DISCOVERY

Effect of national internet data center colocation service on digital transformation in Tanzania

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ABSTRACT

The study assessed the effect of NIDC (National Internet Data center) colocation service on digital transformation in Tanzania. The study specifically focused on the effect of NIDC colocation on digital infrastructure and it was guided by six predictors tested towards digital transformation namely cost, power, uptime, reliability, support services and connectivity. Explanatory design was applied using relationship testing between study variables with data collected using questionnaire from a sample of 80 respondents who were employees of the mentioned entity. The collected results were computed in SPSS data sheet version 24.0 to generate statistical tests to present the results. The relationship testing between study variable was facilitated using multiple regression analysis. Findings indicated that five of the tested predictors with the exception of cost had significant effect on advancing digital transformation. The implication of the results is that digital transformation through data center colocation is affected by power, uptime, reliability, support services and connectivity.

Keywords: Data Centre Colocation, Power, Cost, Uptime, Reliability, Support Services and Connectivity

1. INTRODUCTION

Colocation is a data center facility service in which a business, an organization or individuals can rent space for its servers and other computing hardware. In addition to space, colocation provides the building, cooling, power, bandwidth, maintenance and security to co-located devices with 24/7 technical supervision for close to 100% uptime guaranteed by the owner of the data center, while the customer provides servers and storage fees (Pashke, 2016). In that case, the networking hardware resources owned by an organization, such as web applications or database servers are located outside the vicinity of the organization's premises and co-located to another organization's facility, usually an ISP or a service provider. Colocation is considered as the most cost-effective solution for organizations to employ instead of building own server spaces which are normally capital-intensive (Bigelow, 2020). Through colocation service, organizations or individuals are able to lease office space, use reliable networks and internet bandwidth and enjoy other benefits such as security and reliable

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maintenance to its hardware and data resources coupled with up-to-date technology. Several organizations particularly the government institutions can also benefit from using shared data center colocation facility such as the NIDC in Tanzania with guaranteed security and service availability thus offering conducive environment for digital transformation (Rath, 2011).

Data Center Colocation and Cloud Computing Comparison

Based on various studies, data center colocation and cloud technologies offer conducive environment to deliver the services in accordance to the needs and wants of the customers reliably and efficiently, thus fostering digital transformation. Apart from colocation, cloud computing is another service offered by most data centers which refers to the delivery of computing services including data storage, software, servers, databases and networking resources over the internet (Posey, 2022). These resources are shared by a number of subscribers and each subscriber only pays for the services they use. However, this model is more suitable for small companies or start-ups that do not need much internal IT (Information Technology) expertise to operate due to minimum entry barriers (Saran, 2021).

Cloud is often described as a consumption-based model. In other words, there are computing resources within the public cloud and those resources are shared by a number of different subscribers using the online platform. Initially, YouTube and Google drive were the only cloud service provided for the purpose of storage of photos, videos and other data over the internet and could be accessed from anywhere at any time. However, with the advance in technology, the cloud services can be categorized in three groups which are Infrastructure as a service (IaaS), this provides IT infrastructure such as storage, computing resources which includes servers with operating systems together with network services (Bartels, 2011). Another service offered via cloud is Software as a Service (SaaS), which provides for shared software such that a customer does not have to buy own software but only pay for its license (Glanz, 2012). A good example of this is Microsoft Office 365 suite in which one can use part or full product based on subscription option. Platform as a Service (PaaS) is another cloud service that provides infrastructure for software development, often used for businesses that are into software development (Katynews, 2021). Both data center colocation and cloud computing have significant contribution towards digital transformation.

On the other hand, colocation is also a consumption model, but it is a different type of consumption model because rather than leasing computing resources such as server, an entity lease space within a shared data center which can be rack space, cabinet or a cage space, or an entire room for its servers and other computing hardware (Fox, 2012). Therefore, one of the most important distinguishing factors is that, with colocation a company or individual only lease space and brings in their own computing resources while with cloud computing the client uses cloud provider's computing resources. Additional things provided to colocated computing resources include the building, cooling, power, bandwidth, maintenance, security, technical supervision and uptime services reliability guarantee, thus the model provides for suitable platform with reliable services access compared to in house services reliance (Vance, 2008). Colocation is mostly preferred option due to the flexibility it gives for the client to bring in their preferred hardware and software and configure them in a way that fits best to their business. On the contrary, cloud uses standardized hardware and software (one fit for all); this arrangement can be challenging due to incompatibility that may exist in some client's hardware and software.

