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Cloud-Based Service Model Adoption and Supply Chain Performance of Retail Petroleum Marketing Firms in Rivers State

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Abstract**:** *This study empirically examined the influence of cloud-based service model adoption on supply chain performance of retail petroleum marketing firms in Rivers State. The causal method, the positivist ontology and the quasi-experimental research design were employed. The survey research was used as a method for collecting primary. Besides, the study adopted the quantitative research approach or methodology, i.e. nomothetic methodology, which allows questionnaire usage. The nature of the research setting or environment is a non-contrived one or natural setting and the level of control the researcher has over elements of the research-the variables, the setting, study subjects and method of data collection is partial control or non-complete control. The population of the study consists of 55 retail petroleum marketing firms in Rivers State The simple random technique was adopted and quantitative data were generated through a 5-point Likert-type scale questionnaire. 202 copies of questionnaire were completed by the management staff of 55 retail petroleum marketing firms in Rivers State, obtaining a 95.3 percent response rate. The study adopted descriptive statistics, simple regressions, and analysis of variance techniques to determine the usefulness of cloud-based service model adoption dimensions (software as a service, platform as a service and infrastructure as a service) in influencing supply chain performance. The results suggest that SaaS service model adoption has a moderate, positive and significant influence on supply chain performance; while PaaS service model adoption and IaaS service model adoption have a weak, positive and significant influence on supply chain performance respectively. The study therefore concludes, that cloud based service model adoption significantly influence supply chain performance of retail petroleum marketing firms in Rivers State, and recommends amongst others that, retail petroleum marketing firms should emphasis on the adoption of cloud-based service models that will dramatically attract and enhance efficiency in their supply chain performance processes.*

Keywords: *Cloud-based service model adoption, Iaas service model adoption, PaaS service model adoption, SaaS service model adoption, Supply chain performance.*

INTRODUCTION

It's necessary to remark that, for any business to stay farsighted and contend appreciatively in existing business terrain; they need to embrace information technology (IT) to accelerate the growth or progress. This is because the field of technology takes a dynamic path and for firms to make a head way in the highly competitive operational landscape, they need to grasp technological innovations and move in progressively in the direction of enhanced technology. The emergence of the internet has made it imperative for

companies to reexamine their business operations, for example, cloud computing, a new opportunity is available for companies to apply this technology in their operations for optimal supply chain performance.

Cloud computing is positioned as the most recent annex in the IT infrastructure (Lal & Bharadwaj, 2016), materializing in the 2000s as a utility mechanism (Chen, Chuang & Nakatani, 2016), and it constitutes three dimensions of software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS) (Chen, Chuang & Nakatani, 2016:Lal & Bharadwaj, 2016; Mell & Grance, 2011). Imperatively, a research on cloud computing and supply chain performance can be embarked upon, because in recent times, they have allured a considerable focus in the business domain. Management appreciates as it receives an encouraging attention in academics and industry. The cloud improves collaborations, and cleverness to modify to shifts in harmony with demand increase (Jede & Teuteberg, 2016). The tool empowers collaboratively and evolves contracts, rigorously ameliorating contract management (Attaran, 2017). Nevertheless, in Nigeria, there are areas of concern such as inadequate electricity, reliable connectivity, lack of adequate awareness security, privacy and lack of standards and multiple taxation (Dahunsi & Owoseni, 2015; Awosan, 2014).

Cloud computing is a service-and–application-based technology that employs resources that are easy to reach through the internet (Malik *et al.,* 2016). Cloud computing is remarked as the first among the major 10 most important technologies with superior wide world outlook in consecutive years by companies. (Rattern, 2016). The adoption of this device is more and more fashionable enclosing famous businesses (Ambrust *et a*l., 2010).

Previous scholarly inquiries on cloud computing (Cheng *et al.,* 2014; Lin & Liu, 2014; Fu & Cheng, 2015) and recent ones (e.g., Loukis *et al.,* 2017; Attaran, 2017; Schnederjans, 2016) conceptually report influence of cloud-based service adoption or maintain conceptual development, making their works almost in-exhaustive. These studies are new to Nigeria and constitutes a geographical gap whereby scanty or no research has been done in the current site where the researcher intends to conduct his research.

Besides, most existing studies on cloud computing were founded on their use of concepts, definitions and qualitative analysis (Lin & Chen, 2012; Sultan, 2011, Marston *et al.,* 2011; Iyer & Henderson, 2010), it lacks empirical studies. This is a methodological gap, since there is a trend to the use of qualitative approaches at the expense of quantitative method with the possibility that certain data that could be obtained only through the use of quantitative method may have been missed. It is possible to assert that planners and decision makers have found little value in the work that has been carried out so far.

These problems bring about a study to connect retail petroleum marketing firms with cloud-based service model as a driver of optimal supply chain performance. Hence the investigation of the link amongst the variables; using software as a Service (SaaS), platform as a Service (PaaS), and infrastructure as a Service (IaaS) on supply chain performance in the retail petroleum marketing industry in River State.

