**The Impact of Green Supply Chain Management on Operational Performance of Private Hospitals in the Niger Delta Region, Nigeria**

Orji Nnaemeka Joel1\*, Ajueyitse Martins Otuedon2

*1Universidad Central De Nicaragua (UCN), Nicaragua.*

*2College of education, Warri, Delta state, Nigeria.*

***Abstract***

*This study takes a close look at how Green Supply Chain Management (GSCM) practices affect the operational performance of private hospitals in Nigeria’s Niger Delta—tackling the important need to integrate sustainable and eco-friendly practices into healthcare to boost efficiency and reduce costs. The objective of the study focuses on evaluating the current GSCM practices these hospitals are employing and how they relate with operational performance indicators such as service quality/patient satisfaction and cost efficiency. The study employs a mixed-methods approach (Qualitative and Quantitative) to collect data from about 198 respondents (hospital administrators, supply chain managers, and procurement officers) in 45 private hospitals within the Niger Delta Region. A simple random sampling technique was adopted to select the sample size appropriate for the study, and a multiple linear regression was employed to examine the relationship between GSCM implementation and operational outcomes. The findings suggest that private hospitals which adopt GSCM practices tend to show significant improvement in their operational performance especially through enhanced service delivery and cost efficiency. These findings have the potential to inform healthcare administrators and policymakers that the benefits of environmental sustainability are not just about being eco-friendly but also about improving operational metrics. The study contributes to the wider field of healthcare management by emphasizing that strategic integration of GSCM can improve resource use and patient care—even nudging institutions in Nigeria and similar areas to rethink how they operate.*

***Keywords****: Eco-Friendly, Green Procurement, Green Supply Chain Management, Operational Performance, Sustainable Healthcare, Waste Management.*

**Introduction**

Health management and environmental sustainability are getting a lot of attention these days. Global challenges like climate change and dwindling resources force institutions to rethink how they operate. Take Nigeria’s Niger Delta, for example—the region is grappling with serious environmental and health crises due to oil exploration, rampant industrial activity, and a shaky infrastructure. This situation makes it pretty urgent for private hospitals in this region to mix in some Green Supply Chain Management (GSCM) approaches.

**Background of the Study**

The interaction between healthcare delivery and environmental sustainability is getting a lot of attention these days, especially within the context of healthcare system inefficiencies and significant ecological issues. In Niger Delta, a good example of urban expansion, oil extraction, industrial activities and inadequate healthcare infrastructure has aggravated environmental deterioration, which affects health outcomes as well as the operational capabilities within healthcare facilities. This situation makes it important for private hospitals within this region to integrate Green Supply Chain Management (GSCM) approaches in enhancing their performance. Meanwhile, over the last two decades, environmental considerations have become more important for business organizations [17], including hospitals. As environmental concerns have risen, the need to extend environmental initiatives to the supply chain management practices also grown in prominence. Globally, organizations are under pressure from their stakeholders to improve or increase their green supply chain operations to gain a competitive advantage [16]. A green supply chain management (GSCM) refers to an organization adopting innovative practices and policies on the supply chain operation and management to ensure environmental sustainability [9]. The GSCM practices are essential in the healthcare industry as they help balance high-quality care with sustainability, thereby addressing environmental issues.

**Statement of the Problem**

Among the environmental challenges and health inequities in the Niger Delta region of Nigeria, sustainable practice in healthcare management has become a major issue. The Niger Delta region of Nigeria is facing environmental degradation as a result of oil exploration, industrial pollution and poor waste management. Private hospitals in this region are adding to the environmental burden through improper disposal of medical waste, excessive energy consumption and unsustainable procurement practices. Despite the global emphasis on Green Supply Chain Management (GSCM) in healthcare, many hospitals in the Niger Delta are not adopting eco-friendly practices, thus leading to increased environmental pollution, public health risks and inefficiencies in healthcare delivery.

Healthcare facilities generate hazardous and infectious waste; syringes, chemical residues and pharmaceutical waste which if not properly managed can contaminate water sources and soil and worsen the region’s ecological crisis [24]. Studies show that only 30% of Nigerian healthcare facilities comply with medical waste disposal guidelines [20] and the Niger Delta is lagging behind due to weak enforcement of environmental policies. Furthermore, hospitals reliance on fossil fuel powered energy increases carbon emissions and climate change which is a major concern.

