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Moderating Role of Total Management Support on the Relationship between Cloud Based Deployment Models and Supply Chain Performance

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Abstract: *This study investigated the moderating role of total management support on the relationship between cloud service models and supply chain performance by means of a quantitative approach, to realize the objective of the study, which is to examine management's perception of the implementation of cloud computing deployment models in their companies. The study adopted the survey approach and a multi-item a five-point Likert scale format. The study's population consists of 55 Retail Petroleum Marketing Companies in Rivers State, and the entire population was studied. The key informant approach was adopted to obtain reliable data from four respondents in each of the Retail Petroleum Marketing Companies, and four questionnaires were distributed to each company to arrive at a total of two hundred and twenty (220) distributed copies of questionnaire. The Simple Regression and Analysis of Variance (ANOVA), through the usage of the statistical package for social sciences (SPSS), were exploited to carry out data analysis. The findings revealed that, total management support significantly moderates the relationships between cloud deployment models and logistics process flexibility. The study concludes that, total management support significantly moderates the relationship between cloud deployment models and supply chain performance of retail petroleum marketing firms in Rivers State, and concludes that, retail petroleum marketing companies should fine-tune top-management-support to improve on the relationship between cloud deployment models and supply chain performance in their organizations.*

Keywords: *Cloud deployment models, Logistics flexibility, Supply chain performance, Total management support*

INTRODUCTION

A company's primary goal is to outdo its rivals in terms of superior performance (Khayer, Jahan, Hossain, & Hossain, 2020); therefore, they use competitive IT contrivance, such as cloud computing, in achieving this goal. Cloud computing is one of the recently embraced novel technologies in the business field that requires total management support (TMS) for its successful implementation. Top management support (TMS) is widely recognized as the single most important determinant in the success of all organizational processes and activities (Dong, Neufeld, & Higgins, 2009), and it has been wished-for that TMS should be integrated all the way through the cloud computing implementation process (Elbanna, 2013). Lucidly, the unequivocal and energetic use of TMS enroute for a new Information System is fundamental for cloud computing assimilation, with the intention of putting together the practical aspects of cloud computing services into business processes to derive the predictable business benefits of that action. (Wang, Liang, Ge, Xue, & Ma, 2019).

The literature on cloud computing has acknowledged top management support as a momentous achievement dynamic. For example, some studies have examined and long-established the significance of TMS in deploying cloud computing (Alsadi, 2018; Usman, Ahmad, & Zakaria, 2019; AL-Shboul, 2018; Kinuthia, 2015), though, these studies focal point were on the adoption/implementation stage. On the other hand, considerable studies have investigated the role of TMS in the post-implementation phase of cloud computing. For instance, (Ooi, Lee, Tan, Hew & Hew, 2018 revealed that TMS has an insignificant effect on business performance, while Shee, Miah, Fairfield, and Pujawan (2018) who examined TMS's role as a moderator in cloud-enabled supply chain integration and supply chain performance, found a positive moderating role, but due to the study's supply chain bias, conclusions was difficult to arrive at on their findings regarding cloud computing implementation that cuts across internal and external collaborations, as well as overall company performance.

It is clear as crystal that, some studies have shown that cloud computing can have a significant impact on firm performance (Jayeola, Sidek, Rahman, Mahomed & Jimin, 2020; Al-Sharafi, Arshah, Abu-Shanab, & Alajmi, 2019; Gangwar, 2017). However, a number of these studies examined the direct relationship between cloud computing and performance, but stay questioned for failing to include the cloud-based deployment models effect in its classic. Therefore, this study intends to shed light on the effectiveness of total management support by analyzing its moderating effects in order to acquire a better understanding of predictable relationship between cloud-based deployment models and supply chain performance of retail petroleum marketing companies in Rivers State.