Research Questions

In line with the study objectives, the following research question was raised:

1. To what extent are the three cloud-based service models (Software as a Service, Platform as a Service and Infrastructure as a Service) used in retail petroleum marketing firms in Rivers State?

LITERATURE REVIEWAND HYPOTHESES

Related literature on the concerned subject was reviewed. The review envelopes theoretical foundation, review on the major concepts of the study, previous empirical studies on the variables.

Theoretical Foundation

The study illuminates some important models and theories expressed below because of their relevance to cloud based services adoption and supply chain performance:

Technology-Organization-Environment (TOE) Model

This model posits that innovation is a function of three facets: Organization; Environmental and Technology accessible in the market employed, or not, by the organization (Tarnatzky & Fleibher (1990) in Baker 2012).

The TOE is architecture for investigating and collecting of products and ICT services on the organizational level. Zhu, Kraemer, Xu and Dedric (2004) assert that, this model is a far-reaching theoretical framework providing an extensive background of impression and agility and ensures impact on business decisions. Adopting information technology demands that business congregate architecture to back up operations in decision making. The weakness of the model framework comes handy as its major constructions are not very obvious and precise determinants. A research of this nature sees computing as a theoretically informed consortium of established device spanning and projecting factors that impact software as a Service (SaaS), platform as a Service (PaaS), and infrastructure as a Service (IaaS) and how it can lead to efficiency in firms' supply chain performance.

Technological Acceptance Model (TAM)

This model envisages the behavioural intention of technology application and proposed its usefulness as a delicate contributory force to embrace technology. The TAM model has been broadly examined and extended into distinct aspects and therefore, effort is made by supply chain managers regarding activities in retail petroleum marketing firms. This model has been extensively employed originally in IT literature and stresses the importance of trust to diminish uncertainty.

Diffusion of Innovation Theory (DIT)

This is a widespread theory on technology acceptance literature with the intention to account for how emanating technologies are stretching and functioning in operations. The weaknesses observed in DIT are that same attitudes stated in DIT are short of logical justifications. Besides, DIT was not able to associate the innovation with a proper attitude (Abbasi, Tarhini, Hassouna & Shah, 2015). However, the field of information systems contains a number of recent diffusions of innovation related studies (Low *et al.,* 2011). If retail petroleum marketing firms perceive the relative advantage in DIT, and acknowledge innovations by acquiring favourable service adoption device, they stand to gain optimally in their supply chain performance.

Meaning and Evolution of Cloud Computing

This concept is extracted from the notion of business and customers ability to obtain computing power globally when required (Battleson, 2016). Information system existing currently in the cloud is: Email, ERP, Human Resources System, Information Security System, Video Conferencing, CRM, e-Business, Project Management. Cloud is used to describe platforms that enables and spreads computing, which helps a user to implement a specific amount of work. Cloud computing is conceptualized as a gathering of a body of corporeal devices obtainable globally through the aid of a mobile device with an internet-based connection (Cao *et al*., (2017).

Imran (2013) defined cloud computing in terms of technologies offered by a third party which, vigorously equips and handles a vast array of requirements. Holding the same view, Cao *et al.* (2017) reference was on transferring computing and storage of data through a network to an offsite computing infrastructure administered and sustained by a vendor, supporting the views of Goscinski and Brook (2010) that the cloud on the internet camouflages accessible resources and furnishes a criterion interconnection, through which users would be enabled to use the internet as a potent personal computer.

The above definitions and explanations clarify what cloud computing is. One common agreement among the authors is that cloud computing is a solution delivered as a service. These definitions and explanations visualize the device as the fusion of hardware and system software which tender the services. Cloud computing is therefore, a copious tool, that proffer storage of data with considerable assurance that becomes visible as a framework that aims at providing stable and rapid services, and a means of support pictured as a service and delivered via the internet.

Cloud-Based Service Models

In the sequence of cloud computing development, different taxonomies have been established to capture its service layers. These layers have been denoted to as cloud service models (Sriram & Khajeh-Hosseini, 2010), cloud business models (Yang & Hsu, 2011; Zhang *et al.,* 2010) and cloud architectural layer (Stanoevska-Slabeva & Wozniak, 2010). The most basic cataloguing branded as the SPI model (Ahson & Ilyas, 2011) divided cloud services into software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS) (Yang & Hsu, 2011; Zhang *et al.,* 2010). A greater number of the research

literature discerns between Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). (Chen *et al*., 2016; Wu, 2011; Mell & Grance, 2011, Yang & Hsu, 2011). This study, in corroboration with Chen *et al*. (2016) and Wu (2011) adopts Software as a service, Platform as a service, and Infrastructure as a service (IaaS) as the dimensions of cloud-based service model.