World Health Organization (WHO) strongly advocates for sustainable healthcare practices and says “health systems must reduce their environmental footprint while maintaining quality care” [25]. Adeniran did a study on the drivers and barriers of GSCM in Nigeria healthcare, yet there is limited understanding of how GSCM practices affects the operational performance of private hospitals, in Niger Delta region, with specific attention to service quality and cost efficiency [1].

**Objectives of the Study**

Generally, the purpose of this study is to examine the impact of GSCM practices on the operational performance of private hospitals in the Niger Delta region of Nigeria. Primarily, the study seeks to evaluate the current GSCM practices employed by private hospitals in the Niger Delta region, the barriers to implementation and then analyze their impact on their operational performance, particularly in terms of quality care deliver and cost efficiency. These objectives are expressed through the following research questions:

*RQ1: Is there a relationship between green procurement or purchasing practice and the operational performance of private hospitals?*

*RQ2: How does reverse logistics practice affect the overall operational performance of private hospitals in the Niger Delta region of Nigeria?*

*RQ3: To what extend does waste management affects quality of care and cost efficiency in private hospitals in the Niger Delta region?*

*RQ4: How does green distribution practice contribute to the overall operational performance of private hospitals?*

The objectives articulated through these questions are designed to provide a multifaceted understanding of GSCM's impact and to formulate recommendations that effectively align healthcare practices with sustainable outcomes.

**Literature Review**

**Theoretical Perspective**

For this study, the Resource Based View (RBV) is adopted. It is a major theory that focuses on gaining an edge over others by using internal resources (Bohnenekamp, 2013). In healthcare, RBV suggests that hospitals can obtain sustainable competitive advantage based on their valuable, rare, inimitable, and non-substitute resources and capabilities. According to [10], GSCM practices can be considered as strategic capabilities that can be exploited to gain competitive advantage. Similarly, organizations with better GSCM practices tends to experience enhanced performance [22]. Thus, RBV was adopted as a lens of perspectives to examine the relationship between GSCM practices and key healthcare operational performance.

**Conceptual Perspective**

For this study, the green supply chain management practices could be classified as the independent variables while the Operational Performance as the dependent variable. The is visualized in figure 1 below:

A diagram of a supply chain

AI-generated content may be incorrect.

**Figure 1.** Independent and Dependent Variables

*Source: Research Work*

**Overview of Green Supply Chain Management (GSCM)**

The concept of Supply Chain Management which is traditionally applicable to manufacturing industry, has the scope to streamline the entire dynamics and operations of service industry, especially the healthcare industry. In Healthcare, it involves both the internal and external chain. The internal chain includes patient care unit, hospital storage and patients, etc, while the external chain includes the vendors, manufacturers, distributors, etc. [23]. Environmental issues are seen at every stage of supply chain that starts from getting the raw material and ends with reuse or recycle or disposal [6]. This makes it necessary for service industries, especially the healthcare, to consider the adoption of green supply chain management (GSCM) practices.

Green Supply Chain Management is integrating environment thinking into SCM, including product design, material sourcing and selection, manufacturing process, delivery of the final product to the consumer, and end-of-life management of the product after its useful life [11]. It can be seen as a way for firms to achieve profit and market share objectives by lowering environmental impacts and increasing ecological efficiency [21]. It is the incorporation of environmental management into supply chain management, and it tries to keep wastes contained inside the supply chain system so as to save energy and prevent the discharge of hazardous elements into the environment.

A number of scholars have dived into this concept of GSCM as a key technique for pushing performance forward, yet the story of private hospitals in Nigeria’s Niger Delta hasn’t gotten the same level of attention [13].

**Green Supply Chain Management (GSCM Practices in Healthcare)**

Many researchers considered GSCM practices as strategic capabilities for creating competitive advantage. According to [10], GSCM practices can be considered as strategic capabilities that can be exploited to gain competitive advantage. GSCM practices are key component factors in enhancing the dynamic capability of any organization, including the healthcare industry, to achieve competitive advantage and improved performance [6].

