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Cost-Saving and Internally Generated Revenue in Tertiary Educational Institutions: The Role of Cloud Computing

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Abstract

Dwindled funding of public tertiary educational institutions in Nigeria is a clear indication that it cannot be solely funded by government. In response to this, tertiary educational institutions have embarked on several Internally Generated Revenue (IGR) activities. This paper therefore, provides an insight for educational administrators who either seek cost-saving measures in their institution operations or sought for alternative technological innovative IGR strategies not constrained by time and geographical location, without compromising quality service delivery and institutional goals. The paper revalidate using several literatures, the role of Cloud Computing (CC) in realizing cost-saving and revenue generation which is an untapped paradigm that could be leveraged by educational institutions in Nigeria.

Keywords

Cloud Computing, Internally Generated Revenue, Nigeria Tertiary Educational Institution, Cost- Saving Measures

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1. Introduction

One of the major problems now facing the Nigerian public universities is the problem of under-funding. This is not surprising considering the fact that in the recent time, government revenues have reduced sharply due to the collapse of the oil market, and the need to meet heavy and rising debt service obligations [1].

For universities to effectively perform their roles, there must be adequate funding. Nigerian government's priority to universities in terms of funding has declined and this has limited the ability for the universities to effectively and efficiently perform their duties, particularly in the roles of teaching and research [2].

Nigerian government has not been able to fund higher education adequately in order to achieve best result [3]. Ajayi and Ekundayo argued that the Nigerian government over the years has not met the United Nations Educational Scientific and Cultural Organisation (UNESCO) recommendation of 26% of the total budget allocation to education sector despite the government hoax claim of heavy budget allotted to higher education on yearly basis [4].

Trend in the funding of University education in Nigeria revealed that there is no progressive increase in the funding injected to the universities with the growing cost of maintenance, increased students intake, inflation trends and overhead cost [3].

It is imperative to note that non-commensurate of funding with other growing indices in Nigerian Universities have a negative impact on the quality of education as the Universities are constantly been shut down by all categories of staff unions agitating for one form of demand or the other. Sometimes, staff unions demand are not limited to staff

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welfare but renewed improvement in teaching facilities like classroom, laboratories, utilities, staff and students accommodation and library resources [3].

The problem of under-funding and over-reliance on government funds remain a clog in the wheel for university governance in Nigeria. The inadequate funding of the universities has had profound effects on teaching and research, while universities in Nigeria have been forced to embark on income generating projects in order to source alternative funds [5].

The Federal Government (FG), through the National Universities Commission (NUC), has continuously directed all federal universities to explore ways of generating revenues internally such that the managements would not have to look up to the government for solving all their financial problems. Public universities are mandated to internally generate at least 10% of its income annually [1].

Although this directive by FG have been condemned by scholars as this is a shift of responsibility from government to institutions which can make them lose focus in core responsibility of human capital development. This is a clear indication that educational institution can no longer be solely funded by government and in response to this, Nigerian federal universities have embarked on income generating activities.

In as much that education is not the only sector in Nigeria couple with the yearly increase in enrolment and demand for tertiary education, there will hardly be a time government budget allocation will be enough. However, strategies for cost-saving and revenue generation will help in coping with the funding inadequacy and CC is one driving force for such strategies presented in the paper.

Ercan noted that CC is an excellent alternative for educational institution which are especially under budget constraint in other to operate their information system effectively. The author added that many technologies previously expensive or unavailable to users are becoming free and accessible over the internet and taking advantage of this will reduce budget impact in educational institution [6].

Following this background, the present study has as its primary objective to critically determine the role of CC in cost-saving and IGR in educational institution. It exposes some opportunities CC presents in achieving innovative IGR that not time bound or geographically constrained.

The paper propose CC as an untapped innovative paradigm for IGR in addition to several other IGR strategies adopted by educational institutions. It explore how CC could help institutions cut down capital cost in Information Technology (IT) operations and infrastructure provisioning, yet achieving quality academic service delivery.

