and security. Organizations, both commercial and government, are accepting that all online systems, whether Cloud based or on premise, are at risk and they are looking to Cloud service providers for enterprise-class reliability and security.

State of the art security

Cloud service providers architectures, security workflow processes, skills and capacity typically outstrip what organizations IT departments can provide independently. The adoption of the Government Cloud by the GoTG will create an opportunity to reduce risk profile as Cloud service providers can be relied upon to keep systems up to date, available and respond with agility to any cyber threats using ‘patch once for all’ approaches.

Data security will be a core question for MoCDE before any move to the Cloud. With a combination of technologies and adoption frameworks, it is possible to drive the right behaviours and make sure that information remains secured within the organization.

7.4. IT Landscape Threats

- **Government Procurement and implementation challenges & timelines could derail Cloud Initiatives**
- **Social Infrastructure deficiencies**
- **Energy security as a power crisis could negatively impact Cloud Operations and viability in Gambian**
- **IT and Cyber Awareness and confidence**
- **Data ownership and Privacy Concerns**

Government procurement and implementation challenges & timelines could derail cloud initiatives

Public sector procurement and implementation procedures may hinder MoCDE from fully utilizing the current Cloud Service opportunities available to it. If MoCDE is not diligent enough to act on the Government Cloud opportunity and implement the strategy in a timeframe that remains relevant, it may see its efforts lose relevancy as a result of a fast-changing technology landscape and evolving GoTG priorities.

Social infrastructure deficiencies and impact on Cloud Operations viability in Gambia

Inadequate social infrastructure and services, including power generation and distribution could increase the cost of operations and the smooth running of major IT facilities such as data centres, and also limit access to these amenities by the last-mile data consumer. Despite efforts to expand the national grid to enable 1.6 million more people gain access to electricity; Energy security remains a concern for Gambia. Challenges with internet infrastructure in both the first mile (international submarine cable), middle and last mile cloud may threaten the full utilization of the current Cloud Service opportunities available to it

Energy security will negatively impact Cloud Operations and viability in Gambia

Nearly 50% of Gambia's population do not have access to electricity[5]. Furthermore, the quality of services is weak due to frequent service outages, with some neighbourhoods not receiving days at a time. This could negatively impact cloud operations and the viability of cloud computing services. Frequent power outages and fluctuations could lead to data loss, downtime, and decreased productivity for businesses that rely on cloud services. Cloud service providers may have to resort to backup power sources, such as diesel generators, to maintain their operations which will further increase the cost of cloud services.

IT and cyber awareness and confidence

Gambia's incorporation of IT in early education programs provides early insight into technology. This also provides an opportunity for the early development of IT skills and enhanced perception and affinity to adopt cloud services and its accompanying offerings. Although not many security incidents have been reported, there is a negative perception of the cybersecurity posturing of both public and private sector organisations in the Gambia. Furthermore, the November 2022 malware attack of the Central Bank has left the public pessimistic about the security of governments IT infrastructure. If a proactive national concerted approach is not adopted in dealing with cyber security related matters, confidence in the Government Cloud solution would be undermined.

Data ownership and privacy concerns

While organizational leadership is increasingly becoming accepting of non-traditional ways of administering their operations (Business Process Outsourcing) and accepting use of cloud technologies, concerns around data handling remain a primary concern. Many organizations still have a preference to maintain physical custody of sensitive data to avoid risk of protection breaches and unauthorized access.

[5] World Bank, June 2020 (The Gambia: World Bank to Strengthen Access to Energy and Water)

8. GoTG Cloud Strategic Proposition

Realising the vision - Strategic direction for The Gambia Government Cloud

GoTG should use Cloud services, shared, and managed by one or many authorized and pre-identified Government Cloud service providers. IT infrastructure, software and information will be device agnostic (laptops, smart phones, tablets etc), and provided as a utility via a ratified pricing model – on a pay-by-use basis or otherwise. Government Cloud services should be accessed via a network connection – in many cases traditional internet connectivity; and be supported by new delivery and supply models. The core of the Government Cloud landscape should be facilitated by an online portal (Digital Marketplace) that enables dynamic scalability, service delivery agility, and easy service life-cycle management. Government Cloud implementation for GoTG should not be a milestone achievement but rather an evolutionary program of work which should be instrumental in changing the way GoTG institutions procure and operate IT for all stakeholder benefit.

8.1. Establishment of a Self-service Digital Marketplace

Access to Government Cloud services in the Gambia should be permitted via the creation of a GoTG Digital Marketplace. A key notion is to empower GoTG institutions to leverage Cloud services, and this should be encouraged via the provision of a centralized online self-service portal (marketplace) that displays SaaS, PaaS, and IaaS services that can be procured and easily re-deployed time after time.

The goals for the Government Digital Marketplace ideally should be to:

- Establish first point of call for the procurement of IT related needs within the public sector
- Create a competitive platform and catalogue for all suppliers of public sector IT services to display their wares, but also manage the full Cloud service product life cycle (acquisition, rollout, support and decommissioning)
- Compartmentalize and standardize the rollout of all Cloud services to ensure that governing data frameworks, supplier accreditation statuses and other provisions related to the security of GoTG business prevails

- Be a key enabler for collaborative procurement to help synergize all GoTG projects and initiatives

Benefits for GoTG and key stakeholders

Benefits for Government Institutions

For government the benefits of a Government Cloud would be:

- Rationalized business value received from shared service centre investments
- Build toward clearly articulated goals
- Cost savings
- Measurement and management of IT value in business terms
- Clarification of leadership, sponsorship and governance responsibility

Benefits for Heads of various Government Institutions

For institutional heads, the benefits would be:

- Understand the impact of strategic imperatives on key internal organizational functions and their required obligations
- Drive clear consideration on the value of 'common and joint' versus 'single and distributed' approaches to IT capability delivery
- Provision of a common framework for strategy implementation

Benefits for Senior IT Administrators within GoTG

For IT administrators, the benefits would be:

- Development of a common language for cross-institutional communication and collaboration
- Focus the value IT provides to the respective institution
- Prioritisation of actions and delivery of projects that promote synergies and drive towards a common outcome
- Ensure IT has the resources needed to deliver value

8.2. Suggested Government Cloud Strategy - Achieving the Strategic Direction

How the Strategy Direction can be realized

The move from traditional in-house IT and bespoke applications to the use of Cloud, providing ready-to-use services requires a measured change in approach for government in its dual role as a buyer and user.

The transition to cloud will not happen overnight, and the intermediary phase will be dominated by hybrid cloud deployments. Relying fully on a Government Cloud deployment will be a paradigm shift for government users, support staff and senior management. Hence the transition should be measured to minimize the impact which would not be achieved if a 'big bang' change approach is utilized. It is proposed that MoCDE considers making the Gambia ICT Agency (GICTA) the principal Government Cloud provider. The principal Government Cloud provider may consider establishing MoUs with government institutions who have significant IT infrastructure installations (e.g., data centres) to cede their custody and administration to operators of the National Data Centre. Naturally, these institutions will be looking to recover the RoI on their IT expenditure and the authority as part of these institutional arrangements may choose to meter and monitor their IT service patronization and credit them appropriately till the initial capital expenditure is recovered.

In the short to medium term the GoTG cloud implementation should focus on the consolidation and decommissioning of infrastructure. Subsequently, the consolidation of systems (applications) may occur via the adoption of PaaS services. In doing so, widely used applications (e.g., MS office 365) should be prioritized. Bespoke applications may require more effort and may be tackled later.

To establish the basis for success, the principal Government Cloud service provider must seek cross-government support for the introduction of new controls that should mandate that where there are existing IT commodity services, going forward, the Government Cloud program of work must be used for service renewals.

The Gambia Government Cloud program should therefore:

- Engage widely across public sector organizations and launch an "Essential Cloud" initiative
- Create a self-enabling environment with appropriate guidance. Consolidate legislative regulations and establish the right guidelines to enable agencies act autonomously within the Government Cloud framework. This is key to an impending online marketplace for Cloud services. (See Appendix 1)

- Establish clear, consistent metrics for performance and cost (See Appendix 3)
- Develop and manage the transition plans, business change plan and communications plan / brand and marketing plan and cloud business and operational models
- Mobilize and manage the transition projects required to deliver GoTGs Digital Marketplace, the Government Cloud Services and Infrastructure catalogues as well as Data Centre Consolidation

The Government Cloud program should provide a base management structure and ensure consistency across key clusters of services via the implementation of standards. Cloud services will be overseen by the principal Government Cloud provider that is the custodian of the shared services centre. GICTA by virtue of its mandate, should be positioned as the principal Government Cloud service provider. Suppliers and alternate Government Cloud service providers (e.g., private sector entities), under simplified central governance, will form a united IT service delivery and management structure for government. Figure 5 depicts a high-level conceptual view of the Government Cloud.

