

MATERIALS MOVEMENT AND OPERATIONAL PERFORMANCE OF UPSTREAM OIL AND GAS COMPANIES IN SOUTH-SOUTH NIGERIA**CYRIL-IBAMA Awoiyim¹ NWOKAH Gladson N.² NWULU Chinyere Stella³**^{1, 2, 3}Department of Marketing, Faculty of Administration and Management,
Rivers State University Nkpolu- Oroworukwo, Port Harcourt, Nigeria.**Abstract**

This study investigated the relationship between materials movement and operational performance of upstream oil and gas companies in South-South Nigeria. The study was conceptualized using materials movement as predictor to operational performance with measures such as cost minimization, productivity and service speed. Survey research design with a correlational investigation type was employed in the study. The population of the study comprised 24 oil and gas companies in South-South Nigeria. The sample size of the study was the same as the population, since the population was not large. The researcher adopted census method to administer 3 copies of structured questionnaire to operations managers, logistics managers and procurement managers to each of the 24 oil and gas companies. This means that 72 respondents were used for the study. However, 63 respondents provided useable data for the study. Pearson's Product Correlation Coefficients with a 95% confidence interval in mind was used in testing the hypotheses. Each test was conducted at a 0.01 level of analysis with the help of the Statistical Packages for Social Sciences (SPSS) version 23.0. The results revealed the existence of significant relationship between materials movement and operational performance of upstream oil and gas companies in South-South Nigeria. Based on the findings, the study concluded that materials movement significantly relates to operational performance of upstream oil and gas companies in South-South Nigeria; and recommends that managers of upstream oil and gas companies in South-South Nigeria should adopt modern material movement systems as a way to achieve cost minimization objective.

Keywords: Cost minimization, materials movement, operational performance, productivity, service speed

INTRODUCTION

Materials are the lifeblood of organizations. Effective materials movement can be seen as the heart that pumps an organization's blood through arteries, veins and sinews to sustain its vitality. Adamu (2020) states that most firms achieve savings that amount to between 50% and 60% of costs from efficient materials management. In Nigeria, the oil and gas industry operates in a highly dynamic environment characterized by volatility in every area of their operations.

The core activity of the oil and gas industry involve the exploration and production (E&P) of hydrocarbons. Exploration activities include the search for new reserves through seismic surveys and drilling, while production involves the extraction of crude oil and natural gas from existing reserves (Kathurima et al., 2016). Once extracted, crude oil undergoes refining processes to produce various petroleum products, including gasoline, diesel, jet fuel, and petrochemicals (Daniel, 2019), thus the entire process of refining crude oil and minerals is enabled by efficient movement of materials (Odeleye, 2021).

Materials used in the oil and gas industry encompass a wide range, from drilling equipment and machinery to pipes, chemicals, and safety gears. The movement of these materials involve intricate logistics, starting with transportation of raw materials to exploration and production sites, through the refining process, and ultimately reaching distribution networks. Once refined products are ready for distribution, oil and gas companies must manage vast transportation networks, including pipelines, tankers, and storage facilities. The movement of materials through these channels requires careful coordination to meet market demands while adhering to safety

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and environmental standards (Oyebamiji, 2018). Thus, materials movement has become a competitive tool used to boost performance of oil and gas companies (Ondieki, 2014).

Previous studies (Ramakrishna, 2005; Ogbadu, 2009; Ondiek, 2014) show that materials account for more than fifty per cent of the annual turnover of manufacturing companies. This shows that priority should be given to management of materials to avoid unnecessary costs. Thus, materials movement should no longer be seen as a drain-pipe, but as a success factor (Nwosu, 2014).

Unfortunately, few studies exist (Munga et al., 2023; Asaolu et al., 2012; Nwosu, 2014) that demystify managers on the nexus between materials movement and operational performance within the Nigerian upstream oil and gas industry. However, none of these studies focused on the significance of materials movement to operational performance of upstream oil and gas companies in Nigeria. This study filled this gap by exploring the empirical relationship between materials movement and operational performance of upstream oil and gas companies in Nigeria.