Moreover, in colocation each customer uses their own dedicated hardware which is not shared by any other client as it is the case with cloud computing, this offers more security and reliable performance together with flexibility for customer to scale up or scale down devices depending on the prevailing workload while cloud customers request for additional resources from the cloud provider at extra charges. Further, with colocation the customer is provided with both online and controlled physical access to colocated facility while for the cloud the customer can only access services over the internet (Harvey, 2017). Cloud providers charge fee each month based on the resources/service that the customer use which includes things like compute charges, storage charges, even data access fees. Colocation providers only charge the customer based on the leased space for colocated facility, other charges do not apply because the customer uses own hardware.

Based on the stated benefits, colocation may be the most suitable and cost-effective model for the businesses to transform their IT infrastructure (Violino, 2016). P & S Intelligence, (2020) report on "Data center colocation market" revealed a major growth in Asia Pacific data center colocation adoption with the market revenue of $42.1 billion in 2019 and predicted growth of 14.8% between 2020 and 2030. The factors behind this expansion are increased generation of large volumes of data, rapid adoption of cloud technology, efficient disaster mitigation and financial benefits associated with data center colocation. Data center colocation model allows companies to rent space of a data center and its infrastructure at a reasonable cost.

NIDC Overview

The presence and operations of the National Internet data center and colocation services may serve as the essential platform towards facilitating digital transformation both to the public and non-public entities in Tanzania (Hannah, 2020). NIDC is a government owned institution of $93.6 million worth investment placed under Tanzania Telecommunication Corporation Limited (TTCL). It is a state-of-art tier-3 data center connected with an upgraded MPLS National backbone with the support of Seacom & EASSY international submarine cables, making it a strategic hub which offers multiple redundancy scheme to ensure availability and reliability, it started its operations in the service provision in 2016 with both government and private entities as customers (Munguti & Opiyo, 2018). As reported in local publication "The Daily News"; Prof. Makame Mbarawa by then the Minister of Work issued the directive urging all government entities to use the facility and stop developing their own server spaces. The directive was issued following the fact that the facility was barely occupied while various public institutions were working on developing silo server spaces. This was an effort towards minimizing expenditures and assures efficiency in the tasks and activities.

Further, the measure sought to foster the transformation in government and non-public entities through engagements on reliable digital platform to ensure services availability and foster efficiency in business transactions (Smolaks, 2017). The transformation process towards digitalization in relation to National Internet Data Center colocation in Tanzania is still a concern that needs to be further assessed to determine the predicting outcomes and way forward to assure its realization. This brought about the need to envisage further on the possibility of digital transformation through NIDC colocation by evaluating how well the facility infrastructure is equipped to bridge the gap in Tanzania (Munguti & Opiyo, 2018).

Literature review

The study was guided with technology acceptance model (TAM) centered in the use and applications of the Information and Communication Technologies by different users (Davis, 1989). The theory suggested that application and usage of the technology(s) by different users was influenced by two key motives namely perceived usefulness or value of the technology together with the perceived easiness of use of that technology (Aurore, 2021). In that case, perceived usefulness it is certain that the technology possesses advantages and value to the users which assures the need to use and foster applications (Chuttur & Mohammed, 2021). Despite that, with perceived easiness of the technology implies that the technology is attractive to use and foster applications because in the process it is accommodating to different users and beneficiaries, thus attract usage and application in the process (Wong & Hiew, 2005). The study is connected to this theory on the ground that assessing the role of NIDC colocation on digital transformation in Tanzania entails assessment on the usefulness of the technology with regard to the outcome that is expected to be attained. In that note, studies have been further envisaged in the area including Bari et al., (2013) assessed on Data Center Network Virtualization.