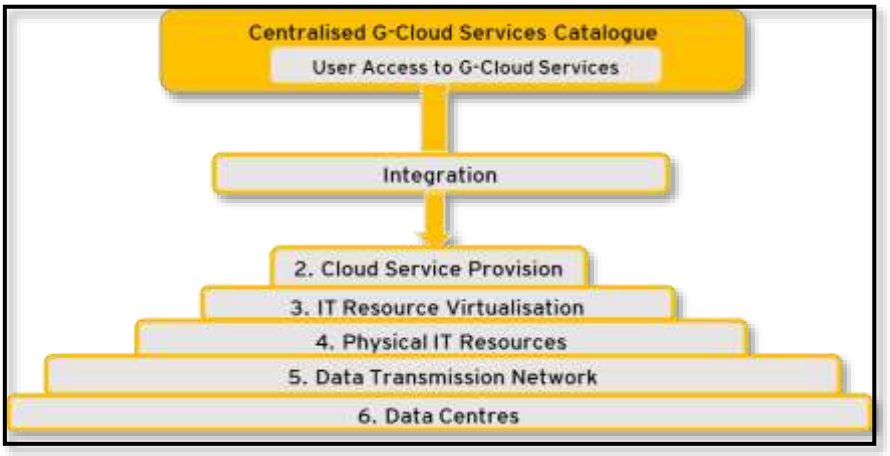


Figure 5: Conceptual view of a Government Cloud infrastructural platform

8.3. Strategic Thrusts

The strategic proposition for how MoCDE may approach the establishment of a viable Government Cloud for use by all is embodied in 5 main strategic thrusts outlined below:

1. **Establish appropriate Governance Framework**
2. **Management of the GoTG IT and Cloud ecosystem**
3. **Rationalization of existing provision and establish role of the private sector**
4. **Reduce bureaucracy, cost and management overheads**
5. **Establish exemplary service management**
6. **Build Workforce Capacity in Cloud Computing**

Strategic Thrust	
Establish appropriate Governance Framework	
Imperatives ► Setup Sponsorship & governance ► Monitor & encourage transparency ► Enable vendor due diligence and vendor management ► Instil audit & compliance precedents ► Promote shared cloud policy and direction	**Outcomes** ► Cloud Legal Methodology basis developed ► Gambia Government Cloud Policy defined ► Cloud policy endorsed ► Government Cloud Authority and IT Governance body established ►
Manage the Government IT and Cloud ecosystem	
Imperatives ► Specify target architecture principles ► Adopt industry standards	**Outcomes** Architecture principles defined Cloud risk analysis completed IT operating model adjusted Compliance and certification framework established IT portfolio dashboard established Principal Government Cloud service provider certification achieved Cloud alternative assessment guidelines established Lifecycle methodology established First Cloud candidates identified

Strategic Thrust	
Rationalize existing provision and establish role of the private sector	
Imperatives . ► Reposition Gamtel as CSP ► Establish cloud policy and selection criteria	**Outcomes** ► Gamtel positioned to meet resident private Government Cloud infrastructure requirements ► Centre of expertise established ► New IT projects have evaluated Cloud options ► One major agency has a roadmap to IaaS ► Major agency has hybrid IaaS ► Major agencies have migrated to IaaS ► All candidate assets have transitioned to Cloud
Reduce bureaucracy, cost and management overheads	
Imperatives ► Facilitate CapEx and OpEx shifts ► Revamp procurement processes	**Outcomes** ► Financial management, procurement and vendor/contract management redefined ► G cloud services developed ► Current cloud assets aligned to policy ► G Cloud usage rolled out across institutions ► Interoperability framework established
Establish exemplary service management	
Imperatives ► Improve delivery support ► Manage current risk perceptions	**Outcomes** Gambia Government Cloud Digital Marketplace established with new procurement rules in effect Cloud digital platform with appropriate helpdesk and support framework for digital service delivery established Strong sponsorship established Communication plan established Establish clear, consistent metrics for performance and cost

Strategic Thrust	
Build Workforce Capacity in Cloud Computing	
Imperatives ▸ Development of a National Government Cloud Workforce Framework ▸ Identification of Skills Gaps / Standardization of Government-wide Cloud workforce skills gap assessment ▸ Reskilling and Reconfigure Workforce	**Outcomes** Workforce Development framework Skills gap for current and future cloud service management Cloud training program defined, and rollout started Workforce reconfiguration started

8.3.1. Establish appropriate Governance Framework

Data-holding organizations and institutions should remain accountable for the risks to the information for which they are an owner or custodian. The Principal Government Cloud provider must however establish a Data Governance framework and set guidelines within which to operate. It is recommended that CSPs be required to disclose the commensurate legal and regulatory frameworks that are being adhered to with regards to commodity (cloud-based) services.

For the efficient use of cloud services across the public sector, it is pragmatic to implement key core services once only or co-ordinate their provision on behalf of all other stakeholders e.g., Identity Assurance and Management and Public Key Infrastructures (PKI).

To achieve this, the Gambia Government Cloud program should:

- Establish a suitable Data Governance framework with associated guidelines for government institutions to follow and abide by in relation to Cloud service and general IT system usage
- Undertake identification and formal recognition of High Value Information Assets (HVIAs) for prioritized and special treatment by GoTG with the larger Government Cloud landscape
- Identify key core services that require a one-time coordinated implementation for all government agencies and stakeholders to leverage and prioritize their implementation within Government Cloud program of work e.g., GoTG Integrated Financial Management Information System – IFMIS

Key Imperatives

I.	**Setup sponsorship and governance**
II.	**Monitor and encourage transparency**
III.	**Perform vendor due diligence and vendor management**
IV.	**Audit & Compliance**
V.	**Promote shared cloud policy direction and strategy**

Setup sponsorship and governance

The primary sponsor (MoCDE) should prop up a principal Government Cloud service provider (anticipated to be GICTA) as a governance body to drive and monitor the move to and adoption of the Government Cloud. In doing so, GICTA would be positioned as an IT service management entity. Figure 6 is an example of an IT service management organisation operating model

The sponsor and governance bodies will have to define clear directions, enforce proposed Cloud policies and standards and monitor its adoption and usage to draw the benefits and mitigate risks.

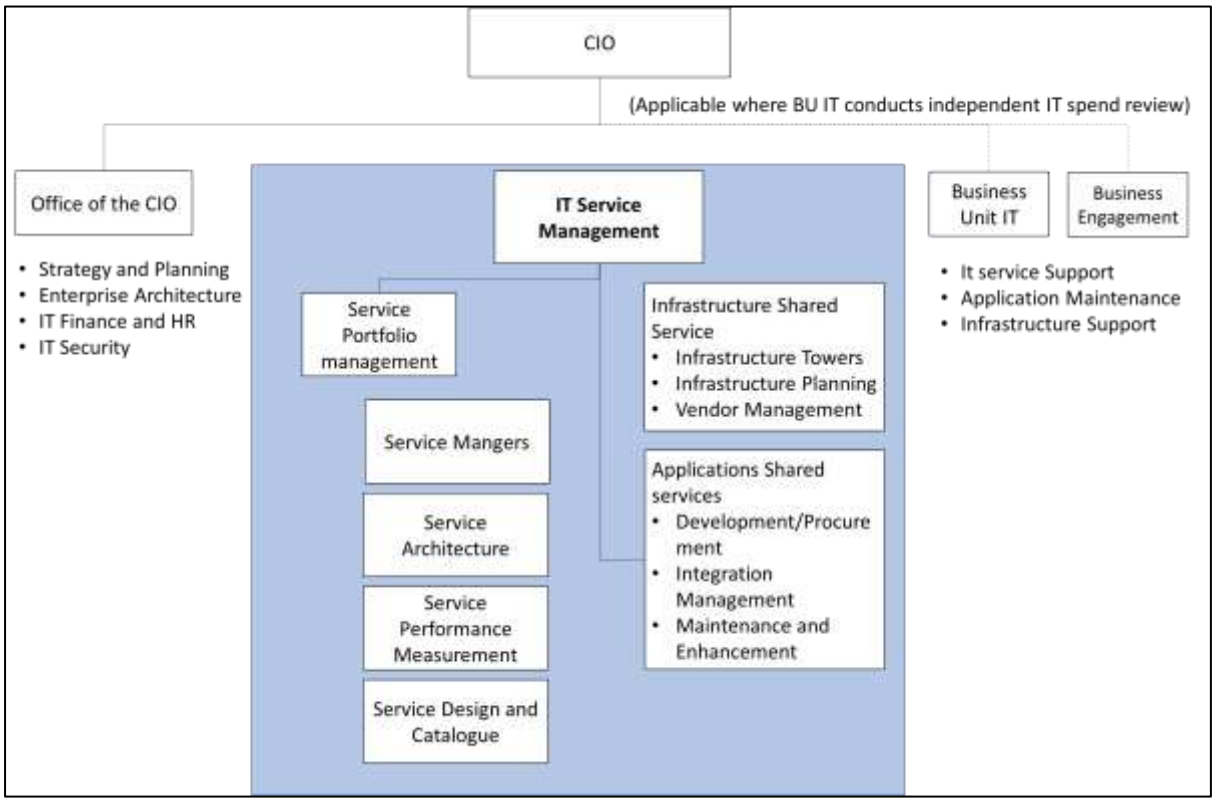


Figure 6: IT Service Management Organization target operating model

In addition to the positioning of GICTA as an IT service management entity, it is recommended that an IT Centre of Expertise is created. The IT Centre of Expertise would provide "IT-in-a-box" enablers and accelerators (strategies, policies, standards, methodologies, and templates as well as controls). It will also capture and disseminate IT knowledge from/to GoTG entities and supports them with use of "IT-in-a-box" enablers.

Monitor and encourage transparency

It is appropriate that the portfolio of (Cloud) projects are centrally reported and available to the governance body to make sure that progress (performance, costs, and adoption) is known and under control.

Enable vendor due diligence and vendor management

With an agile and fast maturing Cloud market, the principal Government Cloud provider, through the MoCDE, will need to develop strong vendor due diligence capabilities to identify reliable mature vendors responding to legislative, standards and technical requirements (e.g. security, privacy, availability). This due diligence can happen either centrally or within the agencies. In the case where the due diligence is executed within the agencies It is appropriate that they share and report centrally to a Cloud "centre of expertise" or knowledge repository so that other agencies can benefit from the market analysis done.

Instil audit & compliance precedents

Regular audits will have to be organized by agencies using Cloud to ensure that Cloud vendors are delivering on SLAs and as per their contract. These audits should be reverted to the Cloud governance body.

Promote shared cloud policy direction and strategy

The ICT4D strategy and the eGovernment strategy (2021-2024) does not clearly articulate a vision and strategic focus for cloud use by the GoTG beyond the adoption of Cloud technology to operationalise the use of common infrastructures in the public sector. The Principal Government Cloud services provider must articulate a strategic focus for cloud use by GoTG.

Leading practice in creating a shared vision can be applied by the Principal Government Cloud services provider. A Cloud enterprise vision creates a trusted Cloud ecosystem through provision of a storefront, IT marketplace and technical brokerage platform to cultivate and develop a business ecosystem and community of Cloud service providers, consultants, integrators and partners. The recommended strategic direction has 3 objectives:

I. IT-as-a-service – adoption of innovative and ready-made Cloud-based IT services
II. Service brokerage – support government to become an efficient buyer and consumer of IT services
III. Service innovation – leverage innovative market capabilities and industry partnerships

While the benefit of Cloud is evident, there are several contentions and potential constraints that the Principal Government Cloud provider should consider. Large scale government wide Cloud adoption will be slowed by issues such as risk perception, complexity of integration, acquisition and security without a coordinated and structured approach to Cloud acquisition and consumption. The Principal Government Cloud provider would benefit from a structured program to govern, assess and refresh Cloud initiatives in the migration plan.