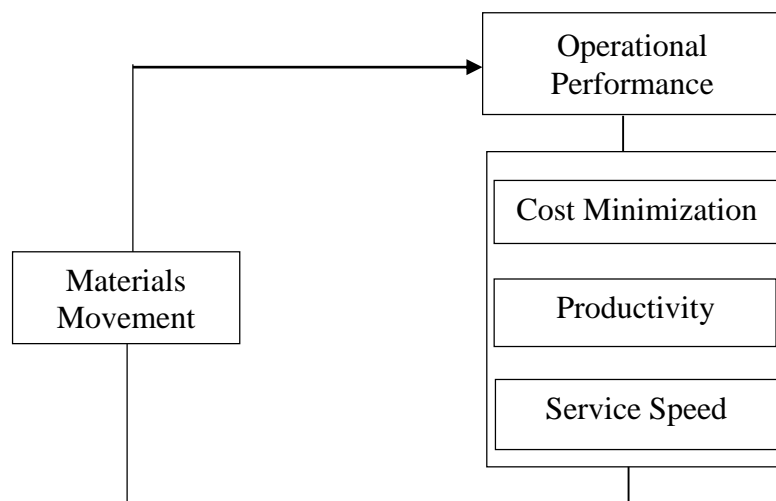


Fig. 1: Conceptual framework of relationship between materials movement and operational performance of upstream oil and gas companies in Nigeria.

Sources: Bae, H., & Park, D. (2018). Gaps in performance between the levels of inter-corporate relationships in port logistics processes. *The Asian Journal of Shipping and Logistics*, 34(3), 209-217.

Baseline Theory

This study is anchored on inventory management theory (Nowicka-Skowron, 2007) which emphasizes the role that management of materials play in manufacturing companies. The theory posits that the chain of movement of material and information depends, to a large extent, on the availability of materials and the quality of information at the disposal of the chain operator (Poi & Okwandu, 2021). The purpose of inventory management theory is to determine rules that materials requirement and management can use to minimize the costs associated with maintaining materials requirement and management and meeting customer demand. Materials requirement and management is studied in order to help companies save costs. Materials requirement and management models answer the questions: When should an order be placed for a product? How large should each order be? The answers to these questions are collectively called materials requirement and management and this aligns to the present study.

Concept of Materials Movement

Materials movement refers to the physical transportation, storage and control of goods and materials within a facility or across a supply chain (Seman, 2021). It encompasses a range of activities, including loading and unloading of materials, movement between different locations, and optimization of processes to ensure cost-effective handling. Kisioya and Moronge (2019) defined material movement as the transfer, storage, control and protection of materials throughout the process of manufacturing, distribution, consumption and disposal.

The focus materials movement is on methods, equipment, systems and related controls used to achieve successful manufacturing, distribution, consumption and disposal. Materials need to be moved carefully at every step of the supply chain to make sure they arrive at their destinations intact. A material movement system should be put in place to optimize the movement of goods and materials around manufacturing and storage facilities (Odhiambo, 2015).

Operational Performance

Performance refers to either results or actions that birth results (Didia & Amesi, 2018). Mwingi (2012) views performance as that which includes inputs, outputs, intermediate outcomes, end outcomes, net impacts and unintended outcomes. Generally, performance is “a set of metrics used to quantify the efficiency and effectiveness of supply chain processes and relationships, spanning multiple organizational functions and multiple firms and enabling supply chain orchestration” (Maestrini et al., 2017).

Tamang (2014) and Tushman and Anderson (2006) view operational performance as the strategic dimensions in which companies choose to compete. Operational performance describes a firm’s capacity as a measure of how well it uses its assets from its core operations and generates revenues over a given period of time. This measure is thus compared to some given industrial average standard of similar firms in the same industry (Mwichigi & Waiganjo, 2014). The present study adopts cost minimization, productivity and service speed as measures of operational performance.