Software as a Service

Software as a service (SaaS) model can be traced back in 1990, and has gradually moved to a prevailing current or direction of activity or influence in the IT area of interest or competition. The SaaS layer provides applications that run on the cloud eradicating the necessity to install and run the applications on the client computer (Marston *et al.,* 2011). Software as a service according to Kung, Cegielski and Kung (2015), clearly grant means of approach through the internet. Li and Yan (2017) and Sultan (2011) referred to SaaS as services developed for the customer. Mell and Grance (2011) observed that software is the existing method of providing solutions to users. Johansson and Ruivo (2013) assert that, clients pay for software applications usage, lowering the software procurement and maintenance costs. From the above, software as a service is seen as a technology which allows vast access to the customer. Software as a service (SaaS) is tendered over the internet by the service providers also referred to as cloud vendors and are attainable for the customers to access and execute. Itis a product delivered as a service, hosted centrally and tendered by a vendor accessible to customers who pay for the service. As a product delivery, itis eased by internet connected source. This is the reason for referring to software as a service as on demand software. Lin *et al.* (2009) noted that, a good example on SaaS service model are: Google Documents (docs.google.com), SalesForce.com (CRM) whereas the application and information technology users constitute the targeted group for this class of cloud service model.

Platform as a Service

Platform as a service (PaaS) facilitates the development and deployment of applications by providing operating system support and software development bases. Platform as a Service (PaaS) according to Tsai *et al.* (2010) can be conceptualized as a set of that ushers a stream of related products. This study defines platform as cluster of services subsystems that outline application infrastructure, operating system, middleware and configuration item by item, furnish developer teams with the aptitude to supply, build, test, and position applications.

The third-party vendors supply customers with virtual resources to develop, deploy and launch software applications minimizing the requirement for backend software development. Platform as a Service embodies the middle layer in the cloud architecture where it is regarded as the deployment environment for developing new services. The layer encloses the platform for developing applications that involves the necessary programming languages, APIs and tools to allow the clients erect their new services. This implies that PaaS brings into existence, software constituent parts, and interfaces and the service provider is accountable for sustenance of the work environment and operating systems, while the developer regulates the application data. Li and Yan (2017) notes that businesses employ PaaS for outsourcing, hosting, construction, security and storage.

Currently, the platform as a service market is still new. Nevertheless, as it fully develops, organizations are looking up to PaaS as a path to expanding overall cloud adoption across companies and to harmonize the development process. Today, the market is separated into fragments. Nevertheless, market research companies anticipate that the dispersal of market shares will alter excitingly in the future (Yang & Tate, 2012). The PaaS service model examples are: Google App Engine (code.google.com/appengine) and Microsoft, whereas the Internet application developers are the targeted group for this service model (Lin et al., 2009)

Infrastructure as a Service

Infrastructure as a service (IaaS) comprise computing resources like computational power (processors) and data servers that can be virtualized and instantly provided as a service. Infrastructure as a service is a soaring tender reserve with full allowance by storage and networking competency tendered to access through performance of duty (Mell & Grance, 2011). Infrastructure is a self-service model for approaching, regulating, and administering distant datacenter infrastructure and users now have to obtain IaaS instead of having to make an open purchase of hardware (Imran, 2013). Infrastructure as a service (IaaS) furnishes

solutions and serves as a model where vendors operates and reach out to the customers. These services are intensely policy-compelled empowering cloud infrastructure service users to carry out excellent level of usage for significant work activity.

Yang and Tate (2012) opine that currently, the market for IaaS lies in a state of great social or political changes, as many service vendors are moving their strategies after experiencing shortcomings in achieving adequate market grip. Market share have continued to become more profoundly focused, even while the market has flourished electrifyingly, the market is controlled by only a few. According to Mell and Grance, (2011), infrastructure as a service is speedily consolidating around a small size of market leaders. Compared to software as a service (SaaS) and platform as a service (PaaS), infrastructure as a service (IaaS) users are answerable for administering applications. Examples of the IaaS service model is the Amazon Web Service (aws.amazon.com) were as the infrastructure providers and administrators are the targeted category (Lin *et al.,* 2009).

Supply Chain Performance

Supply chain performance connotes a firm's level of collaborates with its members which is necessary in the initiation, conduct, or completion of strategic delivery plans (Gupta *et al.,* 2013). It is a series of continuous actions and changes of processes ameliorating and harmonizing production and transportation (Flynn *et al*. 2010). Supply chain management aims at integrating processes which transcends threshold of partners (Huan *et al*., 2004). A prevalent feeling in how superior information could be facilitated and harmonized for the whole members attains useful information (Lim *et al*., 2011). It is in the requirements that transcends line threshold of meeting the customers' requirements through product or service delivery (Soon *et al*., 2012). It needs improvements and unceasing machinery that originates evaluators (Sentanu, 2012). In the last decade, several organizations adapted appropriate metrics for measurement. These metrics were identified under the consideration of the major disciplines. Huan *et al*. (2004) recommends that the ideal measurement for the whole supply chain should be that ideal measurement systems that is far reaching. Supply chain performance thus, entails a dependable necessary and appraisable collaboration with partners in visibly, distinct organizations, functioning in unison, inherently for better product or service delivery to match customers' requirements.