LITERATURE REVIEW AND HYPOTHESIS

Theoretical Underpinning

This study is anchored on the Technology-Organization-Environment Framework

The Technology-Organization-Environment Framework

Technology-Organization-Environment (TOE) framework developed in 1990 by Tornatzky and Fleischer who argued that, the technological context, the organizational context and the environmental context determine the firm's adoption and implementation of technological innovations. It has been used by several authors in order to comprehend different information technology (IT) adoptions like open Information Systems; electronic data interchange; e-business; e-business usage; enterprise resource planning (ERP); knowledge management Information Systems; cloud computing (Alshamaila, Papagiannidis & Li, 2013; Wang, Wang & Yang, 2010).

As cloud computing has been viewed as a new paradigm shift to manage IT services, it has been argued that if TOE is integrated with any other theoretical model, it can offer meaningful insights related to cloud computing implementation and related processes. It is found important to determine how cloud computing affects growth, competitiveness or performance of organizations and created business value (Raymond & Uwizeyemungu, 2007). To achieve this, technology, organization, and environment contexts are used to frame the efficacy of top management support in moderating the relationship between cloud-based deployment models and supply chain performance.

Top Management Support

Top management supports (TMS) is defined as the degree to which top management understands the importance of the Information System (IS) function and are personally involved in IS activities. According to Ifinedo (2008), the extent to which the top management of a business provides direction, expertise, and resources during and following the installation of cloud computing systems is referred to as "top management support." Commitment from top management is critical to ensure that an organization's objective is realized to the point of increasing company performance. Top management support is a critical factor in overcoming barriers and boosting an organization's technological capacity to efficiently utilize new technological services or products (Hsu, Liu, Tsou, & Chen, 2019).

Cloud Computing Deployment Models

The name "Cloud" emanates from a network design that was used by network engineers to portray the position of several separate network artifices and there inter-connection. The shape of this network design was like a cloud (Guru 99, 2019). Cloud is extracted from the notion of business and users ability to obtain applications from anywhere globally on demand (Imran, 2013). Information system existing currently in the cloud are: (1) Email (2) ERP (3) Human Resources System (4) Information Security System (5) Video Conferencing (6) CRM (7) e-Business (8) Project Management (9) SCM. Cloud is used to describe platforms for distributed computing- a group cluster of servers, network, software, interface, etc, which enable a user to implement a specific amount of work. Thus, cloud computing is conceptualized as an assemblage to divest of a body, of corporeal existence of services obtainable from anywhere through the aid of a mobile device with an internet-based connection (Misra & Mondal, 2010; Sultan, 2010). According to NIST special publication 800-145, four cloud computing deployment models were identified (Mell & Grance, 2011). They include:

1. **Private Cloud:** The cloud infrastructure presents many of the benefits of a public cloud computing setting and it is hosted exclusively for a company. It may be administered by the company or a third part and may be present on premise or off premise. Private clouds supply greater regulation over the cloud infrastructure, and are frequently adequate for large installations.
2. **Public Clouds:** The cloud infrastructure is presented to the general public or a large industry group and is owned by a firm who trades on cloud services. Public cloud services are exchanged on demand, characteristically by the minute or hour. Users only make payment for the CPU, storage or bandwidth they utilize. This is a cost-effective way to deliver IT solutions, exceptionally for small or medium sized enterprises. Businesses of all sizes can use Google App as a public cloud. Foremost public cloud providers are Amazon Web Services (AWS) Microsoft Azure, IBM Soft layer, and Google Computer Engine.
3. **Community Cloud:** The cloud infrastructure is a shared cloud computing service setting that is accessible to a confined set of companies or employees, such as

banks, or heads of trading firms. Those who belong to the community generally share similar security, privacy, performance, and computer requirements.

4. **Hybrid Clouds:** It consists of both public and private cloud models with orchestration and automation between the two. A public cloud is employed for non-critical information and exploding workloads and must scale on demands, while mission-critical workloads or sensitive data and applications are placed within private clouds under the regulation of the company. Hybrid cloud computing assist clients to take advantage of the flexibility of the cloud while still becoming aware of value from traditional infrastructure.