Cost minimization is a planned approach to reduce expenditure. It is a continuous process of examining critically all elements of cost and each aspect of the business with a view to improving business efficiency. Cost minimization is the process of cutting down costs incurred by an organization for the purpose of making profit. It starts when cost control ends and considers that no cost is at its optimum level. Drury (2004) cited in Kinyugo (2014) argued that cost minimization deals with cost reduction as well as continuous improvement and change instead of cost containment. Cost minimization is measured by evaluating whether an organization’ cost is higher, equal or lower than

Productivity represents the quantifiable value added by business operations, relative to the costs of those operations (Ateke & Amangala, 2020). Syverson (2011) states that the term productivity was first used by French mathematician in an article in 1766. According to Kouamé and Tapsoba (2018) productivity is the measure of how well resources are brought together in organizations and utilized for accomplishing a set of results. Cusolito and Maloney (2018) believe that productivity is a family of ratios of output to input. The living standard of the country is measured by the productivity (Kouamé & Tapsoba, 2018). Productivity is a comparative tool for managers, marketers, industrial engineers and economists.

Service speed is one of the metrics used to evaluate an operational efficiency. It refers to the total time taken between the submission of a program/process/thread/task or service for execution and the return of the complete output to the customer/user. Service speed according to Van-Winkelen and McKenzie (2011), is the timeliness with which service personnel delivers result to customers or end users. It is one of the most noticeable signs of service and is often used as a key performance indicator of operating performance.

Empirical Review

Previous studies have convergent opinions on the relationship between materials movement and operational performance. Egwuatu (2021) investigated the effect of material management and organizational productivity in breweries industry of South-East in Nigeria. The results of the study showed that material control has a significant positive influence on organizational productivity in Nigeria brewer industries South-East. Material planning strategy has a positive significant effect on organizational productivity in Nigeria brewer South-East. The study concludes that material management positive significant effect on organizational productivity in Nigeria brewer South-East.

Similarly, Rono and Musau (2020) examined the effect of material handling practices on supply chain efficiency of flour processing firms in Eldoret. The study found a positive influence of material handling practices on supply chain efficiency of flour processing firms in Eldoret, Kenya. In Adamu (2020), the effect of material management on performance of Benue Brewery Nigeria was examined. The result shows that inventory control system and stock valuation have positive and significant effect on organizational performance.

Relatedly, Nyongesa and Shale (2019) investigated the influence of material management on performance of large manufacturing firms in Nairobi City County, Kenya. The study established that basic functionality of materials management includes various factors such as supply, material pricing, and usage. Also, Kisioya and Moronge (2019) examined the influence of material handling practices on performance of manufacturing firms in Nairobi Kenya; and found that most material handling practices have positive impact on performance of the firm.

In addition, Daniel (2019) examined the effects of materials management on productivity of firms in Nigeria. The study discovered that material management used by the organization adds to the profitability of the company, sufficient storage facilities stop interruption on production process amongst other things. In view of the foregoing, we hypothesize as follows:

- H₀₁:** There is no significant relationship between materials movement and cost minimization of upstream oil and gas companies in South-South Nigeria.
- H₀₂:** There is no significant relationship between materials movement and productivity of upstream oil and gas companies in South-South Nigeria.
- H₀₃:** There is no significant relationship between materials movement and service speed of upstream oil and gas companies in South-South Nigeria.

Methodology

The survey research design was employed in this study. The study population comprised 24 upstream oil and gas companies in South-South Nigeria as enlisted in the finelib.com Nigerian Directory and Search Engine (2023). The sample size of the study was the same as the population. The study administered 3 copies of structured questionnaire to operations managers,

logistics managers and procurement managers of each of the 24 oil and gas companies. This means that 72 respondents were used for the study. The questionnaire was tested for reliability using the Cronbach's Alpha test.