Empirical Review

This study embarked upon some scientific review on the concerned subject and presents below with particular reference to topics, locations, methodology and findings.

Ikegwuru and Harcourt (2019) investigated the influence of software as a service on supply chain performance of retail petroleum marketing firms in Rivers State using a population of 55 retail petroleum marketing firms and 202 respondents. The study advocated descriptive statistics, regressions and analysis of variance techniques to establish the effect of software as a service on supply chain performance. The study found that, software as a service has positive and significant effect on logistics process flexibility, order fulfillment, and information sharing. The study concludes that software as a service significantly influences supply chain performance of retail petroleum marketing firms, and recommends that managers of retail petroleum marketing firms should focus strategically on software as a service to initiate greater supply chain performance in their companies.

Ikegwuru and Harcourt (2019) investigates the impact of platform as a service on supply chain performance of retail petroleum marketing firms in Rivers State using a quantitative and survey approach was adopted to investigate the influence of platform as a service on supply chain performance. The simple random technique and a multi item Likert scale anchored on five points response format were used on 202 management staff of 55 retail petroleum marketing firms. The study adopted the descriptive statistics; simple regression and analysis of variance (ANOVA), techniques to accomplish data analysis. The results point out that; platform as a service has a strong and significant influence on logistics process flexibility, order fulfillment and information sharing. The study concludes that platform as a service significantly and positively influence supply chain performance of retail petroleum marketing firms in Rivers State, and

recommends that, retail petroleum marketing firms should improve on the effectiveness of their logistics process flexibility, order fulfillment and information sharing to exhaust the possibilities of supply chain performance activated by platform as a service

Battleson, West, Kim, Ramesh and Robinson (2016) examined dynamic capabilities and cloud infrastructure, through multiple case study design on 14 firms currently using cloud infrastructure. The study selected top executives though the purposive method. The snowball method was also used to delineate key informants as the Chief Information Officer. The result proved that; firms react to market dynamism developing dynamic capabilities.

Yang, Qu and Liu (2016), investigated the importance of infrastructure as a service in different firms. It investigates infrastructure as a service potentiality in adaptability and incorporating support participation in business activities that leads to firms' performance. 184 clients from Alibaba were used and the PLS technique employed for analysis. It was discovered that infrastructure as a service influence life cycle and market turbulence.

Schniederjans, Ozpolat and Chen (2016), examined the influence of cloud infrastructure adoption on cooperation desiring agility on humanitarian firms, under moderating influence of inter-organizational trust. The interview method was employed on 19 firms from the relief organizations and their advocates. It was revealed that collaboration have a significantly positive association with agility in humanitarian organizations.

Guided by the above review, the following conceptual framework was designed:

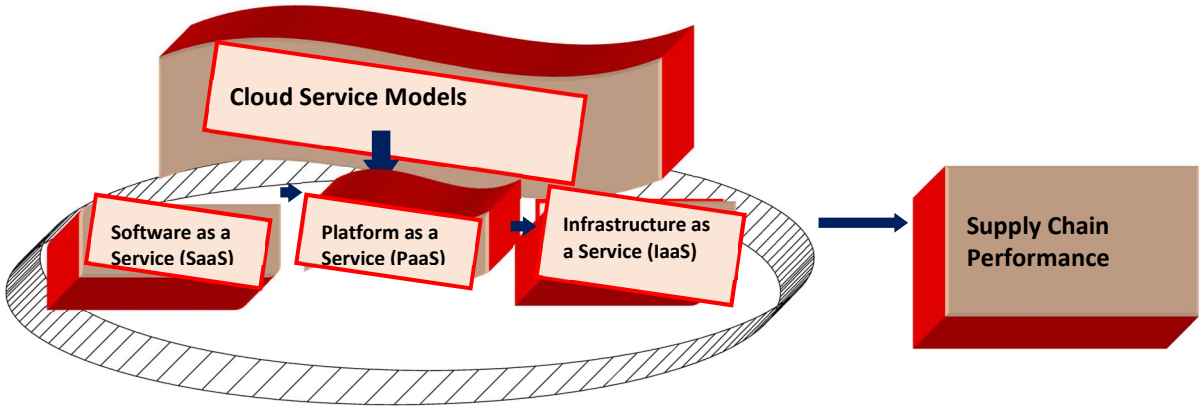

Figure 1: Conceptual Framework of the influence of Cloud-Based Service Model Adoption on Supply Chain Performance

Source: Adopted from Yang, S., & Hsu, C. (2011). The Organizing Vision for Cloud Computing in Taiwan. *Journal of Electronic Commerce Research, 12*(4), 257-271, and designed by the Researcher, 2024.