Several prior studies identified and analyzed various sets of GSCM practices which are common for all types of organizations and industries. For the purpose of this study, GSCM practices in healthcare include the following:

1. **Green Purchasing and Procurement:** This involves prioritizing the procurement of environmentally friendly products - medical supplies with lower toxicity, reusable alternatives, energy-efficient equipment, and items with recycled content. According to [5], it is the act of adopting social, economic and environmental factors alongside the typical price and quality considerations into the organizations handling of procurement processes and procedures. Typical sustainable procurement practices include compliance with environmental laws and targets, the removal of hazardous materials and waste in the supply chain.
2. **Green Distribution:** This involves the practice of using recyclable and biodegradable packaging materials; and optimizing transportation routes to minimize fuel consumption while collaborating with logistics providers who are committed to sustainability. It also involves green packaging activities which affect the transport characteristics of the product. According to [7], Integrating eco-friendly practices into logistics activities such as transportation, warehousing, and distribution, aims to minimize their ecological footprint.
3. **Reverse Logistics:** Generally, Reverse Logistics is the process of planning, implementing, and controlling the efficient and cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal [8]. In healthcare, Reverse Logistics (RL) can be viewed from the perspective of proper disposal and recycling of medical waste and device, refurbishing medical equipment, and return of expired pharmaceuticals. According to [4], RL is crucial for managing end-of-life and end-of-use drugs, ensuring public health and environmental safety, and complying with regulatory standards.
4. **Waste Management**: Hospitals generate substantial amounts of waste including hazardous materials, chemicals, medical supplies and others; hence, effective waste management is an important GSCM practice. This involves strategies for proper waste segregation and disposal; reducing waste and the use of disposable medical supplies and adopting reusable medical devices where appropriate. According to [25], healthcare waste management is an essential part of green supply chain practices, ensuring that hazardous and non-hazardous waste is handled in a way that protects human health and the environment. Similarly, [19] NESREA describes medical waste management as such that requires strict adherence to segregation, treatment, and disposal protocols to prevent environmental contamination.

**Operational Performance (OP) and its Relationship to GSCM in Healthcare**

In today's world, businesses tend to operate in the most efficient and productive manner possible to meet the changes in the dynamic economic situations to enhance their operational performance (Al- Quran et al., 2020). According to [9], operational performance (OP) is assessed using many indicators, such as quality, delivery, flexibility, innovation, stock levels, quality of products, line of products, resource utilization, better efficiency, reduced lead times, and enhanced employee satisfaction. In healthcare sector, operational performance measure could be based on the two objectives of costs and the quality of care [27]. Cost efficiency implies getting the best results from healthcare services while utilizing fewer resources (man, money and materials). On the other hand, the quality of care can sometimes be judged from patients’ perspective and sometimes from physicians’ point of view, and it could be described as the degree to which the healthcare services meet the desired or expected health outcomes. Furthermore, healthcare operational performance must balance cost reduction with value-based care, ensuring that efficiency gains do not compromise clinical outcomes [14]. Akgul et al [2]. noted that organizations that want to maintain their competitiveness in the market and achieve greater performance should enhance their OP in terms of price and quality delivery. Based on the extant literature, this study will adopt cost efficiency and the quality of care delivery as the measures for healthcare operational performance in the context of private hospitals in the Niger Delta region, Nigeria.

Figure 2 below represents the findings from empirical study, projecting the relationship between GSCM practices and OP.

**Challenges of Implementing GSCM in Healthcare**

A lack of care about the environment and stakeholders’ concerns can pose a significant challenge in the implementation of GSCM. Organizations need to care about the environment and ensure alignment with their stakeholders’ concerns.

A table with different types of performance

AI-generated content may be incorrect.

**Figure 2.** Relationship Between GSCM Practices and OP

*Source: Research Work*

If the stakeholders see that a company is going against their ethical beliefs, then they would boycott that organization [12]. This is no different with healthcare organizations. Customer might switch to other organizations as they find it harder to adjust in the constantly changing environment.

