

## DIGITAL TECHNOLOGY AND PROCUREMENT PERFORMANCE OF DOWNSTREAM OIL AND GAS COMPANIES IN RIVERS STATE

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### Abstract

This study focused on digital technology and procurement performance of downstream oil and gas companies in Rivers State. A survey research was adopted in the study. The population of the comprised 29 downstream oil and gas companies; and the entire population was surveyed. Purposive sampling technique was adopted to draw 6 management staff from each of the 29 firms to arrive at 174 respondents. A 5-point likert-scale questionnaire was used to collect data from respondents. 174 copies of questionnaire were distributed to the respondents, out of which, 135 copies were returned, yielding a response rate of 78 per cent. However, only 100 copies of the retrieved questionnaire were usable. The simple Regression statistic was used to test the hypotheses formulated for the study. The study found that digital technology has a very strong, significant and positive influence on time delivery, cost reduction and order processing. Thus, the study concludes that digital technology significantly influences procurement performance of downstream oil and gas companies in Rivers State, and recommends that management of downstream oil and gas companies should sustain their digital technology programmes to boost on time delivery, cost reduction and order processing.

**Keywords:** Cost reduction, digital technology, on time delivery, order processing, procurement performance,

### Introduction

For decades, procurement performance has been attracting great attention from practitioners, researchers due to poor levels of performance (Andrew, 2008). Poor procurement performance in public entities has been a problem due to lack of compliance to procurement regulations, lack of adherence to procurement procedures, lack of professionalism in undertaking procurement activities and lack of transparency in tendering process (Juma, 2010).

Poor procurement performance is a major hindrance to procuring entities growth since it causes delayed deliveries, increases defects, delivery of low-quality goods and outright non-delivery (Gordon & Murray, 2009). Despite the many studies on procurement performance, procurement activities still suffer neglect, lack of direction, interference and poor co-ordination (Gunasekaran, 2013). This has resulted in lack of transparency, corruption and absence qualified procurement specialists.

In the last decade, firms have been exploring how to use emerging digital technologies, e.g., Internet of Things (IoT), big data analytics (BDA), and artificial intelligence (AI), in production and supply chain management (SCM) activities (Addo-Tenkorang & Helo, 2016; Caputo et al., 2016). These technologies are seen as promising means to improve supply chain functions, such as procurement, logistics, scheduling and planning (Arunachalam et al., 2018).

IoT has been extensively applied in factories and transportations to monitor production process, and track and trace logistics and warehouse operations (Hopkins & Hawking, 2018; Caro & Sadr, 2019). The real-time data collected from the IoT devices, combined with the data from other supply chain processes, has the potential to generate significant business value through the application of BDA and AI (Kache & Seuring, 2015). It could help firms better forecast

customer demands, reveal the inventory problems, optimize resource allocation, and manage suppliers' relationships.

These emerging digital technologies are not only changing products and processes; they are also modifying value chains, renovating business models, and affecting industrial structures (Ceipek et al., 2020). There is a growing research interest in the adoption of digital technologies in firms at a supply chain level (Hazen et al., 2016). Existing studies show that supply chain digitalization can improve supply chain performance by enhancing efficiency (Govindan et al., 2018; Yu et al., 2018), visibility (Arya et al., 2017; Gunasekaran et al., 2017; Kache & Seuring, 2017), resilience (da Silva et al., 2018) and robustness (Brandon-Jones et al., 2014), and also reduce supply chain risks (Buyukozkan & Goçer, 2018; Khan et al., 2019) and supply uncertainties (Bag, 2017).

Studies on digital technology have accumulated. Tausif (2022) investigated technological convergence in manufacturing and found that, geographical proximity among automotive and aerospace SMEs and other types of economic actors is not the leading factor in technology adoption, rather institutional and cognitive (knowledge) factors play a more prominent role; Herbst (2021) analyzed the extent to which digital technologies create opportunities for component suppliers in multi-tier supply chains and revealed that, modularity facilitates the understanding of the dynamics of commoditization and knowledge sharing.