2. Related Works

As part of strategies for generating additional funds, Akinyemi suggested that universities should continue to embark on intensive entrepreneurship activities and by so doing, all faculties must look for innovative ways of ensuring that their activities generate income. The work noted that upon achieving qualitative university education in developing economies, funding should therefore be seen as all inclusive where government, households, private sector and enhanced internally generated revenue could be efficiently and effective harnessed for providing qualitative university education [7].

Onuoha's paper proposed that in order to derive sustainable maximum contribution from IGR sources, university management should seek professional and more efficient ways of developing their IGR initiatives [8].

Ayo-Sobowale *et al*., noted that it is very important to adhere strictly to the principle of fiscal justice or the Benefiters' Payers Principle of Fairness where all stakeholders are to share in the burden of funding university education based on the personal benefit they derive through good employment and higher rates of return of income an average, and the high social status or positions they attain in the society. Also to generate more funds, there is the need to introduce the macroeconomic strategy where the government needs to diversify to other sectors of the economy [9].

Ogbogu suggested cost-sharing strategy and revenue supplementation strategy as a viable strategies for attaining economic survival and sustainable financing of Nigerian universities. Cost-sharing is the diversification of revenue sources from heavy dependence on the government to being shared with parents and students. This study advocates for the introduction of tuition fees at all levels of study in federal universities, but with in-built mechanisms such as soft loans for students (e.g. scholarships) which could reduce economic strain on the students and their parents in the face of the current economic crisis in the country. Revenue Supplementation Strategy includes university entrepreneurship such as renting of university facilities as well as commercial marketing of research discoveries, university/industry collaboration, sale of faculty services, consultancy, introduction of specialized and marketable teaching and scholarship, establishment of guest houses, bookshops, petrol stations etc [10].

Yusuf proposed cost-saving, revenue generating and public accountability strategies as the major way-forward for the survival of Nigeria university education in a depressed

economy [11].

Odebiyi and Olabisi study was aimed at identifying the different sources of funds available to the Nigerian universities; the adequacy or otherwise of these different forms of funds; and the implications of these alternative modes of funding on university governance and performance. The study reported that in order to address the challenges of underfunding, Universities first adopted some cost-saving measures in order to cope such as: Curtailment of laboratory/practical classes, Limited number of field trips, Curtailment in the attendance of academic conferences, - Curtailment of the purchase of library books, chemicals and basic laboratory equipment, Freezing of new appointments, Virtual embargo on study fellowships, and Reduction in research grants among others. Since these steps have not brought about significant improvements, attention has now turned to alternative sources of funding [1].

3. Internally Generated Revenue (IGR)

There are basically four sources of revenue generation by Nigerian universities; (i) funds received from the governments (public universities) or funds received from the proprietors of private universities. (ii) Internally generated revenue from fees & tuitions (iii) grants in aid and (iv) donations and endowments [12].

Not so much was known of Internally Generated Revenue (IGR) in the Nigerian tertiary educational about two decades ago. For the era when there were fewer universities in the country and the oil revenue was massively available, the federal government provided all the funding for operations and capital development needs of the [13].

The IGR concept implies that the federal government does not have to accept full responsibility for providing funding for all its universities on every expenditure heading. That way, the universities are persuaded to seek ways of earning additional revenue locally and to use it to meet needs of the university that the government is not able to provide for in a given budget period [8].

The problem of underfunding of Nigerian universities is a consequence of the expansion of the system in response to the growing demand for university education and the intensifying needs of modern economy driven by knowledge, without an increase in the corresponding rates of available resources [10, 14]. The government of Nigeria for a long time remained the sole financier of universities, but due to economic recession and a drop in oil receipts, the country now faces tight budget constraints. Consequently, the federal government has made it mandatory for federal universities to generate 10 percent of their total income, while the government provides the remaining 90 percent. In response to this, Nigerian federal universities have embarked on income generating activities [10].

