

CLOUD COMPUTING ADOPTION AND SUPPLY CHAIN TRANSPARENCY OF FREIGHT FORWARDING COMPANIES IN RIVERS STATE

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Abstract

This study examined cloud computing adoption and supply chain transparency of freight forwarding companies in Rivers State. Cloud computing was treated as a single unit variable, while supply chain transparency was decomposed into supply chain adaptability and supply chain alignment. The population of the study comprised 77 freight forwarding companies. The Taro Yamane's formula was used to arrive at a sample size of 44 freight forwarding companies, and the convenience sampling technique was used to select the 44 companies. 132 management staff were drawn as a frame of 3 management staff per company. Questionnaire was used to collect primary data. 132 copies of questionnaire were thus were distributed to respondents. 127 copies were returned, yielding a response rate of 96%. The usable copies numbered 123 (91%). The study adopted simple regression analysis to test the influence cloud computing adoption on supply chain transparency. The results reveal that cloud computing adoption has moderate, positive and significant influence of on supply chain adaptability and supply chain alignment. The study therefore concludes that cloud computing adoption significantly influence supply chain transparency of freight and forwarding companies in Rivers State, and recommends that Freight and forwarding companies' should adopt cloud computing to connect to supply chain transparency that manifests in supply chain adaptability and supply chain alignment.

Keywords: Cloud computing adoption, supply chain transparency, supply chain adaptability, supply chain alignment

Introduction

The push for innovation has driven businesses to adopt cutting-edge technologies, including cloud computing, to improve efficiency and stay ahead of the competition (Olaniyi et al., 2023; Mackita et al., 2023). Cloud computing refer to a business model in which data service and architecture reside in remote servers (Bogatin, 2006; Vance 2011; Moore & Ryall, 2011). Kashmanian (2017) observed that supply chains have become increasingly extended, fragmented, and complex, heightening the need for transparency that enable stakeholders to track products and verify accuracy.

Zhu et al. (2018) indicates that the application of advanced technologies enhance supply chain analytics and improve transparency. Without adequate transparency, firms struggle to identify risks and meet sustainability goals (The Sustainability Consortium, 2016). Laurell (2014) highlighted that lack of transparency is a major barrier to advancing supply chain sustainability. Additionally, Wong et al. (2012) emphasized that insufficient transparency leads to mistrust in knowledge sharing among supply chain members.

Freight and forwarding companies focus on maintaining competitiveness for survival. However, not all achieve the desired level of competitiveness due to issues like poor transparency, delayed shipment clearance, lack of real-time shipment tracking, inadequate technology, and the pressing need to refine service processes. Additionally, many struggle to offer high-quality services at competitive prices, especially when faced with unsolicited alternatives.

These challenges exacerbate non-competitiveness in areas such as supply chain adaptability and alignment, and hinders the achievement of sustainable competitiveness. Thus, understanding the impact of cloud computing on supply chain transparency is crucial to addressing some of these challenges. Under favorable conditions, freight forwarding companies should enjoy high levels of supply chain transparency, which could result from improved policies, programmes, and practices that connect cloud computing to supply chain adaptability and alignment.

Several studies have been conducted to examine cloud computing and its relevance to desired outcomes of firms. Saratchandra and Shrestha (2022) examined existing literature on the role of cloud-based knowledge management systems (C-KMS) in small- and medium-sized enterprise (SMEs). Koltyukov (2020) looked at the potential impact of future cloud computing trends on business. Ikegwuru and Esi-Ubani (2019) studied effects of interorganizational trust on the influence of cloud computing on supply chain performance of retail petroleum marketing firms

In addition, Ikegwuru and Harcourt (2018) examined impact of cloud computing service adoption on supply chain performance of retail petroleum marketing firms. Chen et al. (2016) studied benefits of cloud computing. None of the foregoing studies focused on adoption of cloud computing and supply chain transparency of freight forwarding firms in Rivers State. It is in light of this gap in literature that this study was conducted.