Another key challenge or barrier to the effective implementation of GSCM in healthcare is the lack of awareness and technical know-how among key players, especially those in decision-making roles and clinical support. In developing nations like Nigeria, particularly in the Niger Delta region, the idea of incorporating green practices into supply chain operations is often either misunderstood. While hospital administrators are basically focused on key clinical care while ensuring adherence to applicable regulations, they often give a low priority to environmental sustainability [18]. And even when the organization is interested in promoting environmental sustainability, the healthcare professionals might not have the requisite technical skills to effectively implement GSCM initiatives, hence, may lead to resistance to change.

Implementing GSCM practices may require some financial investments in new technologies, equipment, and infrastructure. According to Green (2012), he said that there are many organizations out there that need to go green, they want to work in a sustainable manner and work for the environment, but for the financial implications. Implementing Green Supply Chain Initiatives could be quite expensive and critical for the finances of most organization, especially for private hospitals in the Niger Delta region, struggling to stay alive in the market.

Government regulations represent another challenge or barrier to implementing GSCM in healthcare. This usually emerge from ambiguous and poorly enforced environmental regulations, especially when such regulations are not aligned to environmental sustainability goals for the healthcare sector. For instance, regulations or laws may be available for general environmental protection, but they may lack clear guidelines for green procurement, eco-friendly logistics, or medical waste management within healthcare industry. A lack of cohesive government policy and limited regulatory pressure are major inhibitors of GSCM implementation in developing countries [26].

**Methodology**

This study employs a quantitative research methodology using a cross-sectional survey design. This approach is appropriate for examining the relationship between GSCM practices and operational performance [15]. The target population for the study consists of private hospitals operating in Niger Delta region (Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo, and Rivers), Nigeria. With a stratified random sampling technique, forty-five (45) private hospitals were selected randomly based on their size (number of beds), and their location. The study used primary data which was collected through use of structured and unstructured questionnaires with Five-point Likert Scale. Two research assistants were contracted to collect data. The reliability and consistency of the questionnaires for the study was tested using the Cronbach’s Alpha model. The collected data will be analyzed using the Statistical Package for the Social Sciences (SPSS). While the descriptive statistics will be used to analyze the characteristics of the sample and the challenges of implementing GSCM, the multiple regression analysis will be used to evaluate the relationship between GSCM practices and operational performance of private hospitals in the Niger Delta region, Nigeria.

***Model****: Y=β+β1X1+β2X2+β3X3+β4X4 +ε Where,*

Y = Operational Performance of private hospitals

X1 = Green Purchasing and Procurement

X2= Green Distribution

X3 = Reverse Logistics

X4 = Waste Manager

**Data Analysis Result**

The study was aimed to collect data or information from 250 respondents (SC Managers, Hospital Administrators, Finance Manager, and Medical Personnel) from 61 private hospitals in the Niger Delta region of Nigeria. However, the study collected information from 198 key respondents from 45 private hospitals within the region, and this represents a response rate of 74% and 79% respectively. According to [15], a response rate of more than 70% is good to conduct data analysis. The first section of the questionnaire collated information regarding the respondents’ demographic data and data related with their work.

***Table 1*** Shows the results of the data collected in the first section. The results of demographic data indicate that 49% of the private hospitals had a bed capacity of less than 50; 31% had 50-100 beds while 20% had above 100 beds. This implied that 51% of the private hospitals had above 50 bed capacity. The private hospitals were randomly selected from the nine (Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo, and Rivers) states within the Niger Delta region. Respondents were drawn from various healthcare supply chain partners, majority of which were medical personnel (made up of Doctors and Nurses (52%)) and the supply chain managers (20%). Respondents were asked about the years of experience with their current employer, and it was found that 33% were with 6-10 years of experience while majority (47%) were above 10-years of experience.

**Reliability Test Result**

The reliability of the questionnaires for the study was tested using the Cronbach’s Alpha model. The scale overall is reliable and acceptable at **0.79.** The model shows each variables’ contribution to the overall internal consistency as follows: Green Purchasing and Procurement (GP) = **0.71**; Green Packaging/Distribution (GD) = **0.76**; Reverse Logistics (RL) = **0.69**; Waste Management (WM) = **0.82**); and Operational Performance = **0.77**. The overall internal consistency of the scale could be improved if WM is removed.