Table 1: Reliability Test - Cronbach's Alpha Analysis

S/N	Variables	Number of Items	Cronbach's Alpha Coefficients
1	Material Movement	5	0.764
2	Cost Minimization	5	0.700
3	Productivity	5	0.729
4	Service Speed	5	0.902

Source: SPSS Output from Field Data

From results of the Cronbach alpha analysis in Table 1, it was revealed that all the variables in the study produced high Cronbach's Alpha coefficients indicating that, there is inter-item consistency among the variables in the study. This means that, if this study is conducted again in a similar condition the results will be similar to the results of our study. Pearson's Product Moment Correlation was used to test the proposed hypotheses. Each test was conducted at a 0.01 level of analysis with the help of the Statistical Packages for Social Sciences (SPSS) version 23.0.

Data Analyses, Results and Interpretation

Table 2: Descriptive Statistics of Material Movement

	N	Sum	Mean	Std. Deviation	Skewness	Std. Error	Kurtosis	Std. Error
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
To what extent does your company move materials from store to site	63	265	4.21	.676	-1.893	.302	8.485	.595
To what extent does your company have a transport system for moving our materials and natural resources.	63	292	4.63	.630	-1.932	.302	4.282	.595
To what extent does your company use trucks and pick-ups to move our materials to site.	63	276	4.38	.633	-.912	.302	1.735	.595
To what extent does your company use tank cars to move our mineral materials	63	285	4.52	.692	-1.142	.302	.021	.595
To what extent does your company adopt modern technologies to run our transport system	63	261	4.14	1.255	-1.440	.302	1.004	.595
Valid N (listwise)	63							

Source: SPSS Output, 2024.

Table 2 depicts high mean scores for the questionnaire items ranging over 3.00; this means that greater number of the respondents agreed and strongly agreed to the research question with

respect to material movement. However, it can be seen that question 2 which sought to determine the extent to which upstream oil and gas companies in South-South Nigeria have transport systems for moving materials and natural resources, has the highest mean scores of 4.63 with a standard deviation of 0.63. This shows that question 2 has the strongest influence on the variables.

Furthermore, the skewness statistics are all negative indicating a negatively skewed distribution with scores concentrating on the high end of the scale. Also, standard errors of skewness are 0.302 which shows that, the distribution is not skewed to a significant degree. In the area of the kurtosis, the results showed a positive kurtosis indicating a relatively peaked distribution. Values of the standard errors of kurtosis are less than 2 indicating that the distribution is not too high to a significant degree.

Table 3: Descriptive Statistics of Cost Minimization

	N	Sum	Mean	Std. Deviation	Skewness	Kurtosis		
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
To what extent does your company record low operations cost.	63	272	4.32	.469	.804	.302	-1.400	.595
When we reduce cost, profit is maximized in our firm	63	269	4.27	1.003	-.969	.302	-.506	.595
To what extent does your company avoid costs not associated with stock value	63	263	4.17	.794	-1.525	.302	4.085	.595
To what extent does your company avoid wastage in production process	63	285	4.52	.913	-2.041	.302	3.761	.595
To what extent does your company make proper research before taking any purchase decision	63	302	4.79	.699	-4.076	.302	17.661	.595
Valid N (listwise)	63							

Source: SPSS Output, 2024.

Table 3 depicts high mean scores of the questionnaire items ranging over 3.00; this means that greater number of the respondents agreed and strongly agreed to the research question with respect to cost minimization. However, it can be seen that question 5 which sought to determine the extent to which upstream oil and gas companies in South-South Nigeria make proper research before taking any purchase decision, has the highest mean scores of 4.79 with a standard deviation of 0.69. This shows that question 5 has the strongest influence on the variables.

Furthermore, the skewness statistics are all negative indicating a negatively skewed distribution with scores concentrating on the high end of the scale. Also, standard errors of skewness are 0.302 which shows that, the distribution is not skewed to a significant degree. In the area of the kurtosis, the results showed a positive kurtosis indicating a relatively peaked distribution. Values

of the standard errors of kurtosis are less than 2 indicating that the distribution is not too high to a significant degree.