Theoretical Foundation

This study is anchored on technology-organization environment (TOE) model (Tornatzky & Fleischer, 1990), which argue that technological, organizational, and environmental contexts, determine the adoption and implementation of technological innovations. TOE model is a useful framework to explain adoption behavior in relation to three types of technological innovations: applied innovations for technical tasks, innovations for business administration, and innovations embedded in core business processes (Ramdani & Kawalek, 2007; Swanson, 1994).

TOE model is useful for studying adoption and assimilation of different types of information technology innovation (Oliveira & Martins, 2010). This study adopted TOE model as a theoretical lens to understand the relationship between cloud computing adoption and supply chain transparency. The model is relevant to the study because the capabilities of a supply chain can be connected through cloud computing adoption.

Cloud Computing Adoption

Cloud computing has evolved as a technology of enormous possibility, allowing organizations to streamline operations, optimize resource utilization, and foster innovation (Olaniyi & Omubo, 2023). Cloud computing is arguably one of the most important technological shifts within the last decade (Wang et al., 2011). It represents a fundamental change in the way IT services are invented, developed, deployed, scaled, updated, maintained and paid for (Marston et al., 2011).

The promise of cloud computing expressed as cloud desires (Venters & Whitley, 2012) and cloud capabilities (Lyer & Henderson, 2010) seems to have attracted lofty expectations. central to the efficacy of Cloud Computing is its capability to distribute data across multiple locations within a distributed cloud architecture. This advancement marks a departure from conventional centralized systems (Tabrizchi & Rafsanjani, 2021).

This evolution in data distribution and accessibility has redefined how businesses interact with their digital assets, offering newfound efficiency and flexibility (Mackita et al., 2019). Cloud Computing presents numerous benefits, but also introduce security challenges (Tabrizchi & Rafsanjani, 2021). According to Marston et al. (2011), the importance of cloud computing will be measured not only in terms of cost savings but increasingly in terms of the competitive advantages that it can deliver. Janssen and Joha (2011) further list organization, performance, decision, contract and relationship as the challenges of cloud adoption.

Concept of Supply Chain Transparency

Trienekens et al. (2012) define transparency in supply chain as the degree to which all stakeholders within the supply chain have access to, and a common understanding of product-related information. Dubey et al. (2020) define supply chain transparency as the degree to which supply chain members can track existing and past activities of products in the whole chain.

Supply chain transparency enhance visibility of downstream and upstream procedures and reduce complexity of supply chain processes (Brandon-Jones et al., 2014). Duckworth (2018) aver that by growing supply chain transparency, firms can create trust and gain greater supply chain visibility. Bryde et al. (2020) established that supply chain transparency drive trust, information integration and visibility.

Transparency is a multifaceted phenomenon that is referred to in a number of disciplines. In everyday understanding, in everyday interactions, it means clearness and lucidity and implies honesty and openness (Jensen, 2001; Hofstede et al., 2004). In supply chain discourse, transparency means disclosing information such as supplier names and sustainability conditions related to purchasing and preparation of products (Egels-Zanden & Hansson, 2016).

Gardner et al. (2019) propose a framework of supply chain transparency that include six types of information - effectiveness, impact, policy and commitment, activity, transaction, and traceability. This implies that traceability is seen as an important tool in achieving transparency in the SC (Fraser et al., 2020). In this study, we adopted Egels-Zanden and Hansson's (2016) measures of supply chain transparency: supply chain adaptability and supply chain alignment.

Supply chain adaptability

Adaptability is a context-specific competence that facilitate continuous improvement to pace-up with shifting environmental conditions; relying on individual and team characteristics that encourage continuous learning amidst change and uncertainty, to chart a better future for a firm through flexible operations (Ateke & Nwulu, 2021). Organization frequently modify activities, structures and systems to enable them survive shifts in environmental conditions (Denison, 2007 as cited in Ateke & Nwulu, 2021).

The ability to adjust supply chain design concerning products, technologies and strategies to face changes in market condition is the purview of supply chain adaptability (Aslam et al., 2020). It also adaptability refers to a firm's ability to change in terms of technologies, products and strategies (Kauri'c et al., 2014). Adaptability focuses on fundamental changes (Eckstein et al., 2015) needed to cope with long-term and short-term and temporary changes.