Although, these studies highlight the relationship between digital technology and variables other than procurement performance, there are little or no empirical proofs depicting the association between digital technology and procurement performance, particularly among downstream oil and gas firms in Rivers state. This study therefore, investigate the influence of digital technology on procurement performance of downstream oil and gas companies in Rivers State.

### **Theoretical Foundation: Diffusion of Innovation Theory**

Diffusion of innovation theory (Rogers, 1962) states that the cumulative number of adopters of new technology typically follows an S-shaped curve. Diffusion of innovation explain how a new products spread among people (Rogers, 1995). Usually, when new products or ideas come about, they are only adopted by a small group of people initially; later, the innovation spreads to other people. The S-curve starts to rise slowly when the first innovators adapt to the innovation. Following that, the cumulative number of adopters rises somewhat faster due to the early adopters. Diffusion manifests itself in different ways and is highly subject to the type of adopters and innovation-decision process.

Rogers (1995) argue that diffusion is the process by which an innovation is communicated over time among members of a social system; and identify four main elements that influence the spread of a new idea: the innovation itself, communication channels, time, and a social system. This process relies heavily on human capital. The innovation must be widely adopted in order to be self-sustained.

Within the rate of adoption, there is a point at which an innovation reaches critical mass. Rogers (1995) emphasizes the importance of reaching a certain 'critical mass' of adopters beyond which the innovation will diffuse without much stimulation. In adopting this theory, the study reports a relationship between supply chain digitalization and firms' procurement performance hence, we expect that the theory will explain how to increase the rate of adoption of supply chain digitalization processes to help companies achieve procurement performance.

**Concept of Digital Technology**

A digital technology is a form of hardware/software used to control production and logistics, manage the data, and support the integration of applications and processes between companies (Sedera et al., 2016). The software considered in inter-organizational integration is the Internet of things (IoT) platforms, integration platforms, and supply chain management platforms. These enabling technologies offer an opportunity to connect different forms of software and applications seamlessly and assure interoperability (ArditoPetruzzelli et al., 2019).

Although there are several positive outcomes of using digital technology, they are more likely to be accessed if firms have the capabilities to benefit from the technology and to use the information, visibility, and connectivity offered. Therefore, digital technology per se may have limited positive performance effects as they do not offer opportunities to differentiate from competitors if competitors adopt the same general software (Bhatt et al., 2010; Tippins & Sohi, 2003).

In addition, digital technologies can guide user firms to manage their processes in similar ways (Markus & Loebbecke, 2013). If competitors use similar software, none of them should be out performing any others on account of the digital technology itself. Instead, differentiation is sought through other means, such as the combination of resources, capabilities, and organizational factors. Warner and Wager (2019) analyzed the resources and digital technological innovation within financial accounting and managerial information systems that directly affect project management through increasing transparency, accessibility, and speed of digital activities.

**Concept of Procurement Performance**

Procurement performance entails how well organizational procurement objectives have been attained. The extent to which the procurement function is able to obtain best value for spent resources to obtain products is the best indicator of procurement performance (Harland, 2021; Schiele, 2007).

This study adopts the definition of procurement performance by (Patterson, 2015), which sees procurement performance as the supplier management practice of activities up to and including the making of the central/framework agreement for the whole organization to use as well as the management of that contract during the contract period. These tasks are the responsibilities of a procuring unit in an organization.

Even though the purchasing model is supply chain some aspects involved in procuring are to the individual departments. These aspects involve tasks like order processing, invoice approval and approving payments (Patterson, 2015). In line with Mesn et al. (2017) and Haile (2017), this study adopted on time delivery, cost reduction and order processing as measure of procurement performance.