Relevant outcomes

The establishment of an appropriate Governance Framework is expected to result in the following outcomes:

Outcomes	Details
Cloud Legal Methodology basis developed	► Develop legal framework to drive Cloud service adoption within agencies via adjustments to legislative regulation and publication of appropriate guidelines ► Establish or refine existing Government Data governance framework ► Perform High Value Information Asset Identification for prioritized and special treatment by GoTG with the larger Government Cloud landscape ► The governance bodies will have to lead the adoption of the Gambia Government Cloud policies, and standards and monitor its and enforcement
Gambia Government Cloud Policy Directive and strategic focus defined	► Define the directives and strategic focus for Cloud use by GoTG institutions
'Essential Cloud' policy endorsed	► Policy should state that the cloud solutions to be provided by the CSPs must be fit for purpose, secure, provides a RoI, improves citizen services or back-office function effectiveness ► Programs that have not been started will need to assess Cloud alternatives before presenting business case for assessment.
Government Cloud Authority and IT Governance body established	► Principal Government Cloud Authority nominated and mandated to drive Cloud service adoption within agencies and monitor the progress
Cloud service providers identified	► Prepare evaluation framework Select CSPs including Gamtel based on the selection and compliance criteria adopted , negotiate and finalize contract terms

8.3.2. Manage the Government IT and Cloud Ecosystem

While adoption of cloud-based services and centralized IT service provision should improve quality and reduce costs, not all IT services will readily transition. Some existing services will have to be consolidated over time.

The Government Cloud program should develop a broad landscape based on the IT service usage and demand to establish a commissioning and adoption roadmap by:

- Providing IT service and cloud Migration plan – Monitoring and assessing GoTG's general maturity and state of IT service commodity markets.
- Identification of candidate institutions and opportunities to introduce cloud service programs
- Overseeing the existing IT landscape and steer the trend for consolidation
- In the short-term, focusing on migration of institutions to IaaS supported with SaaS rollouts where needed. Complex bespoke applications that will likely leverage PaaS can be addressed in the medium to long-term.
- Prescribe and maintain appropriate standards for technology, security, service and support management
- GICTA to be established and positioned as a leading practice IT Service Management Organization by pursuing certification of relevant standards – ISO 27k, ISO 9001, SOC 2
- Adopt the policies for the Government Cloud and devise the target operating model and specifications (Marketplace catalogue, service management models)

Key Imperatives

- **Specify target architecture principles**
- **Adoption of Industry Standards**

Specify target architecture principles

The architecture principles will need to be defined to provide agencies with guidance on Cloud adoption. These principles can define:

- The events triggering Cloud assessment (e.g., asset end of life)
- The interoperability requirements (e.g., integration with Identity Access Management)
- The performance requirements (e.g., security, availability)

The following operational architecture can be used by agencies to question and analyse the opportunities for Cloud adoption:

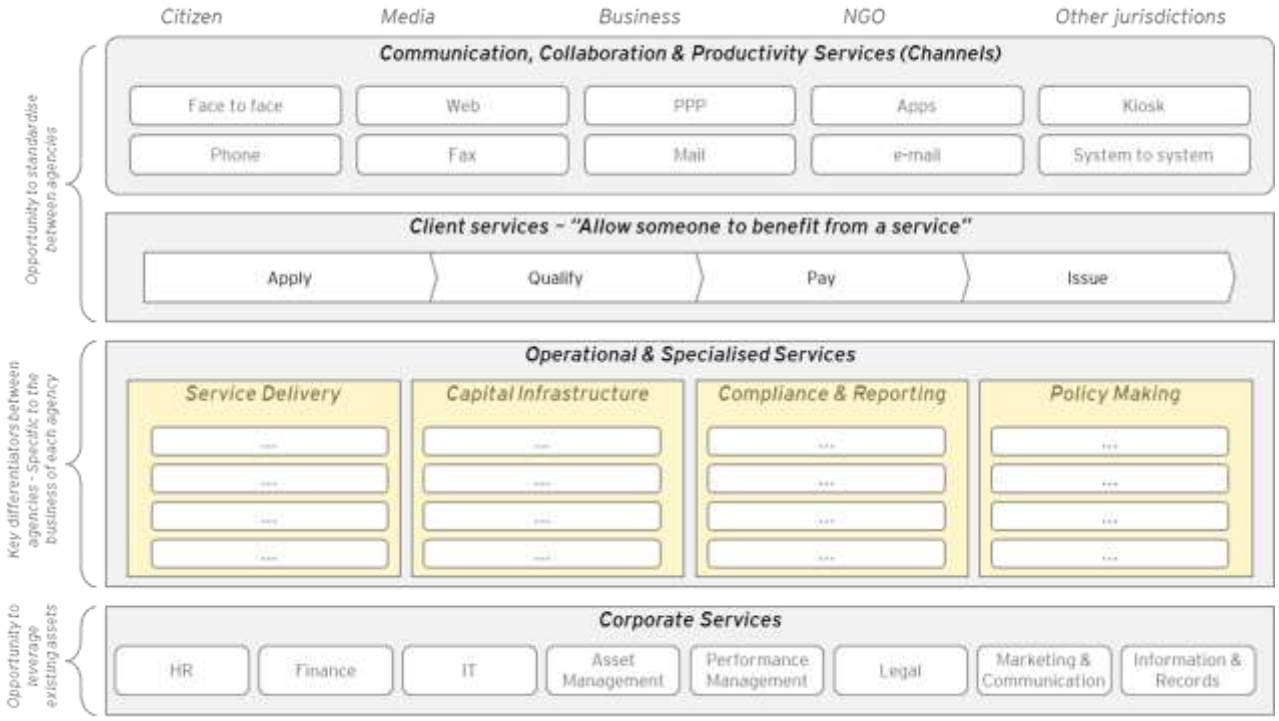


Figure 7: Operational Architecture to support analysis of Cloud adoption opportunities

The following are standard questions to consider:

What **communication, collaboration and productivity services** can we move to or develop in the Cloud? Is there an opportunity to improve efficiency by moving emails and calendars, websites or desktop applications to the Cloud? Has another agency used a cloud solution to deliver these services, and can it be reused?

What **client services** can we move to or develop in the Cloud? Can we better serve the community by jointly providing client services in the Cloud? Has another agency used a cloud solution to deliver these services, and can it be reused?

What **operational and specialized services** can we move to the Cloud? Can some of the core agency services (such as patient administration, police dispatch, school management and licensing management) be leveraging Cloud? Has another agency used a cloud solution to deliver these services, and can it be reused?

What **value-add services** can we move to or develop in the Cloud? Is there an opportunity to leverage industry best practice and simplify corporate processes? Has another agency used a cloud solution to deliver these services, and can it be reused?

Once the candidate services for Cloud are identified, preferred target service models and deployment models can be recommended to agencies. Figure 8 illustrates how the principal Government Cloud provider could provide guidance to GoTG institutions by recommending cloud service & deployment models aligned to the architecture service categories presented in Figure 10.

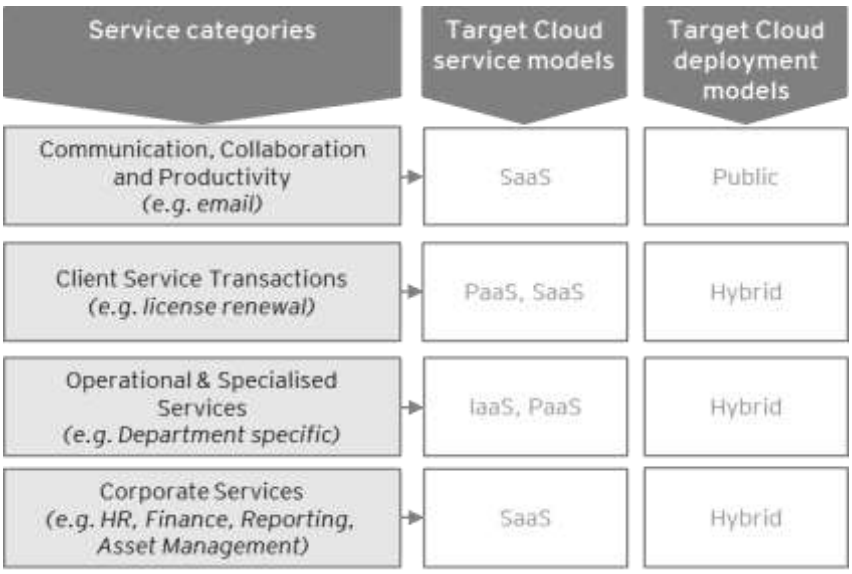


Figure 8: Alignment of Cloud service & deployment models with architecture service categories

One of the key challenges with a mixed IT estate, where it is envisaged the majority of agencies will evolve to, is interoperability. It is imperative that agencies have the expertise e.g., architects, who can design and configure the integration and interoperability standards for Cloud and legacy solutions. Additionally, consideration should be given to establishing a Cloud broker platform that would be used for exposing application functions, orchestrating application workloads, and integrating with both internal systems and the various Cloud service providers.

Adopt Industry Standards

Successful adoption of SaaS service models by GoTG should be accompanied by a move away from bespoke and heavily customized environments to an IT estate with applications that deliver more standardized business processes. In addition to reducing the demand for specialized application development skills within IT, the adoption of SaaS would also drive a cultural shift within GoTG institutions to consider adapting their operational processes to align to the processes supported by the SaaS solution. This is an opportunity to adopt industry-accepted, best practice processes that are being delivered by Cloud vendors in response to market demand. Strong change management is needed to engage end-users, identify the business processes changes required and deliver the necessary training. This may not be the case for all applications considered, however a significant RoI (for the customized solution) should be identified.