Table 4: Descriptive Statistics of Productivity

	N	Sum	Mean	Std. Deviation	Skewness	Kurtosis		
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
To what extent does your company take records of production	63	279	4.43	.875	-2.314	.302	6.563	.595
To what extent does your company keep inventory register	63	260	4.13	.813	-1.356	.302	3.202	.595
To what extent has your production capacity increased	63	299	4.75	.897	-3.755	.302	13.308	.595
To what extent does your company do the right thing, to account for improvement	63	288	4.57	.777	-2.270	.302	6.408	.595
To what extent does your company record significant improvement on production and deliveries	63	309	4.90	.429	-5.616	.302	35.133	.595
Valid N (listwise)	63							

Source: SPSS Output, 2024.

Table 4 depicts high mean scores of the questionnaire items ranging over 3.00; this means that greater number of the respondents agreed and strongly agreed to the research question with respect to productivity. However, it can be seen that question 5 which sought to determine the extent to which upstream oil and gas companies in South-South Nigeria record significant improvement on production and deliveries, has the highest mean scores of 4.79 with a standard deviation of 0.42. This shows that question 5 has the strongest influence on the variables.

Furthermore, the skewness statistics are all negative indicating a negatively skewed distribution with scores concentrating on the high end of the scale. Also, standard errors of skewness are 0.302 which shows that, the distribution is not skewed to a significant degree. In the area of the kurtosis, the results showed a positive kurtosis indicating a relatively peaked distribution. Values of the standard errors of kurtosis are less than 2 indicating that the distribution is not too high to a significant degree.

Table 5: Descriptive Statistics of Service Speed

	N	Sum	Mean	Std. Deviation	Skewness	Std. Error	Kurtosis	Std. Error
Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
To what extent is your company time conscious	63	308	4.89	.444	-5.108	.302	29.841	.595
We avoid procrastination	63	268	4.25	.822	-1.766	.302	4.517	.595
To what extent does your company deliver up to date information	63	279	4.43	.712	-1.955	.302	7.282	.595
To what extent does your company regulate time from when order is taken to the delivery of our product to the consumers	63	258	4.10	.962	-1.317	.302	2.021	.595
To what extent does your company schedule transportation system	63	262	4.16	1.035	-1.861	.302	3.610	.595
Valid N (listwise)	63							

Source: SPSS Output, 2024.

Table 5 depicts high mean scores of the questionnaire items ranging over 3.00; this means that greater number of the respondents agreed and strongly agreed to the research question with respect to service speed. However, it can be seen that question 1 which sought to determine the extent to which upstream oil and gas companies in South-South Nigeria are time conscious, has the highest mean scores of 4.89 with a standard deviation of 0.44. This shows that question 1 has the strongest influence on the variables.

Furthermore, the skewness statistics are all negative indicating a negatively skewed distribution with scores concentrating on the high end of the scale. Also, standard errors of skewness are 0.302 which shows that, the distribution is not skewed to a significant degree. In the area of the kurtosis, the results showed a positive kurtosis indicating a relatively peaked distribution. Values of the standard errors of kurtosis are less than 2 indicating that the distribution is not too high to a significant degree.

Table 6: Relationship between Material Movement and Cost Minimization

		Material Movement	Cost Minimization
Material Movement	Pearson Correlation	1	.254*
	Sig. (2-tailed)		.045
	N	63	63
Cost Minimization	Pearson Correlation	.254*	1
	Sig. (2-tailed)	.045	
	N	63	63

*. Correlation is significant at the 0.05 level (2-tailed).

Source: SPSS Output, 2024.

Table 6 reveals a correlation coefficient of 0.254** between material movement and cost minimization, indicating a weak positive relationship between the variables. More so, the probability value (0.000) is less than the critical value (0.05), this shows that there is a weak significant relationship between material movement and cost minimization. This further implies

that material movement can be used to achieve cost minimization among upstream oil and gas companies in South-South Nigeria. Based on this, we reject the null hypothesis that there is no significant relationship between material movement and cost minimization of upstream oil and gas companies in South-South Nigeria.

