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# Digital Supplychain Technology Proficiency and Sustainable Competitiveness of Oil and Gas Companies in Rivers State

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***Abstract:*** *The study concentrated on digital supply chain technologies enactment and sustainable competitiveness of oil and gas companies in Rivers State. A causal study was well-thought-out to handgrip the three (3) hypotheses articulated for the study. The survey research method was adopted for the study on a population comprised of two hundred and ninety-five (295) oil and gas companies registered with the Rivers State Ministry of Commerce and Industry, Port Harcourt. The appliance of the Taro Yamane's formula for the determination of sample size from a precise population, provided the study with a minimum sample size of one hundred and seventy (170). The study advocated the purposive sampling technique and the key respondents were Chief Executive Officers (CEOs) or branch managers of the companies investigated. 510 copies of structured questionnaire were distributed to the respondents, 345 copies were returned, yielding a response rate of 87.3 percent. Moreover, of the 345 copies of the questionnaire returned, resultantly, no more than 334 questionnaires with a response rate of 75.1% were measured for analysis. The multiple regression analysis was employed for data analysis. The results disclosed that the elements of digital supply chain technology (Big data analytics, Cloud computing systems and Mobile applications) studied had a strong, positive and significant influence on sustainable competitiveness. The study therefore, concludes that, digital supply chain technology proficiency significantly influences sustainable competitiveness of oil and gas companies in Rivers State, and recommends that, to enable a new way of working with digital supply chain technology, management of oil and gas companies should adapt their organizational structures and job designs to bring the best out of their employees and DSCT to enhance sustainable competitiveness. in their supply chain industry.*

***Key words:*** *Big data analytics, Cloud computing systems, Mobile application, Sustainable competitiveness.*

## INTRODUCTION

In these modern times, many firms globally are aspiring to cope with ever-increasing competition in view of the fact that it has consequently twisted into the prime schema for these firms. A good number of firms make choices that affect their competitive position and profitability by means of technologies which is predictable to facilitate the firm's position itself in opposition to their rivals in

the pursuit for upper hand. This is embarked on to help the firm position itself against its competitors in tracking down of sustainable competitiveness. Firm profitability is a utility of organizational prettiness (configuration) and the firm's relative position within the industry. A stout comparative outlook entails that the firm has a sustainable competitive increase that can be assiduous alongside incidence by competitors and transformations in the industry.

Sustainable competitiveness materializes as an indispensable dynamic in the perception of goods and services value, which ought to be calculated as fundamentals of competitiveness. As a result of the importance of sustainable competitiveness to the long-standing success of companies, the accessible literature takes in hand its content as well as its sources, and the diverse categories of strategies such as digital supply chain technologies that may help firms realize sustainable competitiveness.

In this day and age, global technologies, principally digital technologies, have turn out to be a significant utensil for businesses to sustain practicable partnerships and put together an enormous value linkage with other firms. Innovative digital technologies that are up-and-coming every day are on their line of attack to have an effect on virtually all business development and activities. The goal of the digital supply chain technology is to convert heterogeneous resources into competitive product and service offerings. Digital supply chain technology proficiency is built up of a number of core competencies required for harmonizing miscellaneous production skills and amalgamate manifold torrents of technologies. Digital supply chain technology is a result of prearranged set of competencies that amount to proactive, relational, coordinative use of technology by a given supply chain who desires to deliver specific good and service offerings to achieve sustainable competitiveness.

In research, the area of supply chain digital technology is starting to attract growing attention with some of the topics such as 'radiofrequency' and recently 'big data' being investigated by some scholars. A holistic approach to digital supply chain technology proficiency would set the course for streamlined implementation, starting with a digital strategy and a digital operating model. Meanwhile, firms need to adopt digital methodology proficiently in their supply chain system to achieve the potential of having an excellent level of organizational performance (Degroote & Marx, 2013). Even though most firms accept as true that the adoption of digital supply chain technologies would help them raise their supply chain performance some companies are still doubtful to set supply chain digital technology as their primary targets in digital strategies.