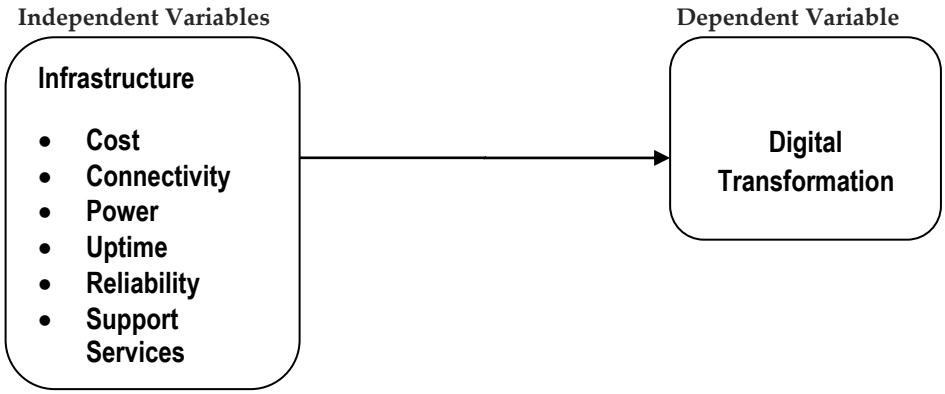
The study was undertaken in Italy using survey design where it was pointed out that data centers have become a cost-effective infrastructure for data storage and hosting of large-scale systems and network applications offering services such as colocation, cloud computing, video streaming etc. These services come with great demands for resources in the underlying infrastructure (storage, computation power, bandwidth and latency). This fostered the need to envisage further in Tanzania pertaining to the issue towards digital transformation in the area Webster, (2020). In his paper "Data Centers: Enablers of the Digital Economy" stated that, "Data centers are critical utilities, the almost invisible heart, lungs and nerve cells of the digital revolution, facilitating increasing general economic activity for the good of citizens – nationally and internationally". Existing traditional data center architectures lack the capacity, scalability and flexibility to accommodate these applications efficiently, thus resulting into poor Quality of service (QoS), deployability, manageability and security threat defence. Data center colocation is a promising technology that can meet needs of tenant applications while reducing infrastructure cost and energy consumption, improved management, scalability, superior resources, reliability and flexibility and better security threats defence all of which are core aspects for digital transformation. Having realizing such outcome it is important to inquire as well in Tanzanian environment to address the situation within the context.

Rahi Systems, (2021) conducted a study in India focusing on why colocation is the best option for health care digital transformation revealed a significant growth in India's colocation data center market with consumption record of 102 MW in 2020. According to this study, this growth was mainly attributed by various aspects including increased operational issues, such as the frequent need for hardware upgrade and updates together with expensive maintenance associated with privately owned data centers. Another critical aspect is that private data infrastructure's lacks room for expansion following faster data growth rate emanating from the Internet of Things (IoT) which brings together a variety of Internet-connected gadgets, including sensors, meters, radio frequency identification (RFID) chips and other devices for data sharing so as to steer up digital transformation.

Moreover, a need for highly enhanced security and reliable infrastructure is vital, the study suggests that network downtimes cost $5,600 per minute; colocation networks guarantee 99.99% uptime which is among the key factor to digital transformation.

Conceptual Framework

The model describes the variables of the study with the way they may influence one another in the process of knowledge generation. The variables constitute of the independent ones and the dependent one with figure 1 illustrates the results.



Source: Researcher's Own Construct, 2022

Figure 1 Conceptual Model

The model describes the study guided by the assumption that digital transformation in Tanzania through NIDC is influenced by the colocation infrastructure services. In that note, six predicting variables were identified for testing and described as follows: -

H1: There is positive relationship between cost and digital transformation in Tanzania.

H2: There is positive relationship between power and digital transformation in Tanzania.

H3: There is positive relationship between connectivity and digital transformation in Tanzania.

H4: There is positive relationship between uptime and digital transformation in Tanzania.

H5: There is positive relationship between reliability and digital transformation in Tanzania.

H6: There is positive relationship between support services and digital transformation in Tanzania.

2. METHODOLOGY

The study was conducted at National Internet Data Center (NIDC), a state-of-art tier-3 Data Center run by Tanzania Telecommunication Company Limited (TTCL) located in Dar es Salaam. Explanatory design was employed with knowledge gathered through relationship testing between study variables. The study comprised of six predicting variables namely cost, power, uptime, reliability, support services and connectivity tested on digital transformation as the dependent variable. The study was guided by the assumption that digital transformation is positively affected by the colocation infrastructure services. The study employed primary data which were gathered from employees using structured questionnaires. The study collected the facts from the sample of 80 respondents. The collected results were computed in SPSS data sheet version 24.0 to generate statistical measurements to present the findings. Multiple regression analysis was used to describe the existing relationship between study variables. In that case, the description is further illustrated by the model that;

$$DT = \beta o + \beta 1C + \beta 2U + \beta 3P + \beta 4R + \beta 5SS + \beta 6C + e$$

Where by

DT = Digital Transformation

βo = Constant factor

β1C = Cost

β2U = Uptime

β3P = Power

β4R = Reliability

β5SS = Supporting Services

β6C = Connectivity
e = Random variable

3. RESULTS

The findings are illustrated to show the contribution of each predicting variable to the dependent variable. Hence, table 1 describes the findings.