Relevant outcomes

The management of the Government IT and Cloud ecosystem is expected to result in the following outcomes:

Outcomes	**Details**
Architecture principles defined	Define architecture principles to provide guidance to agencies on Cloud adoption including: ► Identifying events that would trigger a Cloud assessment ► Defining performance requirements e.g., privacy, security, confidentiality, reliability, record keeping and auditing, that are required for regulatory and statutory compliance. These should be built into Cloud management procedures including vendor management practices – vendor analysis, contractual requirements, vendor audit and certification framework; and information classification considerations as part of the Cloud readiness assessment for assets.
Cloud risk analysis completed	Identify specific Cloud related risks (regulatory, legislation, reputational etc.) and the minimum control requirements that agencies must ensure vendors have in place to mitigate the risks throughout the asset lifecycle

IT operating model	The principal Government Cloud Provider and Authority , needs to be established and positioned to be an IT Service management-oriented organization to increase responsiveness to government cloud and IT support needs and reduce turn-around times on stakeholder problem resolution.
Compliance and certification framework established	Establish framework for performing compliance and certification of cloud service providers / vendors
IT portfolio dashboard established	Establish portfolio dashboard reporting that is available to the governance body and other key stakeholders to provide visibility and transparency on progress (performance, costs and adoption). Deploying consolidated reporting is crucial to realizing benefits for the organization.
Principal Government Cloud Service Provider certification achieved	Principal Government Cloud Service Provider achieves relevant certifications to prop its identity as an IT Service Management Organization for GoTG
Cloud alternative assessment guidelines established	Define guidelines to support agencies in assessing Cloud alternatives for their asset portfolio including cost, benefit and risk analysis This would include decision pathways for identifying the most appropriate service delivery model and deployment model for an asset Selection of a Cloud solution must be in line with relevant Cloud related policies Leverage cost models being developed for financial management processes to provide tools for agencies to undertake the assessments Understand the implications of contracts for current IT assets that could be considered for Cloud adoption
Lifecycle methodology established	Establish a mature approach to Cloud implementation – covering identify, configure, migrate, manage, decommission phases

First Cloud candidates identified by principal Government Cloud provider	Utilizing the Cloud alternative assessment guidelines, the principal Government Cloud provider undertakes the assessment for assets. The priority for assessing assets is taken from the Cloud strategy and architecture principles which define the triggers for asset assessment, as well as any current IT investments for which Cloud alternatives are being assessed. Note that this is an iterative process e.g., as assets reach end of life, the appropriate Cloud service model for that asset may change

8.3.3. Rationalize existing provision

GoTG's IT landscape is diverse as expected and time is required to consolidate and decommission existing assets and infrastructure. Private sector cloud providers may participate in the rationalization procedure with priority given to entities with physical IT resources located within Gambia. However certain data privacy and confidentiality restrictions will limit the types of systems and services that may be ceded to these alternate Government Cloud providers. While a public cloud (private sector involvement) should offer substantial cost savings and increased flexibility for many IT services and service users, data residence and privacy concerns currently prevent some services from being hosted or provided through such means. In these cases, a range of cloud service models can be used to provide the necessary security assurance to hold and process personal or restricted data.

As such, the Government Cloud program should:

- Explicitly define private sector involvement in the Government Cloud program of work as well as their role, obligations, and the required vetting (criteria) to qualify as an official alternate Government Cloud service provider
- Evaluate the commercial approach for current IT service provision to move to commodity / cloud pricing principles early to encourage supplier-led rationalization
- Consolidate all data centres – The National Broadband Network (NBN) data centre managed by Gamtel and any other government-owned and (major) supplier-owned data centres as part of the Data Centre Consolidation plan as the first stage to establishing hybrid cloud capability
- Publish and maintain an up-to-date list of existing re-usable assets and services from which GoTG entities can identify and select services
- Ensure procurement and renewal of IT services is reviewed

Key Imperatives

Establish cloud policy and selection criteria

Reposition Gamtel as a Government Cloud Service Provider

Establish cloud policy and selection criteria

The cloud computing market is dynamic, and the offering and its maturity are evolving rapidly. A collaborative approach to vendor assessment will have to be established from the centre by the Principal Government Cloud services provider.

A Government Cloud policy will need to be established to guide agencies with their choices and their move to the Cloud. Guidance for agencies on implementing GoTG Government Cloud policies and procedures or updating their own policies and procedures to account for the move to Cloud services, should be provided through the centre of expertise that has been proposed. Vendor selection should be centralized.

Selection criteria for Cloud vendors will need to be defined. Like any procurement, selecting a Cloud Service Provider (CSP) involves verifying that the institutional needs and security requirements are fully addressed in the contractual arrangements and that the outcome is based on the value for money principle.

Reposition Gamtel as a Government -Cloud Service Provider

The Gambia's Data Centre industry is in its infancy and whiles ongoing efforts to improve ICT connectivity and energy reliability will eventually open the country up for investments, proliferation of resident CSPs may not be realised in the short to medium-term.

The government has made significant investments in a Tier 3 data centre, managed by Gamtel. Whiles efforts are made to attract investments in the data centre market, the tier 3 data centre should be leveraged to provide infrastructure-as-a-service (IaaS) to GoTG institutions. Gamtel currently provides private cloud services which is highly underpatronized due to factors including lack of marketing, and service reliability and availability. To position Gamtel as one of the alternative resident Government Cloud service providers it is important to restore confidence in its cloud service delivery capability. A systematic repositioning programme must be established to:

1. Address all the issues underlying the lack of service reliability and availability (e.g. unstable power supply, network connectivity etc.)
2. Achieve the required CSP certification to be established by the principal Government Cloud provider
3. Establish MoUs with government institutions who have significant IT infrastructure installations (e.g., data centres) to cede their custody and administration to national data centre operator / government cloud infrastructure operator. This will help achieve infrastructure consolidation.
4. Purchase additional cloud infrastructure where there is still local hosting capacity shortfall.
5. Establish a policy that mandates the hosting of some classes of IT assets (e.g. HVIAs) on the government owned cloud infrastructure.
6. Promote Gamtel's cloud services

Relevant outcomes

The rationalization of existing provisions and private sector participation defined is expected to result in the following outcomes:

Outcomes	Details
Centre of Expertise established	► Establish a central knowledge capability that agencies can access to support their Cloud journey and make contributions to facilitate information sharing ► This capability will provide guidance on the implementation of the Cloud strategy, Cloud readiness assessments, vendor evaluations and other Cloud management policies ► Initiate information sharing activities, in the first instance utilizing examples where agencies have already adopted Cloud services or are in the process of transitioning assets to Cloud services ► Role of the private sector defined, and alternate Government Cloud service providers established

Gamtel positioned to meet resident private Government Cloud infrastructure requirements	► Commit resources to address issues underlying reliability and availability of Gamtel's services ► Achieve necessary certifications ► Augment the cloud infrastructure of Gamtel's through infrastructure consolidation and purchase of additional cloud infrastructure if needed. ► Commission a marketing campaign for Gamtel's cloud services ► Mandate the hosting of certain categories of IT Assets on government owned cloud infrastructure
New IT projects have evaluated Cloud options	► As will be mandated in the Cloud policy to be proposed, any new IT projects will be required to evaluate Cloud options as part of their business case submission of investment
One major agency has a roadmap to IaaS	► The principal Government Cloud provider to nominate a major GoTG entity to serve as a case study and exemplary model institution for which all other GoTG institutions can use as a frame of reference
Major agency has hybrid IaaS	► Major nominated GoTG entity has transitioned majority of their infrastructure, including non-production environments, to IaaS offerings
Major agencies have migrated to IaaS	► Major agencies have transitioned the majority (if not all) of their infrastructure, including non-production environments, to IaaS offerings where the best value for money and acceptable management of risk are met ► Legacy infrastructure is decommissioned
All candidate assets have transitioned to Cloud	► All candidate assets identified by agencies have transitioned to their selected Cloud service delivery model ► Legacy assets are decommissioned

8.3.4. Reduce bureaucracy, cost, and management overheads

A key objective of the Government Cloud program must be to reduce bureaucracy, cost and management overheads for government institutions with regards to IT.

For a self-service online portal (Digital Marketplace) to succeed, the Government Cloud program must change the adoption model, addressing impeding constraints including legislation and existing contracts to encourage new behaviours and products.

The Government Cloud program should therefore:

- Implement a governance model which controls IT procurement, working closely with the Gambia Public Procurement Authority (GPPA), superintended by a principal Government Cloud provider commissioning process
- Implement a Digital Marketplace for Government based upon commodity components. This will display services that will be able to be used, reviewed and reused across the public sector
- Instil the appropriate provisions and middleware to achieve cross-system talk and appropriate data sharing required by agencies
- Define procurement strategies more appropriate to commodity and cloud procurement, such as:
    - Agile purchasing systems, that allow any supplier who meets the criteria for the provision of the commodity service or solution to be included within the framework
    - Re-define the IT procurement and commercial model to discourage and preclude large, bundled IT procurements to a sustainable and affordability driven model.

Key Imperatives

I. **Facilitate Shift from CapEx to Opex**
II. **Reform Procurement Processes**

Facilitate Shifts from CapEx to OpEx

Financial management processes within GoTG institutions will need to be defined to support the adoption of Cloud services. As an institution moves their assets to Cloud based services, there is a transition of funding from CapEx to OpEx which will cause a significant shift in budgeting and funding models currently in place. This would require policy and process

adjustments by the Ministry of Finance and Economic Affairs, to enable GoTG institutions to more easily access the funding required to transition to Cloud based operations[6].

Reform Procurement Processes

Procurement and contract management processes within GoTG institutions will need to be reinvented in coordination with the GPPA to encourage the adoption of Cloud services.

The Principal Government Cloud authority will select and qualify CSPs who will provide Government Cloud services based on a criteria defined by policy.

A framework for undertaking vendor evaluation and selection will he established. This would include evaluation criteria for vendor selection (which should include minimum requirements for addressing key risk and compliance areas).

The Principal Government Cloud authority will sign framework agreements with the selected CSPs which will form the basis for all contractual relationships.

Overall, the reform would provide a flexible process where agencies are not constrained by protracted procurement and contracting processes, whilst still ensuring due diligence is applied to vendor selection.