**Table 1.** Descriptive Statistics on Demographic Data

|  |  |  |
| --- | --- | --- |
| **DEMOGRAPHIC DATA** | | |
| **VARIABLES** | **FREQUENCY** | |
| **Bed size** | **No. Hospitals** | **%** |
| < 50 Beds | 22 | **49%** |
| 50 - 100 Beds | 14 | **31%** |
| 101 and above | 9 | **20%** |
| **States (Niger Delta Region)** | |  |
| Abia | 5 | **11%** |
| Akwa Ibom | 6 | **13%** |
| Delta | 6 | **13%** |
| Bayelsa | 3 | **7%** |
| Imo | 5 | **11%** |
| Rivers | 6 | **13%** |
| Ondo | 5 | **11%** |
| Cross River | 4 | **9%** |
| Edo | 5 | **11%** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
| **Participants' Current Position** | **Frequency (By Experience)** | | | | **%** |
| **1-5 YRs** | **6-10 YRs** | **> 10 YRs** | **Total** |
| Hospital Admin | 7 | 5 | 10 | 22 | **11%** |
| Medical Personnel (Doctor/Nurse) | 15 | 37 | 51 | 103 | **52%** |
| SC. Manager | 10 | 14 | 15 | 39 | **20%** |
| Finance Manager | 5 | 6 | 7 | 18 | **9%** |
| CEO | 1 | 4 | 11 | 16 | **8%** |
| **Total** | **38** | **66** | **94** | **198** |  |
| **%** | **19%** | **33%** | **47%** |  | **100%** |

*Source: Field Work – Data Gathering*

**Descriptive Analysis Findings**

Descriptive statistics was used to test the first and second objectives of the study which are to examine the current GSCM practice in the selected private hospitals and the barriers or challenges in implementing GSCM practices.

***Table 2*** shows four dimensions of GSCM practices namely Green Purchasing, Green Packaging & Distribution, Reverse Logistics, and Waste Management, using a likert scale 1-5 where **1** = No Extent; **2** = Small extent; **3** = Moderate Extent; **4** = Large Extent; **5** = Very Large Extent. The decision-making threshold was established as the weighted average mean of **2.19** **(17.51/8).** variables with ≥ 2.19 are considered highly practiced while those with ≤ 2.19 are not well practiced, hence, require improvement.

The above data analysis shows that private hospitals within the Niger Delta region moderately adopt eco-certified purchasing/procurement at x̄=2.18, meanwhile the selection of vendors process in compliance with sustainability standards is very weak (x̄=2.05) and would require significant improvement. They greatly adopt the practice of re-using or recycling packages (x̄=2.26) but poorly optimize transport routes for more fuel efficiency (x̄=2.06). With the average mean of x̄=1.72, the above data analysis suggests that reverse logistics is poorly practiced. While there is a high return rates for expired drugs, such may be inappropriately disposed, hereby posing some risks. The practice of recycling or recovering used devices is rare, leading to waste of resources and lost opportunities for reuse. Lastly, the analysis shows waste management is highly practiced (x̄=2.72, and x̄=2.81) by the private hospitals within the region. There is a commendable level of awareness and enforcement of basic hospital waste protocols/procedures, and of infectious waste treatment using autoclaves or incinerators, suggesting compliance with eco-disposal standards.