From the operational framework, the following are the hypotheses for the study, indicating conditional relationships that exist between the variables:

Ho_1: There is no significant influence of SaaS model adoption on supply chain performance of retail petroleum marketing firms in Rivers State.

Ho_2: There is no significant influence of PaaS model adoption on supply chain performance of retail petroleum marketing firms in Rivers State.

Ho_3: There is no significant influence of IaaS model adoption on supply chain performance of retail petroleum marketing firms in Rivers State.

RESEARCH METHODOLOGY

This study adopted the quantitative approach to investigate the influence of platform as a service on supply chain performance. To achieve the goal of this study which is to examine management's perception of the implementation of cloud computing service model in their organizations, the study used the survey approach as a measurement instrument, the simple random technique and a multi-item Likert scale anchored on five points response format. In order to make sure that the questions can be understood by the respondents, the questionnaire undergoes a pre-test and pilot test. The study field is the Retail Petroleum Marketing Industry in Rivers State, and the respondents are 202 management staff of 55 retail petroleum marketing firms domiciled in Rivers State, Nigeria. The questionnaire has two parts; the first is the demographic questions which mirror a number of the personal features of the respondents. The second part is the general questions on the subject of the focal variables in the study. 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.

Model Specification

This section specifies the following model to guide the study:

SCP = f (SaaS, PaaS, IaaS)----------1

Where

SCP = Supply Chain Performance

SaaS=PaaS=IaaS=Cloud Computing Service Adoption

Therefore,

SCP= f (SaaS, PaaS, IaaS)

The above equation is trans modified into econometric form by adding constant term (β) and error term (E) in the model below:

SCP= f (SaaS, PaaS, IaaS)

SCP=β0 + β1SaaS +β2PaaS + β3IaaS +e----------2

Mathematical form of the model is:

SCP= β0 + β1SaaS + β2PaaS + β3IaaS

Where:

SCP = Supply Chain Performance

SaaS = Software as a Service

PaaS= Platformas a Service

IaaS= Infrastructureas a Service

β0 = Intercept

β1 β2 β3 = Coefficient of the predictor variables

e = error term.

Apriori Expectation

From the theoretical prescriptions, cloud computing service model adoption is instrument of growth in and mover of adoption represented by software as a service, platform as a service and infrastructure as a service, which are expected to positively affect supply chain performance.

RESULTS AND DISCUSSIONS

To present a feasible response from the study's participants, the outcome of their responses was organized in three distinct sections.220reproduced distributed questionnaire were given out to the respondents of this study, 212copies were delivered**,** yielding 96.4 percent compliance. 8 of the copies originally administered were not delivered and were unexplained**.** In whichever manner, the rate compliance of 96.4% is thought-out to be projecting since it exceeds the lowest response rate of 70% allowed, according to the insinuation of Cooper and Schindler (2014). Furthermore, in the 212reproduced distributed questionnaires, the available copies amounted to 202 ushering in a reply estimation of 95.3%. Howbeit, 4.7% (10 copies) was not involved in this research as they were incorrect and of no consequence. Also, usage estimation unveiled

202 retrieved and available reproduced distributed questionnaires, symbolizing 95.3% of the entire reproduced distributed questionnaires. Consequently, 202 copies reproduced distributed questionnaires were employed for the study's breakdown.With the use of survey design and 55 retail petroleum marketing firms in Rivers State, data was generated, presented and analyzed, with the analysis anchoring the spread and retrieval of questionnaire, demographic of respondents, descriptive, and data cleaning and bivariateThrough a 19 measurement variable, data were collected and presented next.

Types of Cloud-Based Service Models Employed

The study examined the extent of the use of the three cloud-based service models (Software as a Service, Platform as a Service and Infrastructure as a Service) in retail petroleum marketing firms in Rivers State. The result is presented in Table 4.3

Table 1: Types of Cloud -Based Service Models Employed

S/n	Dimension	Frequency	Percentage
1.	Software as a Service	99	49.0
2.	Platform as a Service	63	31.2
3.	Infrastructure as a Service	40	19.8
	Total	202	100.0

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

Table 1 demonstrates that 99 or 49.0% of the respondents use the SaaS service model, 63 or 31.2% use the PaaS service model while 40 or 19.8% use the IaaS service model. This implies that there is a considerable usage of the cloud-based service models in the fuel retail firms studied. This is further illustrated in Figure 2.