In contemporary exceedingly competitive business climate, generating sustainable competitiveness in a firm has to direct the way to achievement (Cao & Zhang, 2011). Conversely, the exploration for reciprocated appreciation of sustainable competitiveness for every single one supply chain partner is still not up till now impactful as challenge for both academics and practitioners exists (Fawcett &Waller, 2014; Halldorsson *et al.,* 2015). Despite the fact that a budding quantity of scholarly writings (e.g. Lee *et al.,* 2022; Marco *et al.,* 2019), which are dedicated to the field of digital supply chain technologies in conveying additional firm's performance have accumulated, it is somehow unclear how the area of supply chain digital technology has evolved and progressed in research, with research status being unclear in linking it to sustainable competitiveness. This paper therefore, analyzes the impact of digital supply chain technology proficiency on sustainable competitiveness of oil and gas companies in Rivers State. This research aims at identifying the main elements constituting the digital supply chain technology and their impact on sustainable competitiveness.

## LITERATURE REVIEW AND HYPOTHESES

### The Resource-Based View Theory

This present study is fixed firmly on the resource based view theory, which stipulates that the elementary foundations and drivers of competitive advantage and better-quality performance are predominantly linked with the traits of resources and capabilities, which are priceless and costly-to-copy (Peteraf & Bergen, 2003). The resource-based view supplies an avenue for firms to chart and implement their organizational policy by exploring the function of their internal resources and capabilities in attaining competitive advantage (Kristandl & Bontis, 2007; Sheehan & Foss, 2007). Several other investigations sustain the magnitude of this resource-based view (Hult & Ketchen Jr., 2001; Ramsay, 2001; Foss & Knudsen, 2003; Gottschalg & Zollo, 2007). When this strategy is well-originated and put into practice, it can significantly influence a firm's level of competitiveness (Richard, 2000; Powell, 2003; Porter & Kramer, 2006). The resource based view theory as an "inside-out" progression of policy origination is therefore, a management machination fit into place to evaluate the accessible quantity of business strategic-possessions. In fundamental nature, the resource based view is anchored on the idea that the successful and resourceful use of every single one serviceable resource that a firm can pull together lends a hand in deciding its competitiveness. This theory is relevant to this study because, proficiency in espousing supply chain digital technology architecture enhances firms' competitiveness continuously.

### Digital Supply Chain Technologies

Technology is altering the way companies plan their supply chain management practices. Technological and digital innovations pave the way for more interconnected actions and transparent flow of information amongst organization, its suppliers, and potential customers. This disruptive information effect is promised to deliver unforeseen values to all entities involved in the supply chain (Buyukozkan & Goçer, 2018).

The most necessity of adopting a digital supply chain technology (DSCT) is not just investing in the latest digital technologies, it is more than that. Organizations must know how to align the existing digital initiatives with its supply chain objectives (Raab & Griffin-Crya, 2011). Every organization nowadays realizes the potential of the newest technology in vogue, and this possibly will offer businesses an opportunity to enhance organizational performance and create a strong foundation to compete and outperform rivals in the vicinity and faraway (Srivastava & Sushil, 2013).This end-to-end supply chain connectivity through the epoch of digitalization could position firms in the locus of competitive advantage where they would be able to match customer shifting requirements more proficiently (Porter & Heppelmann, 2015).

In practice, it gives the impression that more businesses are at this instant spreading over different structures of supply chain digital technologies such as radio frequency identification, big data, cloud computing, Internet of Things, and artificial intelligence amongst others to fashion cohesive and self-optimizing supply chain organisms empowering them to retort proactively to the ever-changing nature of markets (Buyukozkan & Goçer, 2018). According to Bughin *et al*. (2018), innumerable digital technologies such as Big Data Analytics, Cloud Computing Systems, Mobile applications, the Internet of Things, Blockchain, Artificial Intelligence, Man-Machine Learning and masses of supplementary application support the advancement of the supply chain of any business. This study in line with Bughin *et al.* (2018), adopts data analytics, cloud computing systems and mobile applications.

**Big Data Analytics**

Big data analytics refers to the application of innovative statistics to whichever kind of deposited electronic communication, which may consist of "messages, updates, and images dispatched to social networks, interpretations from sensors, and GPS indications from cell phones (Kache & Seuring, 2017). Big data analytics can supplement value and be responsible for an innovative stance by cultivating descriptive, predictive and prescriptive analysis and exhibiting them to boost performance in supply chains (Ikegwuru & Acee-Eke, 2020). Big data analytics momentously influence supply chain competitiveness (Tan, Carriollo & Cheng, 2013). Evidently, big data enables companies to accumulate enormous volume of data from sources such as videos, tweets, click streams, and equally facilitate decrease in order-to-delivery cycle times, and advance supply chain efficiency.