**On time delivery**

Stewart (1995) sees on time delivery as an indication of delivery performance exemplified by reduced lead-time. On-time delivery mirrors whether just right delivery has occurred. A parallel concept, on time order fill, was adopted by Christopher (1992), unfolding it as an amalgamation of delivery reliability and order completeness. On time delivery is a firm's ability to supply goods and services per the standards expected by customers. It is a critical aspect of Supply Chain Management as it reflects the potential of the firm to meet customer expectations concerning time and cost.

**Cost reduction**

Cost is one out of the numerous variables that must be considered in the assessment of the success of any business. The growth of any company is largely determined on how well it can manage its costs. This is partly because to be able to maximize profit, cost must be reduced to the barest minimum. Cost reduction, as posited by John (2017), is the practice of reducing waste and streamlining procedures in order to lower expenses and/or the cost of goods sold. Cost reduction. Nwatu and Idoko (2020) conceptualized cost reduction as, the method utilized by businesses to lower their expenses and boost earnings.

**Order processing**

Ordering processing is the process by which customer orders are translated into product orders, resulting in the delivery of goods according to customer requirements for quality, time, and quantity. The ordering process coordinates demand and production if customer requirements are to be fulfilled (Bertrand et al., 1990).

The organizational aspects of the ordering process are also complex, as the coordination of demand and production involves different disciplines or functions. The ordering process can be viewed as an interface process in which transactions or interactions involve at least two business functions (Parente 1998; Rho, Hahm & Yu, 1994).

**Digital Technology and Procurement Performance**

Tausif (2022) in a study on technological convergence in manufacturing offer discernments concerning policy design and implementation, with Industry 4.0 being more unequivocal and all-inclusive than smart manufacturing and high value manufacturing in its edging, usage and enactment of a vision to sustain specific types of technologies. In Anca (2022) it was established that implementing digital technologies improves all aspect project management. Besides, the perception of increasing the efficiency and effectiveness of project management exerts a significant and positive influence on the behavioral intention to use digital technologies and their actual use, leading to their easier acceptance.

Herbst (2021) analyzed how digital technologies can generate opportunities for component suppliers in multi-tier supply chains confronted with the concern of commoditization. The study reveal that modularity enhance understanding of underlying forces of commoditization and knowledge sharing. Likewise, modularization energies the disproportionate distribution of information in a multi-tier supply chain. Lastly, digital technologies can offer strategic opportunities for steering diverse phases of the value chain.

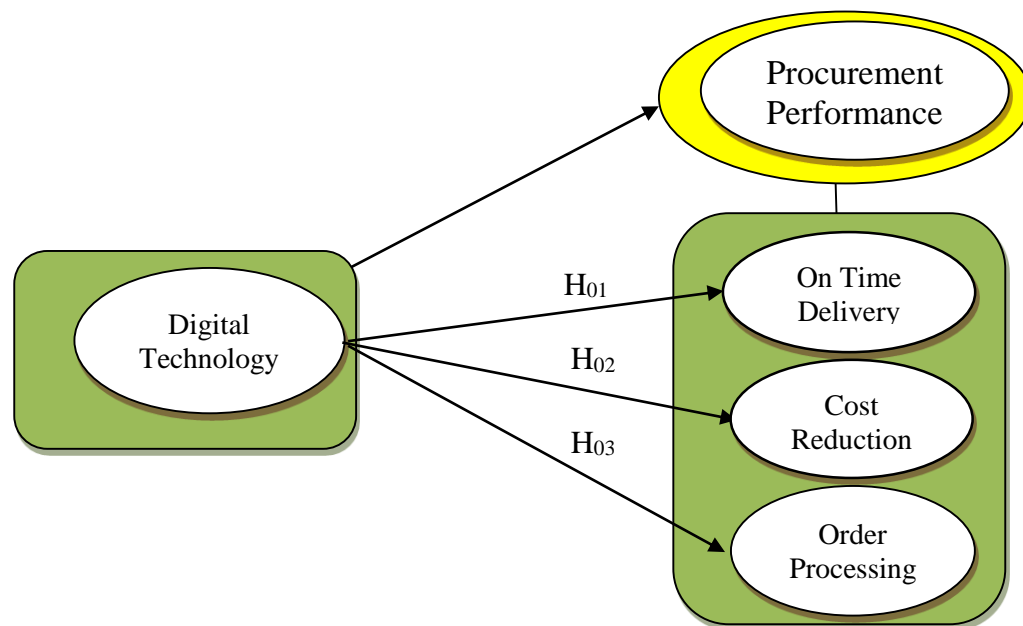
Olofsson et al. (2020) empirically investigated teachers endorsed digital proficiency in three upper secondary schools in Sweden, by means of interviews with teachers and classroom observations. It was found that, teachers' satisfactory digital proficiency is supple in meaning, determined by local contextual conditions and sanctioned in activities and decisions that are based on the teachers' own value frameworks.