Additional procedures that will need to be enhanced include:

I. Business case
II. SLA monitoring
III. Contract management
IV. Financial management of vendors
V. Monitoring vendors for compliance and performance improvement
VI. Service management

Relevant Outcomes

The reduction in bureaucracy, cost and management overheads is expected to result in the following outcomes:

[6] For example, US Federal Government's experience demonstrated a challenge of procuring on a on-demand basis. The pay-as-you-go and on-demand, scalable nature of Cloud services, made it difficult for agencies to budget as they could not predict with accuracy how much they would consume in the future. The proposed Government Cloud Authority would have to manage this challenge appropriately.

Outcomes	Details
Financial management, procurement, and vendor/contract management redefined	***Financial management*** ► Modify budgeting and funding models to enable agencies to more easily access the funding required to transition to and operate in a Cloud environment. (Affect associated policy changes where necessary) ► Develop costing models and supporting financial processes for: • Understanding of the TCO of services • Real-time tracking of service consumption • Vendor invoicing and payments • Internal chargeback mechanisms • Measurement of Cloud ROI • Greater cost transparency for the business to assist in optimizing IT costs ► Establish financial management capability, centrally or within agencies. Where the capability sits with agencies, consider using the 'Centre of Expertise' for guidance and information sharing ***Procurement*** ► Recommend modification to the procurement process to enable agencies to source Cloud services from the Cloud marketplace (affect associated policy changes where necessary) ***Vendor/contract management*** ► Procedures that will need to be enhanced for contract/vendor management include: • SLA monitoring • Contract management • Financial management of vendors • Monitoring vendors for compliance and performance improvement • Service management ► Guidance for GoTG agencies on implementing policies and procedures to account for the move to Cloud services, should be provided through the 'Centre of Expertise' that has been proposed.

Outcomes	Details
G cloud services developed	► Sustain initiatives to rollout cloud services like smart workplace and use it as a vehicle to portray GICTA as an IT service management institution with demonstrable reliability and access to key tools
Current cloud assets aligned to policy	► Align current Cloud assets to meet updated policy requirements including vendor management, information security and privacy and compliance
G Cloud usage rolled out across institutions	► GoTGs administration, stakeholder and citizen transactions are delivered through the digital service platform
Interoperability framework developed	► Developing interoperability requirements i.e. standards for the integration of Cloud services with in-house/hosted services

8.3.5. Establish exemplary service management

Transparency and comparability are critical elements to establishing a vibrant marketplace. Today, the bespoke approach of government in procurement of its IT services means that very few services can be directly compared on price, scope, or quality. This has a number of effects - service arrangements cannot be easily shared as the services procured are different, the value of the service cannot be easily determined, and suppliers cannot easily gauge their own performance except against the specific contract which stifles innovation and improvement. MoCDE must facilitate the establishment of GICTA which will be viewed as a reliable central IT service provider. A proactive support framework via a dedicated help desk must be at the heart of GICTAs service delivery.

The Government Cloud program should:

- Position GICTA as GoTG's ICT services implementation arm of MoCDE and by default, the principal Government Cloud provider in The Gambia, equipped with the requisite service delivery capabilities.
- Redundancies will have to be built into the ECOWAN to provide reliable and fast access to IT resources.
- Rollout smart workplace and use it as a vehicle to demonstrate MoCDE's renewed focus with demonstrable reliability and access to key tools.
- Establish a dedicated cloud service helpdesk to provide first, second- and third-line support to all government institutional user level roles (end-users, administrators etc). Helpdesk and supp ort framework will also be the custodian of centralized public sector Government Cloud knowledge base and act as a central point of collection and collation of processes to be adopted within commodity services for service metrics
- Be responsible for establishing standard service metrics through base SLA definitions
- Publish in a comparable form, service metrics spanning the performance, quality and price of services
- Ensure that institutions do not become susceptible to vendor lock-in practices and are flexible to commission and decommission cloud related services in an agile fashion
- Facilitate transition through training plans, business change plan and communications plan / brand and marketing plan of the 'Essential Cloud' policy

Key Imperatives

Improve delivery support

Manage risk perceptions

Improve delivery support

IT users have expectations about consuming technology services. As a result, the Government Cloud Authority must work to ensure that the underlying service delivery and support infrastructure is optimized to provide continuous value and service to their customers. Effective operations teams must first work to prevent problems. If an issue occurs, they must understand the impact from a user's perspective and then follow up with swift, corrective action to restore service.

Manage risk perceptions

Any transformational change undertaken at a GoTG institutional level requires strong stakeholder engagement, change management and communication to support the achievement of outcomes and draw on the full benefits from strategic Cloud initiatives. If GoTG institutions are not prepared for the change, the adoption of Cloud initiatives will be negatively impacted. These change management processes need to be streamlined to keep pace with the speed at which Cloud solutions can be procured and implemented.

From IT administrators down to the end user, any mention of Cloud services invariably brings up questions over perceived risks, for example:

- Will the privacy of my personal data be compromised?
- How will we manage risk when we no longer control the environment?
- How will we ensure we meet all our statutory and regulatory requirements, particularly if information is being processed and stored overseas?

The principal Government Cloud provider and MoCDE should provide guidance to agencies to clarify real risks and how they can be mitigated when assessing asset readiness, service and deployment models or Cloud vendors. Additionally, communication to all stakeholder groups on what risks are real and what controls are in place to mitigate these risks will be necessary in addressing their concerns, reducing resistance and obtaining buy-in for the adoption of Cloud services.

Guidelines for the minimum standards required for regulatory and statutory compliance e.g., privacy, security, confidentiality, reliability, record keeping, and auditing should be identified and built in to Cloud governance practices. These include vendor management practices – vendor analysis, contractual requirements, vendor audit and certification framework, and information classification considerations as part of the Cloud readiness assessment for assets.

Relevant outcomes

The establishment of exemplary service management is expected to result in the following outcomes:

Outcomes	Details
Cloud Digital Market place established with new procurement rules in effect	► Establish a framework for undertaking vendor evaluations/due diligence. This should consider: • Identifying evaluation criteria for vendor selection (which will include minimum requirements for addressing key risk and compliance areas) ► Undertake Cloud vendor evaluation and analysis to identify what is available and what is mature
Cloud platform with appropriate helpdesk and support framework for digital service delivery established	► Establish a digital service delivery platform to better enable the delivery of information and cloud services through a 'one-stop shop' interface that is intuitive and can be accessed from multiple devices.
Strong sponsorship established	7. Key sponsor for Cloud adoption identified from a MoCDE perspective and across agencies
Communication plan established	8. Communication plan established and delivered on an ongoing basis
Clear, consistent metrics for performance and cost established	9. Establish reporting and analysis to regularly measure benefits derived from Cloud adoption

8.3.6 Building Workforce Capacity in Cloud Computing

Human capital development has been identified as one of the key challenges hampering the effectiveness of e-Government in The Gambia. The e-Government strategy 2021-2024 therefore recognises the need to strengthen GoTG staff ICT skills.

The IT departments of MDAs in the Gambia, play an integral role in the management of the ICT estate of the institutions, delivery of services to the public and the provision of security to the essential ICT systems and information of GoTG. Immediate and sustained investment in GoTG workforce is critical to the enhanced quality, security, and impact of e-Government. Without it, the goal to optimise GoTGs technology infrastructure in keeping with the e-Government strategy and the successful proliferation of the Government Cloud strategy will not be fully realised.

As GoTG institutions adopt and migrate to cloud platforms, the impact of these migrations on the workforce needs to be examined. Specifically, there is need for MDAs to identify potential skills gaps that emerge as a result of transitions to cloud-based infrastructure and services, and, where necessary, equip their existing staff with additional skills and knowledge to keep up with the growing trend of technology options available to procure and deploy.

To sustain the availability of cloud skills within government, the principal Government Cloud provider will have to adopt an integrated skills development plan and programme, designed to facilitate the building of competencies that will enable the workforce within GoTG have the fundamental skills and certification in the management and operations of cloud technologies.

Overall, the transition, management, and operation of Government Cloud services in the Gambia require a combination of technical, managerial, and operational skills, as well as strong communication, collaboration, and leadership skills:

1. Technical expertise: cloud computing, networking, security, data management, and automation.
2. Security knowledge: security protocols, risk management, compliance, and governance. A thorough understanding of security requirements and regulatory compliance is critical.
3. Portfolio and Project management: Effective portfolio and project management skills are essential for overseeing the implementation of cloud services, ensuring that project timelines and budgets are met, and monitoring project progress.
4. Change and Communication management: Managing change effectively is crucial for ensuring that the adoption of cloud services runs smoothly. This

requires a strong understanding of the impact of change on people, processes, and technology.

Effective communication skills are essential for managing stakeholders, negotiating with vendors, and ensuring that project goals and objectives are met.

5. Vendor and Contract management: Managing vendor relationships is crucial for ensuring that Government cloud services are delivered on time, on budget, and to the required quality standards and SLAs are properly monitored and enforced.
6. Analytical skills: Analytical skills are essential for assessing the performance of Government cloud services and identifying areas for improvement.
7. Relationship Management: Collaboration skills are important for working with stakeholders within and GoTG institutions to ensure that cloud services are meeting their needs.
8. Leadership: Leadership skills are critical for managing and motivating a team of professionals responsible for managing the operations of the cloud services.

Refer to Appendix 5 for a list of required competencies and certifications required.

Key Imperatives

I.	**Development of a National Government Cloud Workforce Framework**
II.	**Identification of Skills Gaps / Standardization of Government-wide Cloud workforce skills gap assessment**
III.	**Reskilling and Reconfigure Workforce**

Development of National Government Cloud Workforce Development Framework:

The principal Government Cloud services provider in collaboration with the MoCDE should design a set of guidelines and best practices to help GoTG institutions develop and maintain a skilled workforce capable of managing and operating the cloud services effectively. The framework would provide a roadmap for GoTG institutions to identify the skills and knowledge needed to successfully transition to cloud services and to develop and train their workforce to acquire those skills.

The framework will include the following:

- *Competency models:* Outline of the key skills and knowledge needed to perform specific roles related to cloud computing, such as cloud architects, cloud engineers, cloud security specialists, and cloud project managers.