Entrepreneurship program that serves as IGR for most institutions includes consultancy services, petrol stations, bookshops, hotels, schools, etc. This study exposes a new area that is yet to be explored — cloud computing for IGR.

4. Cloud Computing

Educational institutions needs to be responsive to the increasing demand of students, faculty and researchers while still coping with fixed or declining budget to remain competitive. In this challenging situation, CC presents an attractive option for delivering educational services in a more reliable and economic way without compromising quality.

Every day, sophisticated technologies emerge which becomes difficult for educational institutions to keep up with the trend in the face of limited budget. Ensuring programs and licenses are up-to-date, hardware performing optimally to meet user demand and keeping support team to get issues fix cost a lot.

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and it is composed of five essential characteristics, three service models, and four deployment models [15].

The promise of cloud computing is to deliver all the functionality of existing information technology services (and in fact enable new functionalities that are hitherto infeasible) even as it dramatically reduces the upfront costs of computing that deter many organizations from deploying many cutting-edge IT services [16]. Subashini and Kavitha urges that CC is a way to increase the capacity or add capabilities dynamically to existing IT without investing in new infrastructure, training new personnel, or licensing new software [17].

Basically, students and researchers want to learn and experiment. Ideally, having access to different applications and platforms is expected but in traditional software model, it is quite expensive to meet this expectation. However, CC offers tremendous flexibility, scalability and economies of scale to pool of computational resources. It plays key role in reducing high IT operation cost.

The prevailing financial crisis and the growing need that educational institutions are facing in order to provide

necessary IT support for educational, research and development activities can be rescue by CC [18]. Education institutions must exploit the opportunities afforded by CC while minimizing the associated security risks to allow access to advance IT infrastructure, data center, applications and protect sensitive information.

DeCoufle noted that despite the challenging economic climate, some universities are able to expand their services to faculty and students rather than cut them back with the use of cloud computing facilities [19]. A survey conducted by eCampus News reported that 66% and 63% respondents from institutions cited Server SaaS and Data Storage respectively as IaaS service used by educational institutions. Operating System tops the most popular PaaS service used as cited by 70% of respondents. The survey found that SaaS is the most commonly used CC service in educational institution with innovative applications such as Email, Learning Management System and Productivity tools [20]. Several universities in UK have adopted cloud email due to cost and unreliable in-house email systems [21]. Even universities and schools in developing countries such as Nigeria and Africa at large are using cloud email apps supported by Google and Microsoft [22, 23].

Speed posit some examples of IT service delivery strategies, incorporating cloud computing and some of the key considerations in table 1 [24].

Table 1. Cloud Computing Service Delivery Strategies.

Service Model Examples Using Cloud Computing	Key Benefits	Key Risks to Consider
Operate the entire production application using public cloud-based PaaS or SaaS, including customer interface, data transmission, processing and storage.	1. Significantly lower operation and support costs 2. Potentially more reliable and resilient service than on-premise model 3. Reduced exposure to site-specific threats (e.g., disaster) by use of distributed sites 4. Services. rapidly scalable, as and when required 5. Better able to avoid future risks of end- of-life architecture and technological obsolescence	1. Consider incident response and recovery arrangements in the event of loss of cloud service. 2. Consider protection of data in the cloud, such as by encryption. 3. Consider other measures to protect the security of cloud-based assets and services. 4. Consider strategies to revert or to switch providers if needed.
Operate the production environment using traditional on-premise servers, and use cloud IaaS for development, test and failover/recovery environments.	1. Reduced costs of maintaining redundant environments that are only in use periodically 2. Better service quality through the ability to scale for volume and stress testing and/or recovery during peak processing times	1. Consider data protection in the cloud when testing the use of live data or undertaking recovery activities.
Operate the production environment using traditional on-premise servers, and use cloud IaaS for additional CPU and storage during periods of peak demand.	1. Reduced costs of maintaining production capacity that is underutilized during nonpeak periods 2. Reduced capacity risks, as better able to scale up and down when peak processing demand is higher or lower than predicted	1. Make similar considerations to scenario 1, although risks are limited to periods of peak demand processing.
Use cloud IaaS or PaaS for developing new services during early release iterations, as features are evolving and demand is scaling.	1. Greater flexibility in access to IT resources as services evolve and grow; less concern about acquiring resources that may become redundant later	1. Consider risks regarding the security of intellectual property (e.g., software, algorithms) stored in the cloud. 2. Consider the increased criticality of incident response and recovery provisions as services scale.