Cloud computing deployment models as conceptualized by Guru 99 (2019) is represented in figure 1

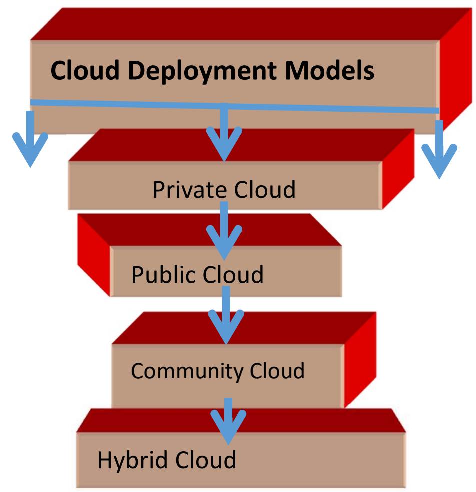

Figure 1: Cloud Computing Deployment Models
Source: Adopted from Mell and Grance (2011) and designed by the Researcher, (2024).

The Concept of Supply Chain Performance

Supply chain performance is defined as a measure of the ability of a supply chain to meet the customer requirements through product or service accessibility at the right time, at the right place, at the right price and at the right quantities (Cuthbertson & Piotrowiz, 2011). Supply chain performance transcends both functional line and company thresholds (Mugo, 2011).The notion of supply chain performance is used to describe performance of an entity with a series of uninterrupted actions and changes of integration of supply chain activities and information flows associated with it, by ameliorating and harmonizing supply chain activities in manufacturing and product supply of a company. Though, the measurement of supply chain performance varies substantially from one study to another, this study adopts logistics flexibility as the measure of supply chain performance.

Logistics Process Flexibility

Logistics process flexibility according to Malhotra and Mackerpeng (2012). is a major dimension of supply chain performance, however, there is no universal harmony on the definition of logistics process flexibility (Lee *et al.,* 2010). Malhotra and Mackerpeng

(2012) defined logistics process flexibility as casing those flexibilities that has straight stimulus on a company's customers. Gupta *et al*. (2013) perceived logistics process flexibility as consequential, essential and effective. Malhotra and Mackerpeng (2012) identified Logistics process flexibility as partly, an evaluation of potential behaviour. This implies that the existence of logistics process flexibility does not depend on its revelation, but complements value internally or externally. Flexibility through information sharing and inter-firm information systems can step-up supply chain flexibility (Gupta, 2013; Sukati *et al*., 2012). Thun (2010) revealed that supply chain flexibility is a function of the extent to which data are shared through interorganizational information systems. While, Flynn *et al.* (2010) investigated the role of e-hubs and web services in supplying flexibility, and reveal that information systems can be applied to grow an in-depth relationship and enhance logistics process flexibility.

Empirical Review

Ikegwuru and Esi-Ubani (2019) studied the effects of interorganizational trust on the influence of cloud computing on supply chain performance of retail petroleum marketing firms in Rivers State by means of a survey questionnaire administered on 202 management staff of 55 retail petroleum marketing firms in Rivers State. The stepwise regression was used for analysis and the results demonstrated that, interorganizational trust significantly moderates the relationship between cloud computing and supply chain performance, and recommends that managers retail petroleum marketing firms should develop sound interorganizational trust practices capable of reinforcing cloud computing adoption that will dramatically improve the firms' supply chain performance.

Ikegwuru and Harcourt (2018) examined the impact of cloud computing service adoption on supply chain performance of 55 retail petroleum marketing firms in Rivers State. Data were gathered by means of a questionnaire survey, obtaining a 95.3 percent response rate. The multiple regression statistics was used for analysis and the results revealed that cloud computing service adoption has a very strong, significant and positive influence on supply chain performance. The study concludes that cloud computing service adoption programs adopted by retail petroleum marketing firms in Rivers Stateaffect supply chain performance through software as a service, platform as a service and infrastructure as a service, and recommends amongst others that, management ofretail petroleum marketing firms in Rivers State should adopt cloud computing services that are capable of stimulating positive supply chain performance that are favorable to the focal company, in order to enhance supply chain performance.