- *Training and development programs*: The framework will include training and development programs that are designed to help employees acquire the skills and knowledge they need to perform their roles effectively.
  It is important for the framework to focus on multiple models for workforce transformation. The capacity development approach should straddle development initiatives for traditional IT and non-IT personnel, emerging talent (including non-IT personnel), professional certification programmes, study tours, apprenticeship programmes, inter-institutional exchange programmes; and exchange programmes through public-private partnerships (PPP) arrangements.

- *Certification programs:* The framework will include certification programs that validate the skills and knowledge of employees working with cloud technologies.

- *Assessment and evaluation tools*: The framework will include assessment and evaluation tools that help identify skill gaps and evaluate the effectiveness of training and development programs.

Identification of Skills Gaps / Standardisation of Government-wide Cloud workforce Skills Gap assessments

The workforce of GoTG institutions need to understand how to manage the complexities of a migration as well as how to support the cloud environment once fully deployed. To help standardise government-wide cloud workforce gap assessment, the National Government Cloud Workforce Development Framework will provide standard skills assessment tools.

Individual GoTG institutions should conduct their own enterprise-wide skills gap analysis to ensure inclusion of all current and future skills and roles specific to their institution's requirements. Heads of IT Departments, Chief Information Officers, HR managers and Heads of Institutional Transformation should collaboratively conduct skills gap analysis that map current IT and Non-IT workforce resources to the skills and role requirements for Government Cloud adoption of the institution.

Reskilling and Reconfigure Workforce

The impact of moving legacy IT estate to the cloud on staff roles, including potential for job losses is often a concern to stakeholders. Workforce reconfiguration will be required for the successful adoption of Cloud services:

- There will be specific need for skills at government managerial levels who understand the opportunities and challenges
- There will be less demand for traditional IT skills such as hardware and system management, application development
- There will be more demand for skills including business analysis, enterprise architecture, portfolio and program management, services provisioning and management, change management, vendor and contract management, relationship management, innovation and problem-solving
- The size of agency IT departments/teams will be reduced over time

Figure 8 illustrates the capability shift that will be required in GoTG institutions for the adoption of cloud computing:

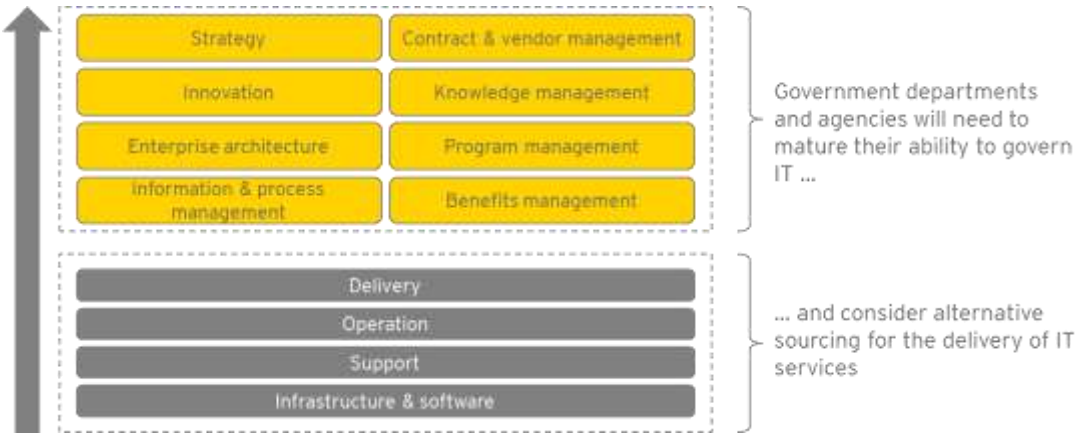


Figure 8: Capability shift required by GoTG agencies for Cloud adoption

GoTG institutions should consider a resourcing strategy as part of their change management programmes. Individual institutions will need to identify their current capability to establish a baseline around the core skill sets required to manage service providers, as opposed to the more traditional 'operator' role that currently exists. Where agencies have already adopted Cloud services, or have outsourced IT assets, this capability may already be evolving. As part of the change management strategy, the organizational structure and required skills to manage the IT estate as it moves to the Cloud will need to be identified, and training and development opportunities or new roles can be established to address the gaps between the required and baseline capability. Additionally, the operational changes that have been developed/augmented to accommodate the necessary Cloud management considerations, will need to be communicated to relevant stakeholder groups to minimize the impact on operations when transitioning to Cloud services e.g., communication of changes to the IT service desk responsibilities.

In instances where the impact of cloud adoption on existing workforce has been identified the skills development approach should consider the interplay between new required skills and new job roles with legacy job roles to foster clarity and ease of transition

Relevant outcomes

The strategy on building workforce capacity in Government Cloud technologies is expected to result in the following outcomes:

Outcomes	Details
Workforce Development framework	► National workforce development framework established and must incorporate, Competency models, training programmes, Certification programmes, Cloud technology skills assessment and evaluation tools. ► Policy implications of workforce development framework considered
Skills gap for current and future cloud service management	► Conduct a skills gap analysis that maps current IT workforce resources to future skill and position requirements. ► Conduct a skills gap analysis to identify both technical and non-technical skill and position gaps to determine which deficiencies are the most significant and represent a critical mission need ► Build a talent pipeline to expand the pool of qualified applicants
Cloud training program defined	► Develop an employee reskilling strategy that focus on training and professional development opportunities and certification in cloud computing
Workforce reconfiguration started	► Based on baseline and gap analysis on the capability required to support the migration of assets to the Cloud, rollout the required workforce changes ► Determine optimal redeployment options to utilize reskilled employees.

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9. Strategic Initiatives

To ensure effective implementation of the Gambia Government Cloud project, the Government Cloud strategic initiatives have been grouped under 4 primary thematic areas which will be the central focus of a roadmap:

Thematic Areas

- Cloud Governance and Trust
- Cloud Adoption
- Cloud Migration
- Cloud Change Management

Cloud Governance and Trust

Establishment of the appropriate legal and regulatory framework to guide and compel GoTG institutions to use and take advantage of the Government Cloud. Identify Government Cloud service providers, regulates costs of the services and also stipulates the services levels that must be maintained. It also involves implementation of foundational infrastructure and support frameworks to establish trust and confidence in the shared service centre to be operated by the Principal Government Cloud services provider.

Cloud Adoption

This involves the establishment of guidelines to enable GoTG institutions to self-assess their current state and determine both their short and long-term cloud service needs. This also involves institutionalizing key platforms to help these institutions embrace cloud services and autonomously adopt the Gambia Government Cloud.

Cloud Transition and Migration

Involves providing support to address the typical challenges faced by Government institutions moving from the traditional in-house IT operating model to reliance on a shared service centre and self-serviced digital marketplace. It also covers actual migration support, i.e., the process of moving existing applications, data, and workloads from on-premises infrastructure or other cloud providers to a specific the Gambia Government cloud environment

Cloud Change Management

This includes areas of institutional capacity support and soft services to optimize stakeholder engagement and involvement. Activities here help to maintain focus on the key objectives, manage expectations and minimize cost.

No.	Initiative	Objectives	Duration
Cloud Governance and Trust			
1	Development of a Cloud Legal Methodology basis	To provide a structured and systematic approach to address the legal aspects of cloud computing (adoption and use) within the GoTG context.	6 months
2	Endorsement of Gambia Government Cloud policy	To establish a formal and authoritative framework for the adoption and use of cloud computing within GoTG	2 months
3	Establishment of Cloud Governance Body	Establishment of a dedicated entity to oversee and govern the Gambia Government Cloud adoption, implementation, and management of cloud computing services within GoTG.	6 months
		Availability of a central authority responsible for providing guidance, establishing policies, ensuring compliance, and driving the strategic direction of cloud initiatives across GoTG entities.	
4	Definition of Architecture principles	To provide a strategic framework for designing and implementing cloud solutions within GoTG.	2 months
		To ensure that Government Cloud adoption in GoTG is aligned with set objectives, promote standardization, address security and risk management, enable scalability and interoperability, optimize costs, and foster innovation	
5	Analysis of cloud risks	Identification of cloud related risks specific to GoTG	6 months
		Determination of appropriate risk mitigation controls	
		Secure and successful implementation of the Gambia Government Cloud, while safeguarding government data, protecting citizen privacy, and	

No.	Initiative	Objectives	Duration
		maintaining compliance with relevant regulations.	
6	Redefinition of Financial management	Effective and efficient allocation of resources to derive maximum value from the Government Cloud adoption To ensure financial transparency, optimization of resource utilization, assessment of ROI, support procurement activities, enable scalability and flexibility in the Government Cloud adoption	12 months
7	Redefinition of Procurement and vendor/contract management	To establish a streamlined procurement and contract management process that maximizes cost savings, efficiency, and effectiveness. To increase transparency and accountability in the procurement and contract management process.	12 months
8	Establishment of Centre of Excellence	Creation of a central cloud knowledge hub to guide, support, and provide best practices to GoTG institutions regarding the implementation and utilization of cloud technologies. Centralization of cloud-related expertise, streamline processes, and foster a culture of collaboration and knowledge sharing among GoTG entities	24 months
9	Establishment of Compliance and certification framework	To ensure GoTG has access to Government Cloud services that meet their specific needs and requirement Establish a standardised process for evaluating risk and also reaping the benefits of Government Cloud services	12 months
10	Certification of Principal Government Cloud provider	To provide the Principal Government Cloud Service Provider with the identity and credibility required to operate as an IT services organisation	12 months