4.1. Cloud Economies

One of the most cited benefits of cloud computing is its economic value. Kepes highlighted four distinct mechanism through which these cost saving are generated [25]:

1. By lowering the opportunity cost of running technology.
2. By allowing for a shift from capital expenditure to operating expenditure.
3. By lowering the total cost of ownership (TCO) of technology.
4. By giving organizations the ability to add business value by renewed focus on core activities.

Speed observed that cloud providers are able to deliver services less expensively than in traditional IT service models due to two key factors [24]:

1. Through standardization and abstraction of technologies (e.g., use of virtual machines), they can upscale and downscale storage and processing capability more efficiently. This reduces costs of adding and removing systems as service demands change.
2. Through sharing of IT capabilities across multiple clients with different demand cycles, they can eliminate underutilization of resources. This reduces overhead costs associated with idle capacity.

Figure 1 depicts how these cost savings may look for a business that undergoes periodic peaks and troughs and has high unpredictability in its demand for IT services.

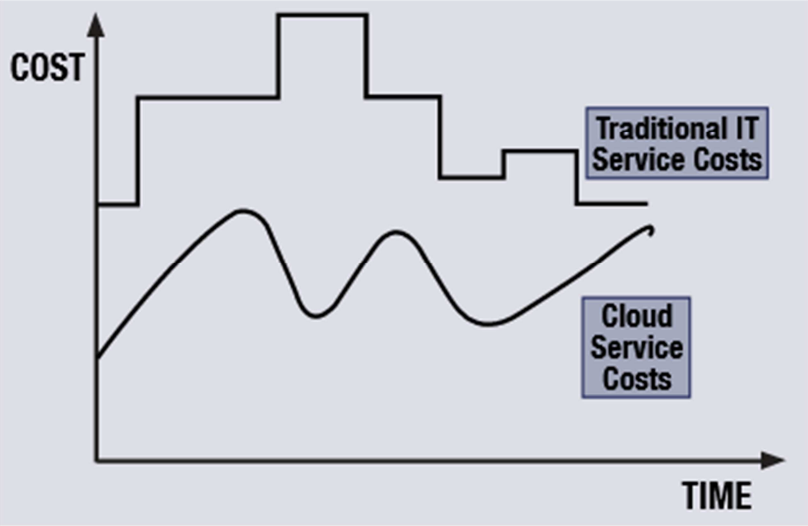

Figure 1. Basic Cloud Computing Economics. Source [24].

Speed noted that cost savings is derived from efficiency of upscaling/downscaling as demand changes and reduced underutilization from shared services [24].

The author noted that the potential cost differential between the two models is even greater when more layers of the IT stack are transitioned to the cloud. For example, for Software as a Service (SaaS), where software, platform and infrastructure layers are bundled into a single cloud service, cost savings are potentially greater than with Infrastructure as a Service (IaaS), where only hardware layers (e.g., storage, CPU, network) are provided. This is because efficiency increases as more and more components are standardized and bundled together [24].

4.2. Capital Expenditure Versus Operating Expenditure

Cloud computing shifts IT spending to a pay-as-you-go model. Most enterprises have hardware utilization rates significantly below 20% because of the excess capacity required to handle peak demand. As such, many organisations provision up to 5 times the required hardware, networking, and data center space during steady state business cycles. If their computing demand is spiky, utilization rates outside of peak cycles are commonly below 10%. As a result, enterprises are spending much more on compute and storage than is required [26].