Based on the empirical literature review, the study proposes the following hypotheses.

**H<sub>01</sub>:** Digital technology does not significantly influence on time delivery.

**H<sub>02</sub>:** Digital technology does not significantly influence cost reduction.

**H<sub>03</sub>:** Digital technology does not significantly influence order processing.



**Fig. 1:** Operational framework of influence of digital and technology and procurement performance.

### Methodology

This study espoused sociological positivism and adopts a quantitative approach which involved hypotheses testing in a non-contrived study setting. The study adopted a survey research design. The population of the study comprised twenty-nine (29) downstream oil and gas companies in Port Harcourt whose authentic list was derived from FinLib.com as at June 3, 2024. The study adopted the census method.

Purposive sampling technique was employed to draw six (6) managers from marketing, production, procurement/purchasing, customer service, quality assurance and research and development departments of each company to serve as respondents.

Thus, a total of one hundred and seventy-four (174) management staff served as respondents. So, one hundred and seventy-four (174) copies of questionnaire were distributed to respondents. Of the 174 copies of questionnaire distributed, 135 copies were returned, yielding a response rate of 78 percent; and of the 135 copies returned, the usable copies numbered 100 leading to a response rate of 74%. The study used copies of questionnaire to elicit data from source, and the simple regression technique was used to test the hypotheses formulated for the study.

### Test of Hypotheses and Results

**Table 1: Influence of digital technology on time delivery**

Model	R	R Square	Adjusted R Square	Std. Error of the estimate
1	.872	.764	.703	4.5343

a. Predictors: (Constant), Digital technology

b. Dependent Variable: On time delivery

The sum of on time delivery was regressed with the sum of digital technology. The value of R is 0.872. The  $R^2$  value of 0.764 represents the correlation between digital technology and on time delivery. It represents a very strong correlation between digital technology and on time delivery. This means that 76% of the change in on time delivery is spelt out by the independent variable. It shows that digital technology makes a contribution of 76% to every change in on

time delivery, while 24% of the changes are not spelt out. Since for hypothesis one, the significant is .000 which is less than 0.05; there is a significant influence of digital technology on time delivery.

**Table 2: One-way ANOVA for difference in mean between digital technology and on time delivery**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	77.074	1	77.074	374.879	.0000
Within Groups	23.849	99	206		
Total	100.94	100			

a. dependent variable: On Time Delivery

b. Predictor: Digital Technology

The satisfactoriness of the model can also be made clear by the value 374.879(F-ratio), at  $p < 0.05$ . This implies that there is evidence to extrapolate that digital technology has impact on time delivery and is linearly related to on time delivery. This puts forward that the model is calculated to be fit and that digital technology has extensive influence on time delivery.

**Table 3: Influence of digital technology on cost reduction**

Model	R	R Square	Adjusted R Square	Std. Error of the estimate
1	.810	.656	.653	.50668

a. Predictors: (Constant), Digital Technology

b. Dependent Variable: Cost Reduction

The sum of cost reduction was regressed with the sum of digital technology. The value of R is 0.810. The  $R^2$  value of 0.656 represents the correlation between digital technology and cost reduction. It represents a strong correlation between digital technology and cost reduction. This means that 66% of the change in cost reduction is spelt out by the independent variable. It shows that digital technology makes a contribution of 66% to every change in cost reduction, while 34% of the changes are not spelt out. Since for hypothesis two, the significant is .000 which is less than 0.05; there is a significant influence of digital technology on cost reduction.