**Cloud Computing Systems**

Cloud computing refers to equally the applications transported as services by means of the Internet and the hardware and systems software in the data centers that offer those services (Amburst, Fox, Griffeth *et al.,* 2016). Cloud computing as a tender transported as a service by means of the internet and computing resources (hardware and software) in the data centers and bestows on-demand right of entry to these resources and services, delivered by service vendors to the final user by means of pay-per-use services (Ikegwuru & Esi-Ubani (2019). This cloud computing systems make available harmonization of supply chain management with IT system of a business that supports scalability, cost reduction, accessibility and efficiency in supply chain operations.

**Mobile Applications**

This refers to categories of application software premeditated to route on a wireless mobile device, such as a smartphone or tablet computer as an alternative to laptop computers or a laptop. Mobile applications are technologies that are modernizing supply chain operations. They materialize in the form of mobile payment, mobile RFID, advance bar code scanning, map routing and inventory optimization and they are greatly boosting supply chain operations. Mobile applications smooth the engendering of real-time information that shrinks inventory and can lead to progression in profits for the vendor (Cogliamo, Marco & Rafele, 2014).

**The Concept of Sustainable Competitiveness**

The vital rudiments of competitive advantage relating to the formation of values to customers were developed by (Jones, 2003). Competitive advantage is a fundamental underpinning for inventing business strategies to achieve sustainable increase (Simpson, Taylor & Barker, 2004). The tracking down of competitive advantage is an inspiration very much at the sensitivity of the strategic management literature (Ma, 2004; Cousins, 2005; Porter & Kramer, 2006; Barney). Understanding the sources of sustained competitive advantage has turned out to be a foremost field of study in strategic management (Flint & Van Fleet, 2005; King, 2007).The sustainability of a business is pulled off through competitive advantage; whereby upon the putting together of business strategies, it is indispensable to generate values to customers (Sultan & Mason, 2010).

A company experience competitiveness when it is depositing into practice a value generating strategy not concomitantly being put into operation by any contemporary or forthcoming competitors, and when these other companies are immobilized to duplicate the advantages of this method. Competitiveness thus stands for the matchless prospective that positions a company far away from its competitors, in that way endowing them with a superior position in the marketplace. Sustainable competitiveness materializes as an indispensable dynamic in the discernment of goods

and services value, which ought to be premeditated as ground rules of competitive advantage in an enduring manner.

**Empirical Review**

Lee et al. (2022) investigates the effect of the digital supply chain on the supply chain and organization performance and additionally evaluates the mediating effect of supply chain performance in the relationship between digital supply chain and the organizational performance in the Malaysia manufacturing industry, by means of a quantitative research design. Data was collected through an emailed online survey questionnaire to 1160 manufacturing companies listed in the Federation of Malaysian Manufacturers (FMM) directory by way of stratified sampling technique and obtaining 56 (5.43 useful for data analysis. Data was analyzed by the use of the Partial Least Square Structural Equation Modeling (PLS-SEM). Seven hypotheses, which include all the hypotheses of moderating effect are supported. The study concludes that manufacturing companies in Malaysia can think about espousing digital supply chain in the business procedure to stay put reliable in the competitive market by making available good supply chain performance and most excellent organizational performance as a whole.

Marco *et al.,* (2019) examined the relationship between investments in digital technologies and firm performances, by also investigating the exact technologies more prone to be associated with superior performance and ultimately the snowballing effect of technologies on performance. Supported on distinctive data assembled in 2017 on a sample of 1,149 Italian firms, outcomes demonstrate the positive impacts on adopters' performance and the function of robotics and laser cutting in this relationship.

Based on the review of literature, the following hypotheses were raised:

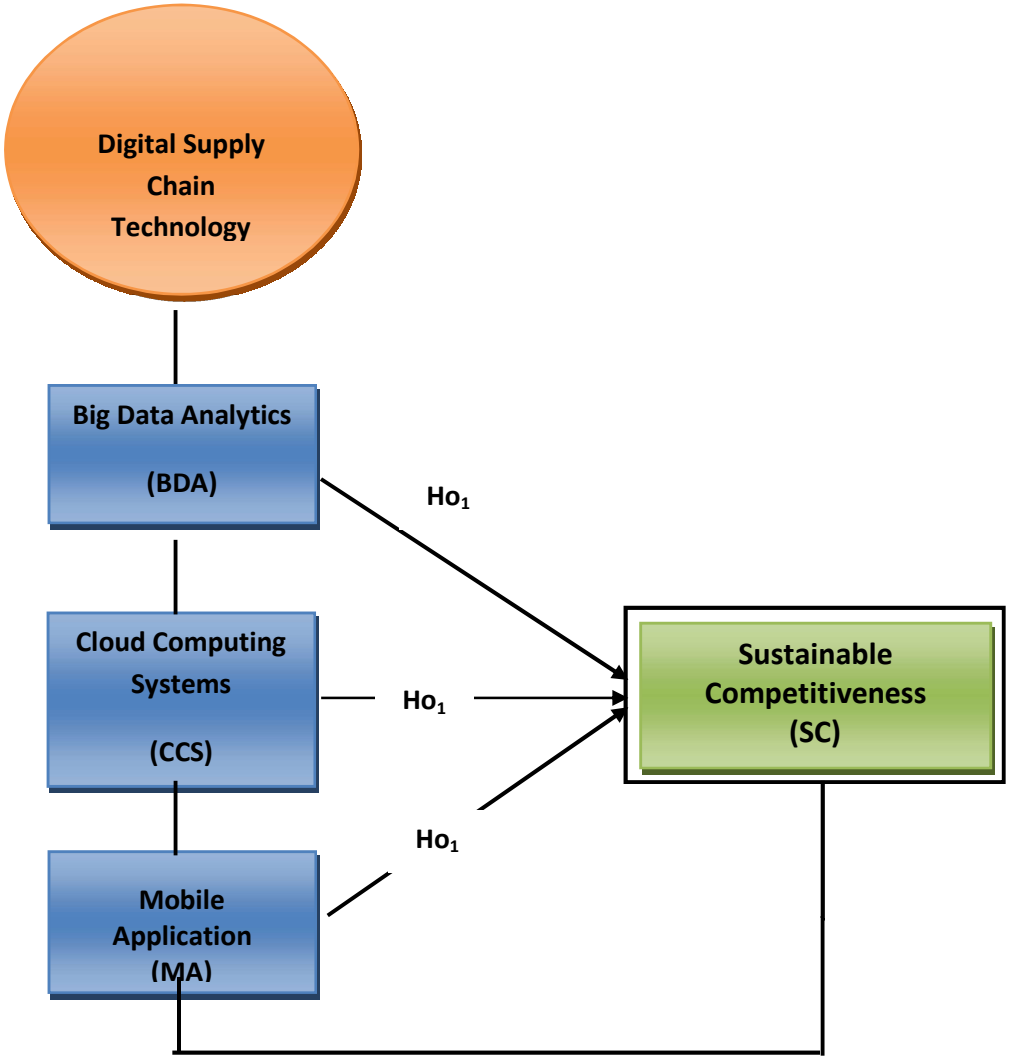


**Figure 1:** Research Model of Digital Supply Chain Technologies and Sustainable Competitiveness

**Source:** Designed by the Researcher, 2022

From the research model, the following hypotheses were raised:

**$Ho_1$**: Big data analytics does not significantly influence sustainable competitiveness of oil and gas companies in Rivers State.

**$Ho_2$**: Cloud computing systems does not significantly influence sustainable competitiveness of oil and gas companies in Rivers State.

**$Ho_3$**: Mobile application does not significantly influence sustainable competitiveness of oil and gas companies in Rivers State.

## RESEARCH METHODOLOGY

**Population and Sample Determination** The population of the study consists of two hundred and ninety-five (295) oil and gas companies registered with the Rivers State Ministry of Commerce and Industry, Port Harcourt. The sample size of one hundred and seventy (170) was arrived at by means of the Taro Yamane's formula for the determination of sample size from a precise population. The appliance of the Taro Yamane's formula for the determination of sample size from a precise population, provided the study with a minimum sample size of one hundred and seventy (170). The study advocated the purposive sampling technique and the key respondents were Chief Executive Officers (CEOs) or branch managers of the firms investigated. 510 copies of questionnaire were distributed to the respondents, 345 copies were returned, yielding a response rate of 87.3 percent. Moreover, of the 345 copies of the questionnaire returned, resultantly, no more than 334 questionnaires with a response rate of 75.1% were measured for analysis. The multiple regression analysis was employed for data analysis.