Figure 2 depicts the traditional model where cloud shifts fixed CapEx expenses to variable OpEx expenses.

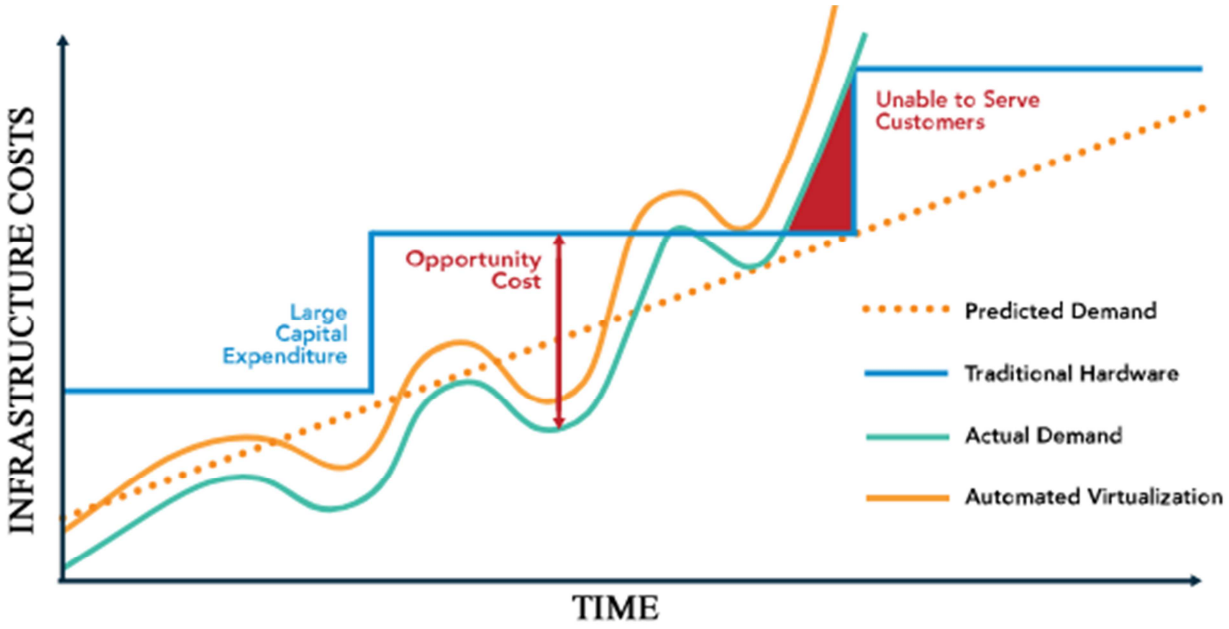

Figure 2. The Traditional View — CapEx vs OpEx. Source [26].

The blue line depicts hardware purchases which are completed periodically to increase capacity ahead of projected utilization. The red arrow indicates the cost an enterprise bears in excess capacity while the red shaded area represents the danger of underestimating utilization.

Logicalis described capital expenditures as a major investments in goods, which show up on the balance sheet and are depreciated over the life of the asset, typically 3 years, whereas operating expenditure shows up on the profit and loss account and relates to expenses incurred on an ongoing basis [27].

Traditionally, an on-premise data centre was considered to be a capital expenditure since it includes the major purchase of a server (compute) and storage hardware, as well as software licenses. In addition, an on-premise data centre means the business will have to incur the direct costs involved with running a server: power, floor space, storage and IT operations, the indirect costs such as network and storage infrastructure and the overhead costs of owning a server including procurement and accounting personnel, along with IT management and attention.

With the advent of cloud computing, the 'as a Service' model of buying software, enterprise cloud storage, and related trends in IT, many organizations are successfully shifting some or all IT expenses to the operational expense [28].