Table 1 Multiple Regression Analysis

Model	Unstandardized coefficients		Standardized coefficients	T	Sig.
	B	Std. error	Beta		
(constant)	-9.472	5.373		-1.144	.000
Cost	.281	.283	.091	9.276	.072
Uptime	.098	.277	.079	11.865	.048
Power	.943	.259	.512	12.053	.039
Reliability	1.241	.221	.583	12.821	.008
Support Services	.821	.268	.525	12.314	.021
Connectivity	1.085	.213	.551	12.638	.015

Source: Field Data (2018)

The study results showed the multiple regression analysis on all study predicting variables to the dependent variable. With that, the results indicated five predictors among six tested including connectivity, reliability, power, uptime and support services were positive with significant effect statistically on digital transformation with $p < 0.05$. Despite that, cost as predictor was found positive with insignificant effect on digital transformation with $p > 0.05$. This implies that digital transformation through National Internet Data Centre colocation is influenced by connectivity, reliability, power, uptime and support services. According to Menear, (2020), for the real-time connected functionalities to operate successfully, cutting edge data centers are essential infrastructure to digital transactions. The claim was further supported with the views by Tabrizi, (2019) suggesting that digital transformation with regard to the data center colocation technology is essential in facilitating digital transformation in the country among entities provided that the services offered are reliable and assured with regard to performance. Despite that, Okeleke, (2019) on the other hand suggested that digital transformation may be deemed effective and efficient facilitated by data center colocation provided that connectivity is efficient and assures adequate service delivery in the process. Moreover, Sultan, (2010) pinpointed that adequate and reliable power availability is key drive towards digital transformation in absence of which information systems uptime cannot be guaranteed.

Furthermore, Ziyadin et al., (2020) suggest that digital transformation through colocation services is facilitated in the jurisdiction using supporting services because systems require some level of human intervention to function effectively. However, cost may have less implication in facilitating digital transformation process due to high initial investment required to cater for the infrastructures, facilities, maintenances and others. For countries with limited economies, it is difficult for the initiatives to be realized due to costs involved. Sampera, (2020), in his study titled "How Colocation Can Future-Proof Your IT Infrastructure" found out that the increase in investment geared towards ICT infrastructure management starting from acquisition, security, maintenance and upgrade to suit fast changing technological demands and ensure optimal services availability makes data center colocation technology the best cost minimization option to digital transformation. Moreover, Munguti and Opiyo, (2018) suggest that systems and services high uptime is essential in the provision of electronic real time transactions and services pertaining to data center colocation in order to guarantee service quality provision and efficiency. Based on the field findings, NIDC colocation provides high uptime with 99% guaranteed service level agreement to its customers, thus signifying that the services and online presence are deemed to be reliable to foster digital transformation in the country.

4. CONCLUSION AND RECOMMENDATION

The study assessed the effect of NIDC (National Internet Data center) colocation service on digital transformation in Tanzania. The study concludes that digital transformation is useful and essential because it embraces emerging technology to bring transformations in organization/business practices in a way that ensure efficiency and effectiveness in meeting consumer demands, and competitiveness in the digital arena. However, to sustain such transformation, conducive and reliable infrastructure is a corner

stone to support electronic real time transactions and reliable services accessibility with guarantee service quality and improved efficiency. In that case, digital transformation is possible to be attained in the context based on the outcomes generated from the tested variables that the conditions exist at this point prior to the colocation services provision. The findings revealed that NIDC infrastructure is well equipped with current technology, highly secured with reliable connectivity and power which guarantees 99% services uptime and support services; all of these are important attributes that makes NIDC colocation a suitable platform to foster digital transformation in the country. With digital transformation practices being realized and becoming a necessity in daily operations, the study recommend that it is important to foster right application and use of advanced technology in the business processes in the manner that assures efficiency and effectiveness. This goal can be achieved through the use of scalable and integrated ICT infrastructure such as NIDC data center colocation together with automated operations as a necessary precondition for success, such services should also be expanded to reach wider population in the country.

Informed consent

Not applicable.

Ethical approval

Not applicable.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

All data associated with this study are present in the paper.

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