### Test of Reliability of Instrument

The Cronbach Alpha Reliability Coefficient was computed for the composite scale and each of the subscales, and the results are reported in Table 1. As we can see, the value of the Alpha coefficient for the composite scale and the subscales are all above the threshold ($\alpha \geq 0.70$); hence, they are all reliable. Table 1 shows the reliability assessment of the variables using Cronbach's alpha. It indicates how the items for each factor were internally related in the manner expected.

**Table 1: Test of Reliability**

| Scale | Dimension | Items | Reliability |
|---|---|---|---|
| BDA | Big Data Analytics | 5 | 0.776 |
| CCS | Cloud Computing Systems | 5 | 0.890 |
| MA | Mobile Applications | 5 | 0.754 |
| SC | Sustainable Competitiveness | 5 | 0.931 |
| **QDSCTSC** | **Composite** | **25** | **0.975** |

**Source**: SPSS 22.0 Window output (based on 2022 field survey data)

**RESULTS**

**Model Summary of Digital Supply Chain Technology Proficiency and Sustainable Competitiveness**

**Table 2: Model Summary (n=334)**

| Model | R | R2 | Adj R2 | Std Error of the Estimate | F Change | dfi | df2 | Sig. F Change | Durbin Watson |
|---|---|---|---|---|---|---|---|---|---|
| **BDA** | .690 | .552 | .550 | | | 1 | 332 | | |
| | | | | 4.92483 | 752.650 | | | .0 00 | 1.869 |
| **CCS** | .667 | .568 | .565 | | | | | | |
| | | | | | | 1 | 333 | .000 | 1.969 |
| **MA** | .776 | .694 | .681 | 167.596 | .47649 | | | .000 | 1.649 |
| | | | | 294.73 | 62.504 | 1 | 334 | | |

**Source: SPSS 22.0 window output (2022)**

a. Predictor (Constant). Big Data Analytics

b. Predictor (Constant), Cloud Computing Systems

c. Predictor (Constant), Mobile Applications

d, Dependent Variable, Sustainable Competitiveness.

Three models were tested indicating three predictors besides constant to determine the dependent variable that arrange entry requirement in the finishing equation (BDA, CCS, MA, SC). Multiple correlation coefficient measures the degree of relationship between the actual values and predicted values. Predicted values are obtained as a linear combination of X1 (Big data analytics), X2(Cloud computing systems) and X3(Mobile applications). R2 represents percentage of the variance in the dependent variable. Table 2 shows that 55.2% of the variation (model 1) in sustainable competitiveness is explained by big data analytics single-handedly, 56.8% of the variation (model 2) is explained by cloud computing systems and 69.4% of the variation (model 3) is explained by mobile applications.

**Test of Model Utility**

The serviceability of the overall regression statistics was tested prior to the testing of the individual hypotheses for their levels of significance. The fitness of the model can be explained by F-ratio in Table 3. The F-ratio in the model is 49.386, which is very significant at $p < 0.05$. This implies that there is significant evidence to extrapolate that digital supply chain technology is linearly related to sustainable competitiveness. The study concludes that; the regression model is useful to the extent that the predictor variables significantly predict the behaviour of the dependent variable investigated. The implication is that at least one of the independent variables has none zero coefficient. This proposes that the model is measured to be fit and that digital supply chain technology has substantial influence on sustainable competitiveness

**Table 3: F-ratio Test of Digital Supply Chain Technology and Sustainable Competitiveness**

| Model | | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2447.670 | 1 | 815.890 | 49.386 | .000[b] |
| | Residual | 3271.063 | 333 | 16.521 | | |
| | Total | 5718.733 | 334 | | | |

a. Dependent Variable: Sustainable Competitiveness

b. Predictors: (Constant), Big data analytics, Cloud computing systems, Mobile applications

**Source: SPSS Window Output, Version 22.0 (2022).**

**Multi-colliearity Test**

Table 4 indicates that big data analytics is statistically significant and account for sustainable competitiveness of oil and gas companies in Rivers State. It has a t-statistics value of 16.893. Besides, the result indicates that a cloud computing system has a statistical significant influence on sustainable competitiveness of oil and gas companies in Rivers State. It has a t-statistics of 16.640. Further the result indicates that mobile applications has a statistically significant influence on sustainable competitiveness of oil and gas companies in Rivers State. It has a t-statistics of 7.393

More sophisticated correlations in data than just the pairwise correlations allow the use of tolerance and variance inflation factors (VIF) associated with Xh. The tolerance explains the statistics used to disclose the degree to which the independent variables have linear (straight line) relationships with one another. Tolerance values heading towards zero and values of VIF exceeding 10 are cardinal signs of multi-collinearity. This decision rule enables the study to conclude that there is no threat of multi-collinearity amongst the dimensions of the independent variables.