KPMG affirmed that CC can enable innovation, dramatically reduce capital and operating costs, increase agility, and reduce time to market for new products and services. With typical IT organizations spending over 30% of their budget on infrastructure (primarily data centers and data networks), shifting some or all of this work to the cloud can save organizations anywhere from 10-20% of their annual IT budget, savings that can either be returned to the firm or reinvested in growth and innovation [29].

Capacity hoarding occurs primarily as a result of organizations not being able to accurately forecast their future capacity needs coupled with the typically long lead times to provision new infrastructure. Rather than risk the potential of not having sufficient capacity when needed, excess capacity is held back. Cloud technologies are "elastic" and provide the ability to add (and subtract) capacity quickly and easily. This eliminates the need to hoard capacity (with the resulting cost).

4.3. Total Cost of Ownership (TCO)

Hardware and software costs account for only a small portion of the total cost of ownership of any contemporary system. When Information technology (IT) and user labor costs are factored in, the hardware and software costs account for only 15 percent of the total cost of ownership (Hawkins, 2001). Gartner defines Total Cost of Ownership (TCO) as a comprehensive assessment of IT or other costs across enterprise boundaries over time. For IT, TCO includes hardware and software acquisition, management and support, communications, end-user expenses and the opportunity cost of downtime, training and other productivity losses [30]

TCO analysis is not an exact science due to the many assumptions and unknowns that have to be taken into account. As more functionality and capability is provided to end users, as more software are installed or provide more complex hardware at the hands of end users, support and maintenance increases hence TCO rises [31].

TCO provides a good model for evaluating computing costs - visible and invisible, budgeted and unbudgeted but should not be the sole determining factor for choosing a computing system but helps make an informed decisions [31, 32]. Tight budgets and limited expertise often keep small organizations from making effective IT decisions. However, understanding hidden technology costs can actually help in reducing unnecessary expenditures and reallocate resources to more important business functions [33].

According to Network Alliance, most organizations believe their direct costs end at the point of purchase. However, research shows (Table 2) that a computer's base price typically represents less than 20% of its TCO, with technical support, maintenance and labor costs accounting for the remaining 80% [33].

Table 2. IT Spending Benchmarks. Source [33].

The average SMB spends 6.4% of its annual revenue on IT expenses.	AMR Research
The average trade association spends $74,000 on hardware and software every year.	American Society of Association Executives
80% of total IT costs occur after the initial purchase.	Gartner, Inc.
An unmanaged PC costs $5,000 per year.	Gartner, Inc.
Employees spend 30 minutes per week trying to fix PC problems or helping a co- worker.	Compass America
On average, firms spend $700 per user per month when all IT expenses are factored.	Gartner, Inc.

4.4. Cloud Governance

Governance at its core is the effective management of the IT function to ensure that an organization is realizing maximum value from its investments in information technology [34]. It is a critical factor in maximizing the ROI on any

infrastructure.

According to Open Group, at the most abstract level, governance seeks to ensure that what we are governing is doing the right things right [35]:

1. Are we doing the right things?
2. Are we doing them the right way?
3. How do we know?

Governance is making good decision over an asset internally owned or leased. It ensures [34]:

1. Assets are implemented based on laid down policies, procedures and best practices.
2. - Assets are effectively supported and maintained -Assets provides maximum ROI to the organisation.

Cloud computing governance is a view of IT governance focused on accountability, defining decision rights and balancing benefit or value, risk, and resources in an environment embracing cloud computing. It creates business-driven policies and principles that establish the appropriate degree of investments and control around the lifecycle process for cloud computing services [35].

This ensures all enterprise expenditures related to cloud are aligned with the business objectives, promote data integrity across the enterprise, encourage innovation, and mitigate the risk of data loss or non-compliance with regulations [35].

While cloud computing is enabling some fundamental changes on how IT groups deliver services, from a corporate management viewpoint, the basic principles of IT governance still remain true. However, the advent of cloud computing is having an increasing impact on how the components of the governance process are executed [34].