Stevenson and Spring (2007) remarked that adaptability enable supply chain partners to cope with supply chain dynamics; and them to quickly adjust the configuration of the supply chain in response to market changes and consequently obtain a favourable competitive advantage. The role of adaptability in saving costs and improving supply chain performance has been extensively supported (Croom et al., 2007; Tatham & Christopher, 2018).

Liang et al. (2007) revealed that building adaptability into a supply chain produce notable marketing advantages. To adapt to diversity, organizations should have the capability to see their supply chains up and down (Dobrzykowski et al., 2015). Feizabadi et al. (2019) suggests flexibility, process integration, and visibility as key antecedents to supply chain adaptability.

Supply Chain Alignment

Supply chain alignment refers to integrating supply chain partners with a view to achieving better performance (Sheel & Nath, 2019). Aligning strategies and processes of supply chain partners is essential (Gattorna & Jones, 1998). Several studies revealed the importance of supply chain alignment in developing customer value and gaining competitive advantage and higher performance (Sheel & Nath, 2019; Wong et al., 2012).

Tuominen et al. (2004) declared that in a challenging and complicated business environment, supply chain alignment is an essential requirement for sustainable competitive advantage and higher performance. The probable relationship between Triple-A supply chain variables: alignment, adaptability and agility was explored by Dubey and Gunasekaran (2016) who found that that humanitarian supply chain adaptability is positively influenced by alignment. This alignment leads to adaptability due to process enhancement, information integration, flexibility, visibility, and data quality. Also, Alfalla-Luque et al. (2018) states that supply chain adaptability is positively influenced by supply chain alignment.

Cloud Computing Adoption and Supply Chain Transparency

Saratchandra and Shrestha (2022) examined existing literature on the role of cloud-based knowledge management systems (C-KMS) in small- and medium-sized enterprise (SMEs) to understanding its impact on knowledge acquisition, creation, storage, sharing and usage. The study that there are numerous empirical analyses on knowledge management processes and tools in SMEs; however, only few studies demonstrate how the whole gamut of KM processes can adopt cloud computing in SMEs. Therefore, SMEs are ineffective at knowledge management.

Koltyukov (2020) examined the potential impact of future cloud computing trends on business. The findings reveal that, 5G networks will enable the emergence of Edge-CoT architecture that will consequently drive increased application of Artificial Intelligence (AI), Machine Learning (ML) and Robotics. The combination of Edge-CoT, Robotics, AI and ML will trigger the development of Smart Cities and Industry 4.0. Cloud computing alone will increase connectivity

and will be the preferred business architecture comparing to Edge CoT. New industries and businesses will result from the Edge-CoT, and the existing companies will benefit mainly from an improved customer experience. Major business challenges triggered by Edge-CoT include workforce re-skilling, promotion of the agile approach and a cultural shift towards risk-taking.

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. The results demonstrate that interorganizational trust significantly moderates the relationship between cloud computing and supply chain performance of retail petroleum marketing firms. Relatedly, Ikegwuru and Harcourt (2018) examined the impact of cloud computing service adoption on supply chain performance of retail petroleum marketing firms. The results revealed that cloud computing adoption has significant positive influence on supply chain performance.

In addition, Chen et al. (2016) studied the benefits of cloud computing perceived by adopters and examined the impact of moderating factors on the relationship between type of cloud computing and perceived benefit. The results show that perceived benefit of cloud computing vary, depending on type of cloud computing, the value chain activity where cloud computing is deployed, and business size. Also, businesses benefit more in enhanced scalability than in cost reduction and increased business capability. After adopting cloud computing, businesses gain more capability in support activities than in primary activities.

Also, Trevor (2016) established that cloud computing has resulted in a significant transformation of information technology service providers' existing business model; and impact information technology service providers' ability to leverage cloud-enabled business model benefits. Yazan (2013) found that relative advantage, uncertainty, innovativeness, and external computing support have significant influence on SME's adoption of cloud computing; while Chen and Wu (2011) revealed that relative advantage, top management support, firm size, competitive pressure, and trading partner characteristics have significant effect on cloud computing adoption.