**Table 2.** Green Supply Chain Management Practices in selected private hospitals

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SN** | **GREEN SUPPLY CHAIN MANAGEMENT PRACTICE** | **NE 1 (%)** | **SE 2 (%)** | **ME 3 (%)** | **LE 4 (%)** | **VLE 5 (%)** | **Mean** | **SD** | **Decision** |
| 1 | **Green Purchasing/Procurement** | | | | | | | | |
| Procuring medical supplies with eco-certifications (e.g., biodegradable syringes, etc.) | 38 | 109 | 31 | 18 | 2 | 2.18 | 0.88 | Low Practiced |
| 19.2% | 55.1% | 15.7% | 9.1% | 1.0% |
| Selecting vendors who comply with environmental and sustainability standards | 62 | 80 | 40 | 16 | 0 | 2.05 | 0.92 | Low Practiced |
| 31.3% | 40.4% | 20.2% | 8.1% | 0.0% |
| 2 | **Green Packaging/Distribution** | | | | | | | | |
| Using reusable or recyclable packaging materials for medical and non-medical supplies | 62 | 40 | 80 | 14 | 2 | 2.26 | 1.01 | Highly Practiced |
| 31.3% | 20.2% | 40.4% | 7.1% | 1.0% |
| Optimizing delivery routes to reduce fuel consumption and carbon emissions | 48 | 111 | 23 | 12 | 4 | 2.06 | 0.89 | Low Practiced |
| 24.2% | 56.1% | 11.6% | 6.1% | 2.0% |
| 3 | **Reverse Logistics** | | | | | | | | |
| Returning expired or unused pharmaceuticals to suppliers for proper disposal or repurposing | 104 | 52 | 36 | 2 | 4 | 1.74 | 0.93 | Low Practiced |
| 52.5% | 26.3% | 18.2% | 1.0% | 2.0% |
| Collecting used medical devices (e.g., infusion pumps) for refurbishment or recycling | 104 | 62 | 22 | 10 | 0 | 1.69 | 0.86 | Low Practiced |
| 52.5% | 31.3% | 11.1% | 5.1% | 0.0% |
| 4 | **Waste Management** | | | | | | | | |
| Segregating waste at source into hazardous, recyclable, and biodegradable streams | 20 | 70 | 70 | 22 | 16 | 2.72 | 1.05 | Highly Practiced |
| 10.1% | 35.4% | 35.4% | 11.1% | 8.1% |
| Treating infectious waste using autoclaving or incineration before eco-compliant disposal | 20 | 82 | 36 | 35 | 25 | 2.81 | 1.21 | Highly Practiced |
| 10.1% | 41.4% | 18.2% | 17.7% | 12.6% |

*Source: Field Work – Interviews and Observations*

***Table 3*** shows the key barriers, among others, faced by the selected private hospitals in implementing GSCM. The analysis reveals that limited awareness and expertise (28%) is a major barrier. There is a lack of knowledge about sustainable sourcing, green logistics and environmental management. The second top barrier is the huge financial implications (25%), followed by weak enforcement of regulatory requirements (24%) and insufficient green suppliers (23%).

**Table 3.** Challenges and Opportunities - SC practices

|  |  |  |
| --- | --- | --- |
| **Barriers** | | |
| **Description** | **Frequency** | **%** |
| High Financial Cost | 50 | 25% |
| Limited Awareness and Expertise | 55 | 28% |
| Weak Regulatory Enforcement | 48 | 24% |
| Lack of Green Suppliers (stakeholders) | 45 | 23% |
| Total | 198 |  |

*Source: Field Work – Interview and Engagement*

**Regression Analysis Findings**

Four dimensions of GSCM practices such as Green Purchasing and Procurement (GP), Green Packaging and Distribution (GD), Reverse Logistics (RL), and Waste Management (WM) are considered as the independent variables, while Operational performance as the dependent variable. The regression coefficient shows the precision and measures the ability of the model to explain the variation in the dependent variable. A Pearson correlation coefficients analysis was also carried out to provide more insight into the relationship among the independent variables.

The regression analysis model was at 95% coefficient intervals. The result, as shown on ***Table 4,*** of F-change and the P-value, F (4, 193) = 27.370; and < .001, indicates that the model demonstrates good fit and it is statistically significant. The adjusted R2 = 0.349 shows that 34.9% of the variation in private hospital operational performance is explained by the independent variables (GP, GD, RL and WM), hence, the model is good. The standard error (std. Error) of 0.581 indicates a moderate level of precision in the model.