Table 7: Relationship between Material Movement and Productivity

		Material Movement	Productivity
Material Movement	Pearson Correlation	1	.479**
	Sig. (2-tailed)		.000
	N	63	63
Productivity	Pearson Correlation	.479**	1
	Sig. (2-tailed)	.000	
	N	63	63

**. Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS Output, 2024.

Table 7 reveals a correlation coefficient of 0.479** between material movement and productivity, indicating a moderate positive relationship between material movement and productivity. More so, the probability value (0.000) is less than the critical value (0.05), this shows that there is a moderate significant relationship between the variables. This further implies that material movement can be used to achieve productivity among upstream oil and gas companies in South-South Nigeria. Based on this, we reject the null hypothesis that there is no significant relationship between material movement and productivity of upstream oil and gas companies in South-South, Nigeria.

Table 8: Relationship between Material Movement and Service Speed

		Material Movement	Service Speed
Material Movement	Pearson Correlation	1	.607**
	Sig. (2-tailed)		.000
	N	63	63
Service Speed	Pearson Correlation	.607**	1
	Sig. (2-tailed)	.000	
	N	63	63

**. Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS Output, 2024.

Table 8 reveals a correlation coefficient of 0.607** between material movement and service speed, indicating a strong positive relationship between material movement and service speed. More so, the probability value (0.000) is less than the critical value (0.05), this shows that there is a strong significant relationship between material movement and service speed. This further implies that material movement can be used to achieve service speed among upstream oil and gas companies in South-South Nigeria. Based on this, we reject the null hypothesis that there is no significant relationship between material movement and service speed of upstream oil and gas companies in South-South Nigeria.

Discussion of Findings

From results of the correlation analysis, it can be seen that there is a weak significant relationship between material movement and cost minimization; a moderate significant relationship between material movement and productivity; and a strong significant relationship between material

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movement and service speed. More so, the probability values (0.000) are less than the critical value (0.05), this shows that there are positive significant relationships between material movement and components of the criterion variables.

The findings of this study correspond to the findings of Munga et al. (2023) that material handling practices have positive impact on performance of firms. The findings also confirm the finding of Okeoma et al. (2022) that material management has positive impact on organizational productivity; as well as that of Albert et al. (2021) that poor materials management has a considerable effect on material waste generation on construction projects; moderate effects on quality of building projects, and considerable and moderate effects on profitability of construction projects.

Our study findings also validate that of Gamariel and Tuyisenge (2021) that material handling and material sourcing affect profitability of Urwibutso Enterprise Ltd.; and that of Odeleye (2021) that material handling aids the profitability of an organization in a way that it facilitates a shorter operating cycle, reduces the handling costs, eliminates unproductive handling of materials, reduces idle time for labour, eliminates factory hazards, maintains quality of materials, enables optimum usage of space, facilitates materials issues, facilitates better customer care, facilitates better quality products and timely production.

In addition, our findings align with the finding of Egwuatu (2021) that material control has significant positive influence on organizational productivity in Nigeria brewer industries South-East; that of Rono and Musau (2020) that materials handling practices have positive and statically significant effect on supply chain efficiency of flour processing firms; and that of Donyavi and Flanagan (2020) which reported that material requirement and management practices contributes to performance of construction of project.

Furthermore, the present finding support the reports that inventory control system and stock valuation have a positive and significant effect on organizational performance (Adamu, 2020); that material handling practices have positive impact on performance of the firms (Kisioya & Moronge, 2019); and that materials management adds to the profitability of firms, and enhance sufficient storage facilities as well as stop interruption of production process (Daniel, 2019).

Conclusion and Recommendations

Sequel to the results of this study and to the extent of their consistency with similar studies, the study concludes that materials movement significantly relate with operational performance of upstream oil and gas companies in South-South, Nigeria. Thus, material movement is integral to the operational performance of the Nigerian upstream oil and gas industry. It impacts cost minimization, productivity and service speed and overall performance. Consequently, the study recommends that managers of upstream oil and gas companies in South-South Nigeria should adopt modern material movement systems as a way to achieve cost minimization objective; and that managers of upstream oil and gas companies in South-South Nigeria.

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