Based on the foregoing review, the study formulated the following hypotheses.

H₀₁: Cloud computing adoption does not significantly influence supply chain adaptability of freight forwarding companies in Rivers State.

H₀₂: Cloud computing adoption does not significantly influence supply chain alignment of freight forwarding companies in Rivers State.

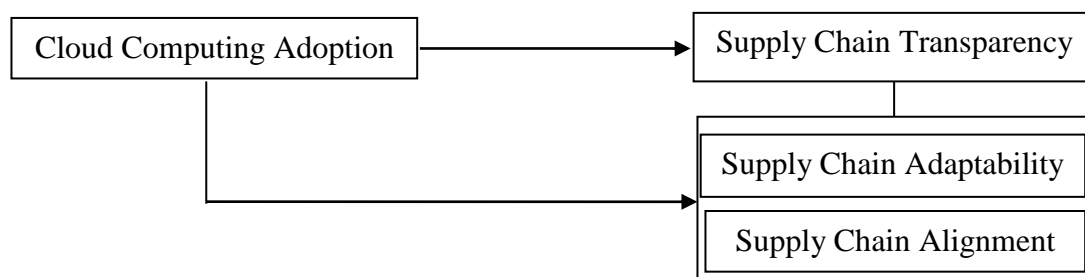


Fig. 1: Conceptual framework of relationship between cloud computing adoption and supply chain transparency

Methodology

This study investigated the influence between cloud computing adoption and supply chain transparency. The study adopted a survey research design. The population of the study comprised 77 freight forwarding companies in Rivers State whose dependable list was derived from FineLib.com as of May 27, 2024. Taro Yamane's formula was used to determine a sample size of 44 companies. 3 executives were drawn from each company based on convenience sampling technique. The reason for choosing convenience sampling technique is that the researcher was able to directly access the companies that are situated in Rivers State. The Cronbach Alpha Reliability Coefficient was computed for the composite scale and each of the subscales, and the results show that the scale exceeded the minimum threshold of 0.7 as recommended by Cronbach (1970) and Nunnally (1978). The hypotheses were tested using simple regression analysis, aided by excel version 2016, and Statistical Software Package for Social Science SPSS version 22.

Data Analyses and Results

Table 1: Questionnaire Distribution and Retrieval

S/n	Characteristics of questionnaire	Available Quantity	Percentage%
1.	Total number of copies produced and distributed	132	100
2.	Copies returned (received)	127	96
3.	Copies not returned (not received)	5	4
4.	Copies returned (received)	127	100
5.	Usable copies	123	97
6.	Unusable (Discarded)	4	3
	Usable rate	$\frac{123}{127} \times \frac{100}{1}$	97

Source: Field Work (2024).

Table 1 shows the analysis of distribution and retrieval pattern of questionnaire. Of the 132 copies of questionnaire distributed to respondents, 127 copies were returned, yielding a response rate of 96%. The return rate of 96% was considered as high and outstanding, making an allowance for a minimum return rate of 70% as proposed by Kothari (2011). Moreover, of the 127 copies returned, usable copies numbered 123, representing a response rate of 97%. 4 copies representing 3% were not used due to wrong filing, missing and curtailed information in the demographic profile. The returned and usable rate is once more well thought-out as satisfactory for the analysis (Kothari, 2011).

Table 2: Distribution of the Gender of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	100	81.3	81.3	81.3
	2.00	23	18.7	18.7	100.0
	Total	123	100.0	100.0	

Source: SPSS 22.0 window output (based on 2024 field survey data).

Table 2 shows that 100 (81.3%) of the respondents were males while 23 (18.7%) were females.

Table 3: Influence of Cloud Computing Adoption on Supply Chain Adaptability
Model Summary

Model R	R square	Adjusted Square	R std error of the Estimate
1 .568 ^a	.465	.463	.000

Source: SPSS 22.0 window output (based on 2024 field survey data).