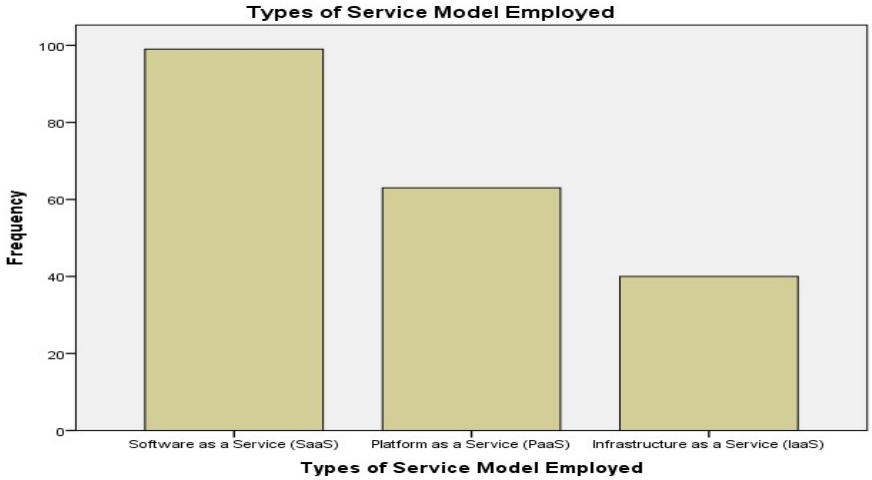

Figure 2: Types of Cloud-Based Service Models Employed (n=202).

Test of Hypotheses

Test of Hypotheses One

Table 2: Regression Model for SaaS Model Adoption and Supply Chain Performance

Model	R	R square	Adjusted Square	R std error of the Estimate
1	.442 [a]	.195	.191	3.576

a. Predictors: (Constant), SaaS model adoption

b. Dependent Variable: Supply chain performance

Source: SPSS Output, 2024.

The sum of supply chain performance was regressed with the sum of SaaS model adoption. The value of R is 0.442. The R value of 44.2% represents the correlation between SaaS service model adoption and supply chain performance. It represents a moderate correlation between the two variables. The R2 is 0.195. This means that 19% of the variation in supply chain performance is clarified by the independent variable. It shows that SaaS service model adoption makes a contribution of 19% to every change in supply chain performance, while 0.81% of the change is not clarified.

Table 3: ANOVA for SaaS Model Adoption and Supply Chain Performance

	Model	Sum of squares	Df	Mean square	F	Sig. 000[b]
1	Regression	620.088	1	620.055	48.499	
	Residual	2557.125	200	12.786		
	Total	3177.213	201			

a. Dependent Variable: Supply chain performance

b. Predictors: (Constant), SaaS model adoption

Source: SPSS Output, 2024.

The adequacy of the model can also be clarified by the value 48.499 (F-ratio) at $p < 0.05$. This implies that there is evidence to extrapolate that SaaS model adoption is linearly related to supply chain performance. This proposes that the model is measured to be fit and that infrastructure adoption has significant influence on supply chain performance.

Table 4: Coefficients of SaaS Model Adoption and Supply Chain Performance.

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. error	Beta	T	Sig.
Constant	12.631	.929		13.601	.000
SaaS Model	.412	.085	.325	4.861	.000

a. Dependent Variable: Supply chain performance

Source: SPSS Output, 2024.

The model illustrates that: supply chain performance = 12.631 + 0.412 SaaS model adoption. For a given unit of SaaS model adoption, supply chain performance is increased by 0.412. The result reveals that SaaS model adoption is significantly correlated with supply chain performance based at 1% ($p = 0.01$) level of significance, while the beta and t-value of independent variable value are 0.412 and 4.861, respectively. This implies that SaaS model adoption brings about (positive) increase in supply chain performance.

Decision:

Ho_1: There is no significant influence of SaaS model adoption on supply chain performance of retail petroleum marketing firms in Rivers State is rejected ($p<0,05$), and the alternative hypothesis, which states

that there is a significant influence of SaaS service model adoption on supply chain performance of retail petroleum marketing firms in Rivers State is accepted. Therefore, the study can conclude that SaaS model adoption significantly influences supply chain performance.

Test of Hypotheses Two

Table 5: Regression Model for PaaS Model Adoption and Supply Chain Performance

Model	R	R square	Adjusted Square	R std error of the Estimate
1	.338 [a]	.114	.110	3.950

a. Predictors: (Constant), PaaS model adoption

b. Dependent Variable: Supply chain performance

Source: SPSS Output, 2024.

The sum of supply chain performance was regressed with the sum of PaaS service model adoption. The value of R is 0.338. The R value of 33.8% represents the correlation between PaaS model adoption and supply chain performance. It represents a week correlation between the two variables. The R2 is 0.114. This means that 11% of the change in supply chain performance is clarified by the independent variable. It shows that PaaS model adoption makes a contribution of 11% to every change in supply chain performance, while 0.89% of the change is not clarified.

Table 6: ANOVA for PaaS Model Adoption and Supply Chain Performance

	Model	Sum of squares	Df	Mean square	F	Sig. 000[b]
1	Regression	403.083	1	403.083	25.829	
	Residual	3121.195	200	15.606		
	Total	2524.277	201			

a. Dependent Variable: Supply chain performance

b. Predictors: (Constant), PaaS model adoption

Source: SPSS Output, 2024.