**Table 4: One-way ANOVA for difference in mean between digital technology and cost reduction**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	55.771	1	55.771	281.139	.0000
Within Groups	23.849	99	257		
Total	100.94	100			

a. dependent variable: Cost reduction

b. Predictor: Digital technology

The sufficiency of the model can also be made clear by the value 281.139 (F-ratio), at  $p < 0.05$ . This implies that there is an evidence to extrapolate that digital technology is linearly related to cost reduction. This puts forward that the model is calculated to be fit and that digital technology has extensive influence on cost reduction.

**Table 5: Influence of digital technology on order processing**

Model	R	R Square	Adjusted R Square	Std. Error of the estimate
1	.983	.963	.963	2.6751

a. Predictors: (Constant), Digital Technology

b. Dependent Variable: Order processing

The sum of total order processing was regressed with the sum of digital technology. The value of R is 0.983. The  $R^2$ -value of 0.963% represents the correlation between digital technology and order processing. It represents a very strong correlation between digital technology and order processing. This means that 96% of the change in order processing is spelt out by the independent variable. It shows that digital technology makes a contribution of 96% to every change in order processing, while 4% of the changes are not spelt out. Since for hypothesis three, the significant is .000 which is less than 0.05; there is a significant, influence of digital technology on order processing.

**Table 6: One-way ANOVA for difference in mean between digital technology and order processing**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0.63	1	0.63	233.264	.0000
Within Groups	.002	99	.000		
Total	0.66	100			

a. dependent variable: Digital technology

b. Predictor: Order processing

The sufficiency of the model can also be made clear by the value 233.264 (F-ratio), at  $p < 0.05$ . This implies that there is evidence to extrapolate that digital technology is linearly related to order processing. This puts forward that the model is calculated to be fit and that digital technology has extensive influence on order processing.

### Discussion of Findings

Digital technology is a driver of on time delivery, cost reduction and order processing. The findings of the quantitative analysis of this study has revealed that digital technology has a very strong, positive and significant relationship with on time delivery, cost reduction and order processing. These findings suggests that digital Technology can guide user firms to manage their processes, increase flow of real-time inter- and intra-organizational data and provide elegance to the companies' processes and technologies.

Clever companies congregate all these perspectives that have the common aim to leverage the operations of the supply chain through the adoption of digital technologies. Our findings agree and support the findings of Anca (2022) whose results show that implementing digital technologies improves all activities in the project management process, Herbst (2021) who disclosed that, digital technologies can offer strategic opportunities for steering diverse phases of the value chain. The study also supports Olofsson et al. (2020) findings that, teachers' satisfactory digital proficiency is supply in meaning, determined by local contextual conditions and sanctioned in activities and decisions that are based on the teachers' own value frameworks.

### Conclusion and Recommendations

This study investigated the influence of digital technology on procurement performance, and confirmed that on time delivery, cost reduction and order processing are influenced by digital technology adopted by a company. Research evidence also revealed that, digital technology has a very strong, positive and significant influence on time delivery, cost reduction and order processing. The researchers therefore conclude that, digital technology significantly influences procurement performance of downstream oil and gas companies in Rivers State. Based on the conclusion, the following recommendations were preferred:

- a) Management of downstream oil and gas companies should sustain their digital technology programs to ensure on time delivery, cost reduction and order processing in their organizations.
- b) Management of downstream oil and gas companies should institute supply chain digital technology mechanism that will attract procurement performance actions such as on time delivery, cost reduction and order processing.
- c) The management of downstream oil and gas companies should invest in modern technologies by increasing specific efforts and strategies regarding choosing, establishing, comprehending, orientating, enhancing and improving technology.

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