Lal and Bharadwaj (2016) investigated the elements responsible for embracing innovations and advanced its understanding. The study employed an interview and semi-structured questionnaire approach, and used a theoretical sampling method on 21 firms in India. The study found that a significant effect of these factors supply relative advantage in terms of scalability, accessibility, and on demand deployment of services and easy to use interface, experience, and expertise of the cloud service provider and support from top management is significant in the decision to adopt cloud based services. The study also revealed that platform as a service (PaaS) impacts organizational flexibility.

Kung, Cegielski, and Kung (2015) studied how the ambient setting of a company assists in the intention to adopt software. The sample was derived from three hundred and fifty seven respondents from selected from retail and manufacturing companies in the USA. The questionnaire administered gave a response rate of 25%. The study found a significant direct and interaction effects influencing SaaS adoption intention in firms. Most significantly, the study revealed an association between mimetic pressure and perceived technology complexity

Yazan (2013) conducted an empirical investigation of factors affecting cloud computing adoption among SMEs in the North East of England by means of qualitative and quantitative research methodology. The statistical tools used were regression analysis and content analysis. The study found that among the factors examined, relative advantage, uncertainty, innovativeness, and external computing support were found to have significant influence on whether SMEs should adopt cloud computing.

Chinyao, Yahsueh and Mingchang (2011) examined the adoption of cloud accounting and financial performance of high-tech industry in Taiwan. The study obtained data through questionnaire from 111 firms in Taiwan. The study used descriptive statistics, and relevant hypotheses were derived and tested by logistic statistical technique. The study found that relative advantage, top management support, firm size, competitive pressure, and trading partner pressure characteristics has a significant effect on the financial performance of high-tech industry in Taiwan of cloud computing.

From the review of literature, the following conceptual framework was designed:

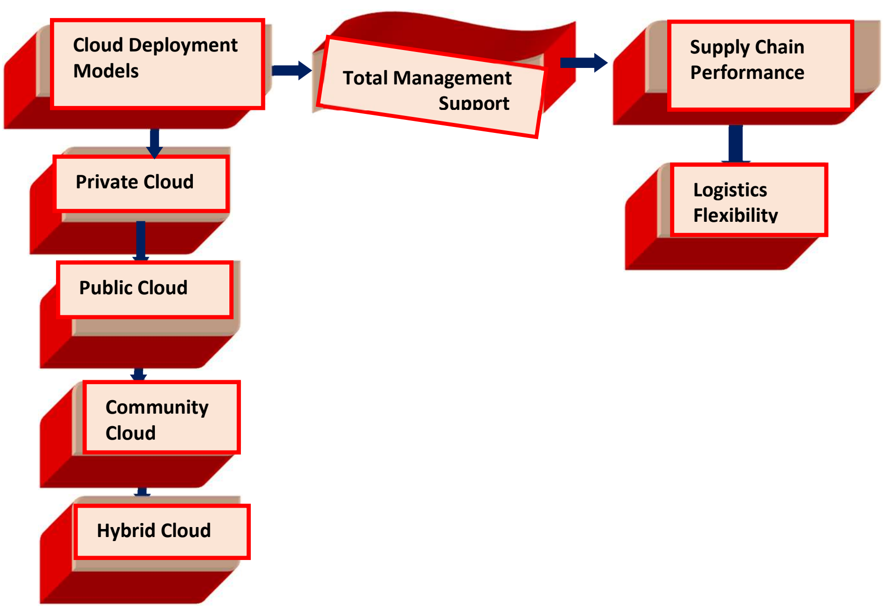

Figure 2: Conceptual Framework of the moderating effect of Total Management Support on the relationship between Cloud Service Models and Supply Chain Performance.

Source: Designed by the Researcher, 2024.

From the conceptual framework, the following hypothesis was formulated:
Ho1: Total management support does not moderate the relationship between cloud deployment models and supply chain performance of retail petroleum marketing firms in Rivers State.