**Table 4: Multi-collinearity Test of Digital Supply Chain Technology Proficiency and Sustainable Competitiveness (n=334)**

| Model | Dimension | Eigen value | Condition | Unstandardized Coefficient B | Std error | Standardized Coefficient Beta | T | Sig | Collinearity statistics Tolerance | VIF |
|---|---|---|---|---|---|---|---|---|---|---|
| Index | | | | | | | | | | |
| Constant | .087 | 29.4762 | .865 | 0.39 | - | 2.375 | 0.000 | - | - | |
| . | | | | | | . | | | | |
| BDA | 37 11 | .464 | .900 | .044 | .857 | 16893 | 0.000 | 1.000 | | 1.000 |
| CCS | 0429 | .6571 | .307 | .075 | .667 | 16.640 | 0.000 | 1.000 | . | 1.000 |
| . | | | | | | | | | | |
| MA | 0288 | .4110 | .640 | .067 | .776 | 7.393 | 0.000 | 1.000 | | 1.000 |

**Source: SPSS Window Output, Version 22.0 (2022).**

## DISCUSSION

In this study the effect of digital supply chain technology proficiency on sustainable competitiveness of the company investigated are proved. Results show that the positive effect of the dimensions of digital supply chain technology (Big data analytics, Cloud computing systems and Mobile applications) became stronger. Mobile application which had significant and strong influence with sustainable competitiveness became even more predictive, indicating that it is the most utilized digital supply chain technology amongst the studied companies. The predictors of digital supply chain technology proficiency showcased in this study are essential catalysts that stimulate sustainable competitiveness in firms supply chains. In view of the fact that there are numerous relations and interdependencies among activities in the value chain of oil and gas companies, the aptitude to synchronize and espouse the elements of digital supply chain technology proficiency is decisive to achieving sustained competitiveness. This is because many companies in our study are determined to improve their supply chains, but the quantity of digital technologies being applied is undersized. The researchers can state that most Nigerian oil and gas companies

now realize the positive potential of adopting digital elements in their supply chain. The implementation of DSCT can help companies develop their businesses well, improve the level of services in the entire level of supply chains and achieve sustained competitiveness in the market, and always stay ahead of the changing industries besides cutting down unnecessary expenses.

It is critical to note that, the presence of digital supply chain technologies in the supply chain process possibly will calculate approximately the amount of competitiveness in a firm's current market. Accordingly, digital supply chain technology proficiency can enhance the sustained competitiveness and supply chain collaboration of oil and gas companies. Therefore, this research completely supports the effect of digital supply chain technologies proficiency on sustainable competitiveness. Our findings corroborates Lee *et al*. (2022) findings that espousal of digital supply chain in the business procedure enables firms to remain dependable in the competitive market by supplying obtainable good supply chain performance and most outstanding organizational performance in totality. our findings are also consistent with the debate in the literature on the quintessence for the development of a supportive IT arrangement to institute collaborative connections with stakeholders (Jabbour *et al.,* 2019; Wong *et al.*, 2015);

**CONCLUSION AND RECOMMENDATION**

The study was conducted to determine the influence of digital supply chain technology (DSCT) proficiency on sustainable competitiveness of oil and gas companies in Rivers State. The DSCT consists of three constructs which are big data analytics, cloud computing analytics and mobile applications. The regression model valuation proves that digital supply chain technology enhances sustainable competitiveness as this research established that the independent variables of DSCT discussed early in this paper positively affect the dependent variable, sustainable competitiveness (H1, H2, H3 accepted). Improving digital supply chain technological efficiency plays a crucial role in any business. Operating businesses in thought-provoking profit margins points out that, any type of process enhancement can have a substantial influence on the bottom line. Therefore, innovative technologies such as DSCT make it easier to manage the challenges of volatility and accurately forecast demand in global supply chains and ushers in sustainable competitiveness. This study therefore concludes that, digital supply chain technology proficiency significantly influences sustainable competitiveness in oil and gas companies in Rivers State, and recommends that, to enable a new way of working with digital supply chain technology proficiency, management of oil and gas companies should adapt their organizational structures and job designs to bring the best out of their employees and DSCT to enhance sustainable competitiveness. in their supply chain industry.

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