Cloud computing trend is putting pressure on traditional IT governance processes to adapt. For prudent decisions regarding the adoption of cloud services, IT governance and risk managers need to work closely with business managers to promote understanding of key cloud computing principles and to help establish effective governance practices [24].

4.5. Issues and Concerns with Cloud

There is no need for storage if security cannot be guarantee. Most cloud security concerns are more of perception than reality. Speed noted that the potential benefits of cloud computing are compelling. Security is one of the most prominent factor deterring rapid adoption of cloud computing paradigm by most organisations [24].

The aggregation of data in the cloud can make it very attractive for cyber criminals to attack the infrastructure. However, cloud offer better protection of information compare to current security and privacy practices. Cloud providers may be able to implement better security technologies, backup and recovery capabilities than individual organisations.

Subashini and Kavitha conducted survey more specific to the different security issues that has emanated due to the nature of the service delivery model of cloud computing. The authors noted that cloud security depends and varies with respect to the deployment model that is used, the way it is delivered and the character it exhibit [17].

According to Netwrix, cloud adoption rate has risen during the past year, from 43% of organizations in 2015 to 68% in 2016 [36]. However, only 8% of companies are ready to move their entire IT infrastructure to the cloud in the near future. The survey found that the top three cloud security concerns in 2016 are unauthorized access (69%), malware (37%) and denial of service (DoS) attacks (34%). A hybrid cloud approach is preferred by 55% of organizations that are considering a cloud move; 40% of cloud users are already taking advantage of the hybrid model. This model enables them to balance costs, business benefits and data security.

Speed argue that for businesses that dread the thought of their applications and data sitting on a public server right alongside who knows what, a private cloud may be the option for them. This may cost more, but it is still potentially cheaper than traditional IT systems [24].

Despite critics and limitations of CC, it is evident that CC is here to stay [22]. Prevailing economic situation especially in developing countries and the need to remain competitive in keeping up with changing technologies in service delivery will continue to compel more institutions to consider adopting cloud services.

4.6. Rationales for Cloud Computing

This paper succinctly outlines some rationales for switching to cloud. They are as follows:

1. Reduced IT operational cost: This paradigm has the potential of cutting IT operation cost such as hardware and software acquisition, software license purchasing, update and patches, cheaper integration of services, scaling up and down resources etc.
2. Better Educational Service Delivery, Research and Collaboration: It enables higher educational institutions delivers more efficient and quality education to students beyond the campus; provides lifetime learning environment; easier to start and grow online institution; set greater mobility as students and faculties can interact on an array of devices while almost anywhere; allows student and faculty to store and access almost all types of content and data, bridge geographical constraints, disregarding the

physical locality of the student, making available set of collaboration tools for effortless sharing and dissemination of ideas as well as increase productivities between students and faculties.

3. New Opportunities: Cloud computing is redefining campus infrastructure and learning as it offers the new opportunity for infrastructure provisioning. It provides increased accessibility to infrastructure hence greater return-on-investment. CC paradigm provision software "as a service" rather than "as a product" which eliminated issues of software piracy.

5. Research Summary

It is increasingly acknowledged that using technology effectively in educational institution is essential for providing high quality education. The adaptation of new technology is very slow mainly due to the cost implication at a times of deep recession and depleted budget reserves of government and private institutions. To address their financial shortfall, educational institutions are resorting to a variety of cost-cutting measures, including significant cuts to IT budgets [18].

This paper extensively review literatures On CC and it able to establish its role in realizing cost-saving and internally generated revenue as follows:

5.1. Cost-Saving Strategies

Education institutions will continue to enhance infrastructure and curriculum to attract students. Universities and colleges usually do not have sufficient fund to install and continuously maintain state-of-the-art ICT technologies for learning environment that can support students, staff, researchers and developers [37]. Inadequate funding that has resulted to lack of teaching facilities in some cases can be gradually be revive by CC paradigm. This suggest that rather than educational institution investing on every computational resources which most time are underutilised or depreciate fast due to rapid technological changes such should be rather rented if available. This paper recognizes optimal utilization of facilities and innovative technological approach to certain educational processes is a pathway to cost-saving.