No.	Initiative	Objectives	Duration
Cloud Adoption			
11	Establishment of Cloud alternative assessment guidelines	Establishment of guidelines to provide flexibility and options for GoTG institutions to choose the most suitable cloud deployment models based on their specific needs and requirements	6 months
12	Alignment of current cloud assets to policy	To maximize the benefits of Gambia Government Cloud adoption while mitigating potential risks and ensuring compliance with relevant regulations and standards	12 months
13	Consolidation of infrastructure and repositioning of Gamtel as a CSP	To optimise and rationalise existing infrastructure Position Gamtel as a resident private Government Cloud service provider	12 months
14	Establishment of a Cloud Digital Market place with new procurement rules in effect	Offer cloud services to GoTG institutions as a utility To establish a one-stop-shop where GoTG institutions can compare and procure cloud services.	30 months
Cloud Transition and Migration			
15	Establish Lifecycle methodology	To establish a structured and systematic approach to ensure successful planning, execution, and management of cloud adoption efforts of GoTG institutions. To mitigate risks, promote alignment with GoTGs objectives, and drive the realization of expected benefits from cloud technology.	12 months
16	Identify First Cloud candidates identified	Identification of first candidates for cloud migration to serve as a model cloud transition case studies.	6 months
17	Migration of First cloud candidates / major institutions to IaaS	Use candidate GoTG institutions as case studies in order to minimize the impact which would not be achieved if a 'big bang' change approach is utilized	24 months
17	Migrate all candidate assets to Cloud	All candidate assets for transition to the cloud will be successfully migrated and tested, with end-users fully trained and able to effectively use the cloud-based assets.	48 months

No.	Initiative	Objectives	Duration
Change Management			
18	Establishment of sponsorship	To establish influential individuals or entities within GoTG who can drive and support the adoption of cloud technologies at various levels	6 months
		To secure high-level support and guidance, mobilize resources, address concerns, and create a conducive environment for successful cloud adoption within GoTG	
19	Establishment of a Communication Plan	To ensure effective communication, engagement, and collaboration among stakeholders, while building trust, managing expectations, and ensuring a successful transition to cloud with GoTG.	6 months
20	Establishment of metrics for performance and cost	To effectively monitor, measure, and evaluate the progress, success, and impact of the Gambia Government Cloud adoption initiative	6 months
21	Establishment of Training program	To address specific skill gaps	12 months
		To equip GoTG workforce with the necessary knowledge, skills, and expertise to effectively plan, implement, and manage the cloud adoption programme.	
		To ensure that GoTG workforce have the capabilities required to leverage the full potential of cloud computing	
22	Workforce reconfiguration	Reconfigure the workforce to align with the Government Cloud implementation project objectives, reduce skill gaps, eliminate redundancies, and improve efficiency and effectiveness.	12 months

Refer to Government Cloud implementation plan for a roadmap and detailed charters, on each initiative

Appendix

Appendix 1: Case Studies

Aspect	United Kingdom	Oman	Ghana	Nigeria
Governance Structure	A cloud governance framework is in place with detailed policies regulating procurement of ICT and cloud services to public sector are in place. Clear rules and regulations mandating when public sector bodies can use public service providers are set. Cloud services are payable, prices are transparent, buyers' and suppliers' duties are well specified.	Cloud services governance is ensured via general ICT policies and procedures of Oman's Information Technology Authority (ITA), which are adequate. ITA manages service portfolio in accordance with public sector needs and feedback from customers.	The portfolio of IT projects are centrally reported at all times and are available to a governance body to make sure that progress (performance, costs and adoption) is known and under control. The National Information Technology Agency drives and monitors the move to and adoption of the Government Cloud. It implements the governance model which controls IT procurement, working closely with the Public Procurement Authority.	Nigeria's cloud governance functional module consist of the bodies charged to implement the operational module. Mainly the National Information Technology Development Agency (NITDA) coordinate activities across governance bodies, set overall cloud related priorities, and provide guidance to agencies whiles the Bureau of Public Procurement (BPP) operationalize governmentwide procurement regulation for Cloud services.

Aspect	United Kingdom	Oman	Ghana	Nigeria
Pursued strategy	UK Government Cloud strategy is clearly geared towards an open cloud-first and cloud-native market ecosystem where public service bodies can purchase cloud services from competing private sector vendors using simplified procedure and avoiding public procurement bureaucracy. In addition, the Government as a Platform (GaaP) concept is used to promote and encourage reuse of public services and avoid duplication of work, waste of resources.	Compared to the UK Government Cloud, Oman solution is much more controlled and homogenous, there is no competitive marketplace involving private sector cloud providers. The new digital strategy of Oman stresses the need to foster private ICT sector, hence some private providers may appear in the future.	The Ghana Government Cloud strategy is centred on an open essential cloud program overseen by the National Information Technology Agency (NITA) that is the custodian of the shared services centre. Suppliers and alternate Government Cloud service providers under a simplified central governance, form a united IT service delivery and management structure for government.	The Federal Government of Nigeria is pursuing a cloud-first strategy. Local cloud service providers are the fist choice of consideration while deploying and assessing computing resources in the public sector and by SMEs that provide computing services to the public sector.
Marked spend	£1,696,137,364 - current total (ex VAT) of reported Government Cloud sales, November 2016 - 56% of total sales by value and 64% by volume, from all reported Government Cloud sales to date, have been awarded to SMEs ; 77% of total sales by value were through Central Government; 23% through the wider public sector	No official public data, most likely around 100M USD.	No official public data, most likely around 300M USD.	No official public data, most likely around 500M USD.

Aspect	United Kingdom	Oman	Ghana	Nigeria
Underlying Architecture	As UK Government Cloud services are provided by private sector companies, the architecture varies – some agencies use Amazon AWS, others use Microsoft Azure and so on. The general trend is, that the ultimate providers are big, world-class cloud players, which foster brokerage and consulting services ecosystem around them. Common standards and guidance documents are available for GOV.UK (PaaS, implementing GaaP) platform, as well as deployment environment. Digital service standards are published.	Oman Government Cloud is architected and built using open standards and open source approach and components, namely OpenStack as the main cloud technology. Customers use IaaS, PaaS and SaaS services, so far there are no cloud-native solutions. Cloud platform design and virtualization layer foresees usage of various hypervisors and IaaS-level technologies.	Government of Ghana adopted an 'Essential Cloud' Policy meant to replace the traditional in-house and distributed IT infrastructure of GoG to provide consolidated, integrated, reliable and secure government IT service delivery. The Open Group Architecture Framework (TOGAF) was leveraged as a basis for enterprise architectural development	No data has been published
Security and Data Classification	Comprehensive security guidance and principles are published as well as security classifications (three levels – official, secret, top secret) aimed to protect confidentiality and integrity of any government information and data. Some private providers accredited for top secret level.	Comprehensive security guidance and principles are published as well as security classifications aimed to protect confidentiality and integrity of any government information and data.	Ghana National Data Sharing Policy details the Security classifications of government data. Information is classified as either restricted, shareable or open.	Nigeria defined a clear data classification framework in its National Cloud Computing Policy. It clarifies what types of data can be stored on each type of system and also guides institutions when considering any type of cloud either within or outside Nigeria.

Aspect	United Kingdom	Oman	Ghana	Nigeria
Digital Marketplace Structure	UK Digital Marketplace lists thousands of cloud and digital specialist service providers, all of them pre-screened and verified, having framework agreements for simplified procurement of services. Each provider lists openly priced services and supplies other relevant information for public sector bodies to make appropriate decisions.	Cloud services are available for purchase via Government Cloud self-service portal, prices are published. Public sector entities use cloud services provided by ITA. Buyers' and suppliers' duties are well specified through Master Services Agreement.	Ghana's Digital Marketplace is expected list pre-approved cloud services providers	Nigeria partnered with the Bureau for Public Procurement (BPP) and other critical stakeholders to establish a "Digital Marketplace" which encompass a series of framework agreements with pre-approved cloud services suppliers and maintain a database of services in an online portal that can be accessed by procuring entities
Number of Government Cloud providers	19249 Government Cloud services (hosting – 2735, software – 6563 and support – 9951) at the time of reporting. Some providers offer several services. Important note: providers can be from other countries, not only UK.	At the moment ITA is the only government cloud provider, however Oman pursues a strategy aimed to attract private cloud vendors to the market.	The National ICT Agency (NITA) is the principal Government Cloud Service provider (CSP) amongst others (e.g. Microsoft Azure, AWS etc) contracted by the government agencies provide cloud services in Ghana.	No data has been published

Appendix 2: Regulatory Framework - Data Classification Scheme

A typical data classification scheme may include the following tiers:

Classification	Definition	Examples	Data Volumes in this Classification	Appropriate Technical Safeguards
Level 1	Data that is critical national and economic security	Extremely sensitive data such as national defence data, actionable intelligence information, and critical economic data.	Very Small	Storage in government cloud where available; on-premises storage.
Level 2	Data that is restricted by default and shared only with select individuals inside Government on a strict “need to know” basis	Sensitive materials with restricted uses, including law enforcement investigations, sensitive personally identifiable information (PII), and restricted health information	Substantial	Information is suitable for government cloud, or for public cloud but only subject to robust security controls
Level 3	Data that can be shared within government by default, but is rarely shared outside of government	Day-to-day government data, such as non-sensitive PII (e.g., a driver’s license application), routine contracting and economic data etc.	Large	Suitable for public cloud; some security controls may be appropriate
Level 4	Data sets without source information, viewable only	otherwise, de-sensitized, and provided as data sets for public analysis (e.g. anonymized public health or tax records)	Large	Suitable for public cloud; robust security controls on the underlying data but minimal controls on anonymized datasets
Level 5	Publicly available data, with no restrictions on use	Data available to the public generally, including government-published data such as bus schedules and weather data	Very Large	Suitable for public cloud

Appendix 3: Digital Marketplace Cloud Service Provider Selection Criteria

The Principal Government Cloud Authority should establish a selection criterion for Cloud vendors who will provide services within Digital Marketplace and how GoTG institutions will select these vendors based on their requirements. This is intended to ease the navigation of the marketplace and support agencies in selecting Cloud Services that best fit their requirements. Selecting a Cloud Service Provider (CSP) involves verifying that the institutional needs are fully addressed, and that the outcome is based on the value for money principle.

Guiding criteria that the Principal Government Cloud Authority may publish for agencies includes to:

- Assure pricing is transparent, e.g., subscription or pay-as-you-go pricing, upgrades, maintenance and exit costs.
- Costs for unexpected peaks in demand.
- Required service price for upgrade and maintenance fees appropriate to the services being procured, some upgrades may be automatic and included in the service.
- Confirm the cost model is suitable and allows for scaling and changes to service.
- Look for commitment requirements, such as minimum use.
- Confirm setup, training and integration fees; and
- Request references to clarify ongoing cost of service.