Adequacy of the model can also be clarified by the value 25,829 (F-ratio), at p<0.05. This implies that there is evidence to extrapolate that PaaS model adoption is linearly related to supply chain performance. This proposes that the model is measured to be fit and that PaaS model adoption has significant influence on supply chain performance.

Table 7: Coefficients of PaaS Model Adoption and Supply Chain Performance.

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. error	Beta	T	Sig.
Constant	9.975	.1.185		8.415	.000
IaaS Model	.550	.108	.338	5.082	.000

a. Dependent Variable: Supply chain performance

Source: SPSS Output, 2024.

The model illustrates that: supply chain performance = 9.975 + 0.550 PaaS model adoption. For a given unit of PaaS model adoption, supply chain performance is increased by 0.550. The result reveals that PaaS model adoption is significantly correlated with supply chain performance based at 1% (p = 0.01) level of significance, while the beta and t-value of independent variable value are 0.941 and 39.255, respectively. This implies that PaaS model adoption brings about (positive) increase in supply chain performance.

Decision:
Ho_2: There is no significant influence of PaaS model adoption on supply chain performance of retail petroleum marketing firms in Rivers State is rejected ($p<0.05$), and the alternative hypothesis, which states that there is a significant influence of PaaS model adoption on supply chain performance of retail petroleum marketing firms in Rivers State is accepted. Therefore, the study can conclude that PaaS model adoption significantly influences supply chain performance.

Test of Hypotheses Three

Table 8: Regression Model for IaaS Model Adoption and Supply Chain Performance

Model	R	R square	Adjusted Square	R std error of the Estimate
1	.325 [a]	.105	.101	3095

a. Predictors: (Constant), IaaS model adoption

b. Dependent Variable: Supply Chain Performance

Source: SPSS Output, 2024.

The sum of supply chain performance was regressed with the sum of IaaS service model adoption. The value of R is 0.325. The R value of 32.5% represents the correlation between IaaS service model adoption and supply chain performance. It represents a week correlation between the two variables. The R2 is 0.105. This means that 10% of the change in supply chain performance is clarified by the independent variable. It shows that IaaS service model adoption makes a contribution of 10% to every change in supply chain performance, while 0.90% of the change is not clarified.

Table 9: ANOVA for IaaS Service Model Adoption and Supply Chain Performance

	Model	Sum of squares	Df	Mean square	F	Sig. 000[b]
1	Regression	226.299	1	226.279	23.627	
	Residual	1915.621	200	9.578		
	Total	2141.921	201			

a. Dependent Variable: Supply Chain Performance

b. Predictors: (Constant), IaaS model adoption

Source: SPSS Output, 2024.

The adequacy of the model can also be clarified by the value 23.627 F-ratio), at $p < 0.05$. This implies that there is evidence to extrapolate that IaaS service model adoption is linearly related to supply chain performance. This proposes that the model is measured to be fit and that IaaS service model adoption has significant influence on supply chain performance.

Table 10: Coefficients of IaaS Service Model Adoption and Supply Chain Performance.

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. error	Beta	T	Sig.
Constant	12.631	.929		13.601	.000
IaaS Model	.412	.085	.325	4.861	.000

a. Dependent Variable: Supply Chain Performance

Source: SPSS Output, 2024.

The model illustrates that: Supply chain performance = 12.631 + 0.412 IaaS model adoption. For a given unit of IaaS service model adoption, Supply chain performance is increased by 0.412. The result reveals that IaaS model adoption is significantly correlated with supply chain performance based at 1% ($p = 0.01$), while beta and t-value of independent variable value are 0.941 and 39.255, respectively. This implies that IaaS model adoption brings about (positive) increase in supply chain performance.

Decision:
Ho_3: There is no significant influence of IaaS service model adoption on supply chain performance of retail petroleum marketing firms in Rivers State is rejected ($p<0.05$), and the alternative hypothesis, which states that there is no significant influence of IaaS model adoption on supply chain performance of retail petroleum marketing firms in Rivers State is accepted. Therefore, the study can conclude that IaaS model adoption significantly influences supply chain performance.

This study dealt with investigating the effect of cloud-based service model adoption dimensions on supply chain performance. The study reported that independent variable affects the dependent variable thus supporting earlier works (Chen *et al.,* 2016; Lal & Bharadwaj, 2016; Wu. 2011; Mell & Grance, 2011). The findings analyzed in this study show that retail petroleum firms' cloud-based service model adoption is a driver for firms' supply chain performance. Cloud-based service model adoption influence on supply chain performance was tested by means of simple regression analysis, and it was confirmed that cloud-based service model adoption has significant influence on supply chain performance.