Leveraging on cloud infrastructure rather then it acquisition will help cut down cost in labour, maintaining, training and operating those infrastructures. This paper suggest that cost saving can be realized by completely or partially outsourcing educational services such as email, e-library, virtual lab, student portal provided to staff, students and researchers etc. through a leased infrastructures of a CC provider.

One of the core precepts of CC is to avoid the cost impact of over-provisioning and under-provisioning. This is in addition to the opportunity for cost, revenue, and margin advantages of business services enabled by rapid deployment of Cloud services with low entry cost, and the potential to enter and exploit new markets [38].

Westmont College reports that after deploying six cloud-centric service platforms, it has achieved numerous benefits, including a 65 percent cost reduction up front (over more traditional deployments), and a 55 percent cost saving over the useful lifetime of the solutions [39]. By including the cloud services, North Carolina State University achieved a substantially decreasing of expenses with software licensing and at the same time to reduce the campus IT staff from 15 to 3 employees with full working schedule [40].

The impetus for change right now is seen predominantly from a costs perspective underutilised as organizations increasingly discover that their substantial capital investments in information technology are often grossly [41].

5.2. Internally Generated Revenue Strategies

Cloud IGR is basically infrastructure or services provisioning. Berman *et al.,* affirmed that enterprises are applying cloud to generate additional revenue streams by enhancing, extending and inventing new customer value propositions. And cloud is being used to improve, transform and create new organization and industry value chains [42].

Most institutions that needs sophisticated IT infrastructures in driving their programmes are usually limited on the capital they can invest. However, with the advancement of information and communication technology (ICT), leasing infrastructure has becomes an attractive options rather than purchasing them. Resources waste when infrastructure lays idle.

Research shows that most systems acquired by educational institutions are underutilised with utilisation level of individual CPU usage as low as 3% and RAM usage around 25% during peak [43, 44]. This is a waste of money and productive time for any institution when such infrastructure can be commecialised. This paper proposed that institutions with expensive, specialized and sophisticated underutilised experimental or computational resources can open up such for facilities over the internet for commercial usage on pay-per-use mode using cloud technologies.

Educational institutions research centers with highly skilled professionals and academic staff could develop generic or industrial specific SaaS application that could be commecialised on its cloud infrastructure.

CC provides new opportunities to educational institutions to

share underutilized computational resources in the laboratories as a source of IGR through Laboratory as a Service (LaaS).

6. Conclusion and Recommendation

The decline in government funding will continuously put pressure on educational institution to seek viable source of revenue as well as cost cutting initiatives. There is no amount of fund internally generated in a system that can continuously sustain such system if it lacks cost-saving strategies. CC IGR strategy can help address some of the present crises in tertiary education such as under-funding; and lack of adequate infrastructures and facilities which tend to having serious implications for university mandate. CC could help institutions provide services that are not confined to time, space and location. It could be used to deliver services to wider audience that are geographically disperse. CC is ushering in a gradual shift from structural expansion to innovative technological expansion as such institutions do not need to maintain physical and gigantic structures and facilities before they can provide quality education.

The disparity between small and large organisations capability to leverage emerging and sophisticated technologies is gradually being bridged by CC. Smaller organisations can now compete with large ones given a fair technological platforms to leverage. Hence, disparity will no longer be based on financial strength of organisations but how informed their decision on cloud adoption.

The paper therefore, recommend that administrators and stakeholders in educational institutions who seeks additional viable sources of IGR as well as cost saving strategies should implement a paradigm-shift to CC where necessary. Although, this paper recognises that not everything fit into cloud, however, it urge the possibility of using CC paradigm in achieving objectives and goals when planning new IT initiative should be critically explore. There should be more sensitisation on the opportunities that CC presents to educational institutions especially in cost saving and IGR.

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