RESEARCH METHODOLOGY

This study investigated the moderating role of total management support on the relationship between cloud service models and supply chain performance by means of a quantitative approach, to realize the objective of the study, which is to examine management's perception of the implementation of cloud computing deployment models in their companies. The study adopted the survey approach and a multi-item a five point Likert scale format. The study's population consists of 55 Retail Petroleum Marketing Companies in Rivers State, and the entire population was studied. The key informant approach was adopted to obtain reliable data for this study. Hence, the key informant in each of the Retail Petroleum Marketing Companies constitutes the respondents. The key informant approach enables the study to collect data from Fuel Terminal Managers, Fuel Transportation/Logistics Managers, Fuel Retail Station Managers and Fuel Retail Station Supervisors, on information relating to the construct under study. Wherefore, four questionnaires were distributed to each company to arrive at a total of two hundred and twenty (220) distributed copies of questionnaire. The Simple Regression and Analysis of Variance (ANOVA), through the usage of the statistical package for social sciences (SPSS), were exploited to carry out data analysis.

RESULTS AND DISCUSSIONS

Cloud Deployment Models adequate for Firms

Four distinct cloud deployment models are available for cloud based service users. This study further investigated the exact service model that is adequate for fuel retail firms in Nigeria, and presents the results in Table 1.

Table 1: Cloud Deployment Models (n=202)

SN	Models	Frequency	Percentage
1	Private Cloud	23	11.4
2	Public Cloud	29	14.4
3	Community Cloud	109	54.0
4	Hybrid Cloud	41	20.2
	Total	202	100.0

Source: **SPSS Window Output, Version 22.0 (based on 2024 field survey data).**

Table 1 depicts that 23 (11.4%) of the respondents use the private cloud, 29 (14.4%) use the public cloud, 109 (54%) of the respondents use the community cloud, and 41(20.2%) use the hybrid cloud. This means that the majority of the respondents use community cloud. This is further illustrated in figure 3.

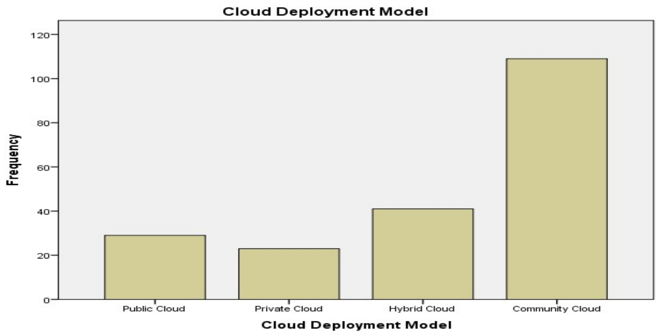

Figure 3: Cloud Deployment Models (n=202).
Source: SPSS Window Output, Version 22.0 (based on 2024 field survey data).

Test of Hypothesis
Decision Rule:
Reject $\mathbf{Ho_1}$ if the *p*-value for the interaction term is less than 0.05. Otherwise, do not reject $\mathbf{Ho_1}$.
All four components of cloud deployment models simultaneously interact with one another and together with supply chain performance. Hence multivariate analysis tends to be more realistic. This study present result according to the four respective dimensions of cloud deployment models in the following subsection:

Model 1: Cloud Deployment Models Dimensions and Logistics Process Flexibility
The functional representation of Model 1 is given by:
LPF = f (CDM, TMS, CDM*TMS) 1.1
Where;
LPF= Logistics Process Flexibility of companies in the study sample
CDM= Cloud Deployment Models
TMS= Total Management support
CDM*SCP = The interaction between Cloud Deployment Models Dimensions and Total Management Support

Under the consideration of logistics process flexibility (LPF) as supply chain performance, the model for testing the moderating role of Top Management Support is presented as follows:

$$LPF = a_o + CDM_i + a_7 TMS*CDM_i + U$$

The measure of supply chain performance defined in this study is logistics process flexibility. Logistics process flexibility as a dependent variable is regressed on the four cloud deployment model variables (Private Cloud, Public Cloud, Community Cloud, and Hybrid Cloud), top management support (TMS) and the interaction variable (CDM*SCP), and the results are presented in Tables 2.