In addition to the Security Considerations, agencies may consider the following as they evaluate their own requirements:

- Look for requirements which may not fit into the CSP's existing pre-configured templates and may increase the cost of configuration.
- Confirm the CSP's ability to meet service levels, noting the CSPs will likely have differing service level definitions and capabilities.
- Confirm the ability to monitor CSP service levels.
- Confirm the CSP's architecture will meet scalability, availability, capacity and performance guarantees and is sufficient for agency requirements.
- Confirm any multi-tenancy arrangements and their impact on security requirements.
- Determine any foreign laws which may impact the CSP and the data it stores.
- Confirm where the CSP's data will be located, including any trans-border data transfer, if applicable.
- Confirm the CSP's willingness to allow audits, particularly in multi-tenancy arrangements; and
- Confirm the CSP's disaster recovery (DR) capability meets the agency's requirements.
- If necessary, ask for proof that the supplier conducts DR exercises which confirm the ability to fail key production components to a secondary data center with documented disaster recovery procedures, and

- Key elements of proof include the ability to access to network, components and applications while maintaining data currency, and evidence of processes to keep DR plans, scripts and procedures reviewed and updated.

Appendix 4: Regulatory Considerations

*General provision with reference to sub-statutory legal act which provides the methodology document or guidelines and examples/ templates/ more detailed description. As The Gambia matures in its cloud adoption, a Cloud Computing Act must be considered.

No	Legal Considerations	Implementation Structure
1	Establish or share IT services and Cloud services definition legislative regulation.	*Legislative Regulation
2	Establish shared IT services (e.g., Colocation) and Cloud services classification (e.g. IaaS, DaaS, PaaS, SaaS)	*Legislative Regulation
3	Establish Cloud services provision model definition, private sector and state-owned cloud services providers or only one of them.	*Legislative Regulation
4	Establish mandatory or optional usage of cloud services Legislative Regulation	*Legislative Regulation
5	Identify prerequisites, which are to be met, in order for the state-owned cloud services provider and private sector cloud services providers to be allowed to provide the cloud services with reference to the more detailed policy with the requirements.	*Legislative Regulation
6	Obligations to have the SLA for cloud services defined with the reference to the methodology / guidelines / templates of SLA definition.	*Legislative Regulation
7	Mission critical Information System (High Value Information Asset - HVIA) definition and mission critical Information System classification together with the reference to the methodology of mission critical IS identification and classification (e.g. based on the impact level if the data confidentiality, availability or integrity would be affected)	*Legislative Regulation
8	Establish the principles of financing of state-owned cloud services provider(s) and their activity of cloud services provision together with the reference to the methodology of cloud services costing and chargeback.	*Legislative Regulation
9	Establish State owned cloud services provider's services pricing principles, if institutions would be paying for the cloud services, together with the reference to the methodology of cloud services pricing.	*Legislative Regulation
10	Establish State owned cloud services providers' governance model and principles together with the reference to a more detailed description of the State-owned cloud services providers' governance model.	*Legislative Regulation
11	Establish the procurement principles of Cloud services (centralized, decentralized) and institutions responsible for centralized procurements, etc.) with the reference to policy of cloud services procurement.	*Legislative Regulation

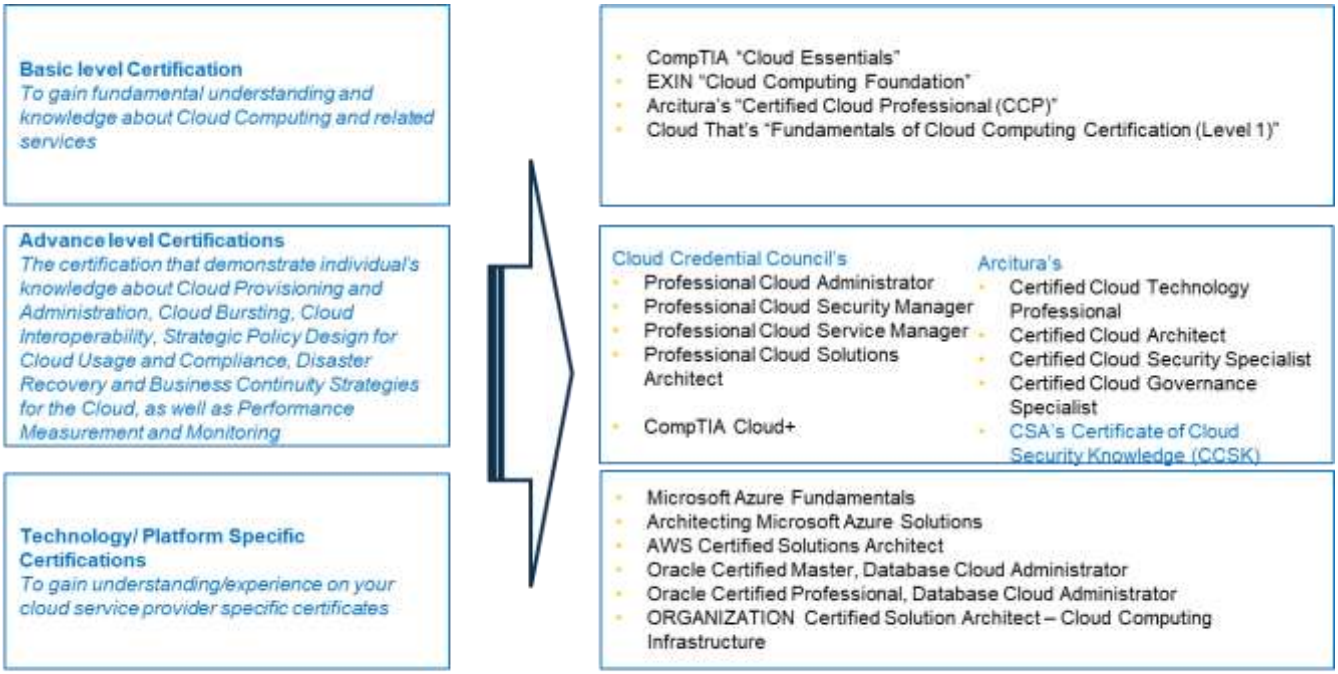
No	Legal Considerations	Implementation Structure
12	Document requirements for state owned cloud services providers operations (e.g. responsibilities matrix (split of responsibilities between the state owned cloud services providers and institutions, who would be using the services, per type of the cloud services, services demand management / IT resources planning and etc.)	Institutional standards and guidelines
13	Document methodology and guidelines with templates for SLA definition of cloud services used by public sector institutions.	Institutional standards and guidelines
14	Document methodology/ policy for mission critical IS identification and classification	Institutional standards and guidelines
15	Document requirements for Cloud services providers' (including state owned cloud services providers and private sector cloud services providers) Data centres facilities	Institutional standards and guidelines
16	Document methodology/ policy of cloud services, which are provided by state owned cloud services providers, costing and chargeback.	Institutional standards and guidelines
17	Document methodology/ policy for cloud services, which are provided by state owned cloud services providers, pricing, if the institutions are to pay for the cloud services provided by the state-owned cloud services providers.	Institutional standards and guidelines
18	Document State owned cloud services providers' governance model and governance policy	Institutional standards and guidelines
19	Document policy for cloud services procurement (centralized, decentralized) and institutions responsible for centralized procurements, etc.)	Institutional standards and guidelines
20	Document methodology for state information resources infrastructure migration to the cloud, including the description of approach and detailed activities	Institutional standards and guidelines
21	Identify priority state information resources, which infrastructure should firstly be moved to Government Cloud.	Institutional standards and guidelines

Appendix 5: Skills Requirements

While embarking upon cloud journey it is critical to gain related understanding on respective domain. The table below lists the minimum key skills required for the different teams across the Principal Government Cloud provider and GoTG IT teams to be successful in cloud adoption. It does not consider current state cloud skills maturity of existing IT teams.

Role	Required Understanding/ Learning
IT Senior Management Team	► Establish and agree on a common understanding on Cloud Fundamentals, Trends, Futuristic Technology, Pros and Cons of Cloud Computing, Business and IT Benefits of adoption cloud
Data Centre Management	► Common understanding of different cloud deployment models e.g. Public, Private, Hybrid and related considerations ► Skills upgrade to cover implementation, management and maintenance of DC components (e.g. IT Infrastructure) in hybrid cloud environment ► Common understanding on Cloud Interoperability
Network management	► Understanding on implementing, monitoring and managing network configuration and consumption in hybrid cloud environment (for example, Configuring Virtual Private Network on Cloud) ► Understanding of Software Defined Network and hands on expertise
Security Operations / Quality Assurance	► Understand IT security considerations in hybrid cloud environment ► Capability to review security measures taken on-premises and also Cloud Provider's end ► Capability to interpret / understand Cloud Service Provider Audit Reports and correlate / identify potential risks related to services availed from GoTG institutions ► Understand the key quality parameters applicable in hybrid cloud environment and define KPI accordingly to achieve high quality
Service Continuity and DR	► Understand Service Continuity and DR perspective in Hybrid Cloud environment e.g. Review / revise existing RPO/ RTO, understand DRaaS model
Business Analyst & System Analyst	► Capability to map the requirement to related cloud services
App Design & Dev. Teams	► Understand cloud Platform as a Service model ► Build understanding on DevOps tools and methodology
DB Design & Administration	► Gain related understanding on DB Cloud Administration
Helpdesk Support (including End User Support)	► Gain understanding on support model, methodology and procedure of Cloud Service Provider ► Lean ITSM practices based on leading standards e.g. ITIL, COBIT etc.
Procurement Management	► Gain understanding on cloud pricing and billing model ► Gain understanding on cloud accounts management ► Gain understanding on provision cycle/period of cloud services ► Gain understanding on cloud services contract model

Competencies of the existing team on topics related to Cloud can be further enhanced through the following certifications across basic, advanced and specialized levels



*Given Certification list is not exhaustive
*Source: http://itcertificationmaster.com/it-certifications/cloud-certifications/