However, Chen *et al*. (2015) original three dimensions of cloud computing service were replicated in this application. All the three dimensions as renamed (SaaS, PaaS and IaaS), were found to be valid in this research and supports some of the previous studies, which suggest that cloud-based service model adoption affect supply chain performance (Lal & Bharadwaj, 2016; Wu. 2011; Mell & Grance, 2011). The regression analysis of dimensions of cloud-based service model adoption and supply chain performance) revealed that the three models were statistically significant in explaining retail petroleum marketing firms' supply chain performance. All three attributes made statistically significant contributions in predicting the behaviour of supply chain performance. These findings were fairly robust across supply chain performance, as no insignificant influence was recorded. It is no wonder that various studies in this area such as: Ikegwuru and Harcourt (2018), Chen *et al*. (2016), Lal and Bharadwaj (2016), Wu (201), and Mell and Grance (2011), found association between these cloud-based service models and supply chain performance. Our findings provide support in Low *et al.* (2011) assertion that, cloud computing service model adoption has mutual or reciprocal effect on a firm's adoption aspirations, and Ikegwuru and Harcourt (2018) whose findings proved that, cloud computing service adoption has a very strong, significant and positive influence on supply chain performance.

SaaS service model adoption recorded a higher influence on supply chain performance as it recorded a moderate, significant and positive influence on supply chain performance. However, the study discovered in the second and third hypotheses that, PaaS service model and IaaS service model recorded a weak, significant and positive influences on supply chain performance respectively. The results appear this way because PaaS service model adoption and IaaS service model adoption are still an emerging technology in Nigeria and are in their relative infancy. Most companies are not in a hurry to adopt it, yet PaaS service model adoption and IaaS service model adoption are useful and could be adopted for decision making for efficient supply chain. This corroborates Abollahzadhegan *et al*. (2013) assertion that, even though the overestimated state of these technologies, most firms are not in a rush to embrace it.

CONCLUSION

The study came up with and analyzed data received from respondents from 55 retail petroleum marketing firms in Rivers State who employed cloud computing service models in their business. Results analysis revealed the following findings: SaaS model adoption has moderate, significant and positive influence on supply chain performance, while, PaaS model adoption and IaaS model adoption have weak, significant and positive influence on supply chain performance respectively. This study demonstrates clearly, that the presence of cloud computing service model adoption insinuates overall efficiency in the supply chain process. Besides, the cornerstone hypotheses as established in the study were highly upheld in the outcome of the study. Hence, significant outcomes were reported. The findings of the study insinuate that, cloud-service model adoption plays a greater role when assessing performance in supply chains, since the findings show that cloud computing service model adoption is a driver of firms' supply chain performance. The study therefore concludes, that cloud-based service model adoption significantly influences supply chain performance of retail petroleum marketing firms in Rivers State.

Recommendations

1. Retail petroleum marketing firms should emphasis on the adoption of cloud-based service models that will dramatically attract an enhance efficiency in their supply chain performance processes.

2. Retail petroleum marketing firms should articulate cloud-based service adoption models to diagnose and build the required plans to upgrade their supply chain performance.

3. Retail petroleum marketing firms should focus more on SaaS model adoption, because they are cloud computing service model type that predicts supply chain performance more.

Managerial Implications

The study scientifically examined cloud-based service model adoption and supply chain performance phenomenon. The study is new and different from what has been known before, comprising the dimensions of cloud-based service model adoption (Software as a Service, Platform as a Service and Infrastructure as a Service) and supply chain performance, designed, anchored on retail petroleum marketing firms as the unit of analysis, and synthesizing them into a single generic idea. For instance, Software as a Service, Platform as a Service and Infrastructure as a Service (Chen *et al.,* 2016; Wu. 2011; Mell & Grance, 2011), and supply chain performance (Mihi- Ramirez *et al.,* 2012; Misra & Sharan, 2014; Barratt & Oke, 2007). This study, as an inquiry into previous studies, anchored on TOE, TAM, DIT and SCT panorama at firm's level, is scrutinized as original extension of the research. The scientific study insinuates that supply chain performance can be consummated through cloud-based service model adoption within the firm. The research confirms the importance of supply chain performance and how improvement can emanate from cloud-based service model adoption. Thus, cloud-based service model adoption can be a strong and effective tool which retail petroleum marketing firms' managers can embrace to ensure that they perform optimally in a competitive terrain, and enhance their supply chain performance.

Contribution to Knowledge

The contribution of this paper to knowledge is three-fold. First, it extended Technology-Organization-Environment Model, Technological Acceptance Model and Diffusion of Innovation Theory relevance in interpreting the findings. These models and theories were seen as solid paradigm for understanding how supply chain can achieve cloud computing service model adoption. Using these models and theories contributed to the improvement of the validity of this research. To this end, the study's results support the fact that these theoretical underpinnings are useful for cloud-based service model adoptions in supply chains. Second, the study is the first to the best of the researcher's knowledge to have empirically ascertained how cloud-based service adoption models influence supply chain performance in the retail petroleum marketing industry in Rivers State. Third, the study improved on previous studies by utilizing the simple regression technique. This method is straightforward, proficient, and dependable; it generates dispassionate results that are consistent and convincing for policy suggestions

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