Table 2: Moderated Regression of Logistics Process Flexibility

PVCDM	0.766	0.000
PBCDM	0.755	0.000
CMCDM	0.956	0.000
HBCDM	0.285	0.000
TMS	0.941	0.000
TMS* PVCDM	0.935	0.000
TMS* PBCDM	0.442	0.000
TMS* CMCDM	0.937	0.000
TMS* HBCDM	0.338	0.000
C	-0673.376	0.000
R-squared	0.4451	
Adjusted R-squared	4.451	
Prob(F-statistic)	0.000000	

Source: SPSS output Version 22.0

Table 2 shows the multiple regression results for the moderating effect of total management support on the influence of cloud deployment models on supply chain performance based on regression model. The log of logistics process flexibility is a linear function of private cloud, public cloud, community cloud, and hybrid cloud, total management support and the interaction variable. The interaction variable (TMS*PVCDM, TMS*PBCDM, TMS*CMCDM, and TMS*HBCDM) are the products of the four cloud deployment model dimensions and total management support. Based on the reported result in Table 2, all of the interaction terms are statistically significant.

From Table 2, the F-statistic is associated with almost zero probability, indicating that overall, the estimated logistics process flexibility model is highly significant. The Adjusted R-squared is 4.451, indicating that the estimated model has a moderate fit; the model explains approximately 44% of the total variation in logistics process flexibility. Thus, factors not considered in the model jointly account for the remaining 56%.

As Table 2 further shows, the estimated coefficients have mixed signs, with private cloud (= 0.766), public cloud (= 0.755), community cloud (= 0.956), hybrid cloud (= 0.65) and TMS (= 0.941) associated with positive signs. The interaction term (= 0.935, 0.442, 0.937 and 0.338) are associated with positive coefficient. All variables are associated with zero probabilities. This shows that the main effects of private cloud, public cloud, community cloud, and hybrid cloud are significant at 1% level. The effects of total management support and the interaction variable are also significant at 1% level, suggesting that total management support moderates the relationships between cloud deployment models and logistics process flexibility.

DISCUSSION OF FINDINGS

In this instance, there is a significant interaction between TMS and CDM on one hand, and between TMS and LPF, since the coefficient for TMS has p-value (0.000) which is less than 5%, and the coefficient of TMS interaction with CDM (i.e. TMS*CDM) has p-value (0.000) which is also less than 5%. The findings of the study depict that, TMS has a direct effect on supply chain performance (SCP) and a direct moderating and mediating effect on the relationship between cloud deployment models and supply chain performance. The results indicate that TMS acts as a partial mediator of the connection between cloud deployment models and supply chain performance. This result characteristically designates the significance of TMS as a moderator, and it corroborates previous research findings (Soliman & Karia, 2017; Ha & Ahn, 2014) that TMS is decisive in growing technology assimilation into business for enhanced overall company's performance. The study's findings is also in line with Hayes (2015) and Khosravi, Newto and Rezvani (2019) position on the significance of investigating mediating and moderating effects in order to appropriately appreciate the link between IT innovation and performance.

Further, the findings reveal that TMS sustains an accommodating setting for community cloud deployment users in retail petroleum marketing companies, since operational activities accomplished more efficiently, logistics process flexibility is enhanced. Besides, a positive impact revealed in the company's performance is as a result of the top management's efforts to trim down resistance to change (Ooi, Lee, Tan, Hew, & Hew, 2018).

These top management efforts help condense resistance to change by making essential resources available and by training employees to become more proficient in the use of cloud technology. Thus, top management acts as an apparatus for enhancing firm performance through the use of community cloud deployment model.

CONCLUSION AND RECOMMENDATION

The outcome of the statistical analysis indicates that, TMS has significant interaction with cloud deployment models and supply chain performance. Hence there is a significant moderating impact of TMS on how cloud deployment models associate with SCP. The study therefore concludes that, total management support moderates the relationship between cloud deployment models and supply chain performance of retail petroleum marketing firms in Rivers State, and recommends that, retail petroleum marketing companies should fine-tune top-management-support to improve on the relationship between **c**loud deployment models and supply chain performance in their organizations.

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