Table 4: ANOVA of Cloud Computing Adoption on Supply Chain Adaptability

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	.087	1	.087	299.886	.000 ^a
Residual	.006	122	.000		
Total	.093	123			

Source: SPSS 22.0 window output (based on 2024 field survey data).

Table 5: Coefficients of Cloud Computing and Supply Chain Adaptability (n=123)

Model	Unstandardized		Standardized		T	Sig.
	B	Std. error	Beta	Coefficient		
1 (Constant)	.1.866	.068		26.786	.000	
	.567	.048	.568	19.675	.000	

Source: SPSS 22.0 window output (based on 2024 field survey data).

Decision: Since for hypothesis one, the significant .000 is less than 0.05, there is a significant effect of cloud computing adoption on supply chain adaptability. The regression helps us to conclude with the R (coefficient of correlation) that there is 56.8% direct relationship between cloud computing adoption and supply chain adaptability. R-squared value of 46.5% shows that cloud computing adoption can affect supply chain adaptability. The ANOVA Table explains the fitness of the model as shown by. The F-ratio in the model is 26.786, which is very significant at $p < 0.05$.

This implies significant evidence to extrapolate that cloud computing adoption relates to supply chain adaptability. This proposes that the model is measured to be fit, and that cloud computing adoption has some influence on supply chain adaptability. There was also a standardized coefficient of .568 which is perfect as well as corresponding P value (sig.) of 000 which is less than alpha (0.05). Therefore, we conclude that cloud computing adoption significantly influence supply chain adaptability of freight and forwarding companies in Rivers State.

Table 6: Influence of Cloud Computing Adoption on Supply Chain Alignment (n=123)
Model Summary

Model R	R square	Adjusted Square	R std error of the Estimate
1 .589 ^a	.437	.434	.50668

Source: SPSS 22.0 window output (based on 2024 field survey data).

Table 7: ANOVA of Cloud Computing Adoption on Supply Chain Alignment

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	59.765	1	59.765	265.579	.000
Residual	29.780	122	.297		
Total	89545	123			

Source: SPSS 22.0 window output (based on 2024 field survey data).

Table 8: Coefficients of Cloud Computing Adoption on Supply Chain Alignment

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. error	Beta	T	Sig.
	.690	.259	.589	3.569	.000
	.780	.853			.000

Source: SPSS 22.0 window output (based on 2024 field survey data).

Decision: Since for hypothesis two, the significance is .000 which is lesser than 0.05, there is a significant effect of cloud computing adoption on supply chain alignment. The regression helps us to conclude with the R (coefficient of correlation) that there is 58.9% direct relationship between cloud computing adoption and supply chain alignment. R-squared value of 43.7% shows that cloud computing adoption has a significant positive effect on supply chain alignment.

The ANOVA Table explains the fitness of the model as shown by. The F-ratio in the model is 265.579, which is very significant at $p < 0.05$. This implies that there is significant evidence to extrapolate that cloud computing adoption is linearly related to supply chain alignment. This proposes that the model is measured to be fit and that cloud computing adoption has some influence on supply chain alignment. There was also a standardized coefficient of .589 which is perfect as well as corresponding P value (sig.) of .000 which is less than alpha (0.05). Therefore, we conclude that Cloud computing adoption significantly influence supply chain alignment of freight forwarding companies in Rivers State.

The result from our analysis showed that cloud computing adoption has a moderate, positive and significant influence on supply chain adaptability (0.568: $0.000 < 0.05$) and supply chain alignment (0.589: $0.000 < 0.05$). These findings are consistent with the report of Ikegwuru and Harcourt (2018) that cloud computing service adoption has a very strong, significant and positive influence on supply chain performance, and Chen et al. (2016) that a marginally significant interaction exists between types of cloud computing and business size.

Conclusion and Recommendation

Based on the findings of this study and the consistency with similar studies, we conclude that cloud computing adoption has significant influence on supply chain transparency in Freight and forwarding companies in Rivers State. The study recommends that freight and forwarding companies' managers should engage cloud computing adoption, digital technology and digital environment to connect to supply chain adaptability and supply chain alignment to enhance their supply chain transparency

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