**Table 4.** Regression Analysis (Model Summary)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | | | | | | |
| **Model** | **R** | **R2** | **Adjusted R2** | **Std. Error of Estimate** | **Change Statistics** | | | | | **Durbin-Watson** |
| **R2 Change** | **F Change** | **df1** | **df2** | **Sig.** |
| 1 | .602a | 0.362 | 0.349 | 0.581 | 0.362 | 27.370 | 4 | 193 | 0.000 | 2.038 |
| a. Predictors: (Constant), WManagement, GDistribution, GPurchasing, RLogistics | | | | | | | | | | |
| b. Dependent Variable: OPerformance | | | | | | | | | | |

*Source: Field Work – Data Analysis*

**Table 5.** Regression Analysis (ANOVA)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
| 1 | Regression | 36.918 | 4 | 9.230 | 27.370 | .000b |
| Residual | 65.082 | 193 | 0.337 |  |  |
| Total | 102.000 | 197 |  |  |  |
| a. Dependent Variable: OPerformance | | | | | | |
| b. Predictors: (Constant), WManagement, GDistribution, GPurchasing, RLogistics | | | | | | |

*Source: Field Work – Data Analysis*

The model achieves a statistical significance at < 0.001 which indicates that the GSCM practices as a whole have a significant effect on operational performance, specifically in terms of cost efficiency and quality of care at 95% confidence level. The Durbin-Watson test of 2.038 indicates there is no autocorrelation, ensuring the independence of observations or errors in the model.

The One-way ANOVA test results - Table 5, further confirm the model’s significance. It reveals a statistically meaningful relationship between the GSCM practices and the private hospitals operational performance, with a p-value of 0.000.

Table 6 (Pearson correlations) below shows that the predictors themselves Green Purchasing (GP), Green Distribution (GD), Reverse Logistic (RL) and Waste Management (WM) are positively and significantly intercorrelated, implying their ability to influence each other in achieving improved operational performance. The results show that Operational Performance has positive and statistically significant correlations with Reverse Logistics (*r = 0. 508, p 0. 01*), Green Distribution (*r = 0. 423, p 0. 01*), Green Purchasing (*r = 0. 351, p 0. 01*) and Warehouse Management (*r = 0. 304, p 0. 01*). This suggests improvement in the GSCM practices will enhance private hospitals Operational Performance.

**Table 6.** Pearson Correlation Analysis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variables** | **OP** | **GP** | **GD** | **RL** | **WM** |
| Operational Perf. (OP) | 1.000 | 0.351 | 0.423 | 0.508 | 0.304 |
| Green Purchasing (GP) | 0.351 | 1.000 | 0.488 | 0.883 | 0.269 |
| Green Distribution (GD | 0.423 | 0.488 | 1.000 | 0.553 | 0.216 |
| Reverse Logistics (RL) | 0.508 | 0.883 | 0.553 | 1.000 | 0.262 |
| Waste Management | 0.304 | 0.269 | 0.216 | 0.262 | 1.000 |

*Source: Field Work – Data Analysis*

**Discussion**

In the Niger Delta, some private hospitals are showing unexpectedly better operations after adopting greener supply practices. Recent analysis reveals that hospitals embracing what we call Green Supply Chain Management tend to run smoother, with improved patient experience and overall efficiency. Until now, there was no much evidence linking these eco-friendly practices directly to day-to-day operational benefits. Thus, this study dives into both hard numbers and firsthand feedback to fill that void. The investigation set out with a rather simple aim: figure out what green strategies these hospitals are adopting, check how these methods affect operational performance in terms of cost efficiency and quality of care, and then look into thepractical challenges that come with implementing GSCM, hereby, pushing for sustainability.

The demographic data results (on Table 1 above) indicating 49% of the private hospitals with < 50 beds capacity, 31% for 50-100 beds and 20% had more than 100 beds, implied that most private hospitals in the region of investigation are medium and large-sized facilities. Although it represents a snapshot of private hospitals in the region. The data reflects the view of key stakeholders in healthcare supply chain management, with high level of experience, which suggest that the data is informed by professionals who quite understands the healthcare system.

Our descriptive findings also show that while majority of the private hospitals moderately practice waste management and proper packing of medical supplies, they have not adequately considered the procurement of medical supplies with eco-certifications (e.g., biodegradable syringes, etc) or the selecting of vendors with sustainability standards. They are yet to leverage on reverse logistics strategies for improved performance, and there is limited expertise in optimizing delivery routes to reduce fuel consumption and carbon emission. In line with the findings, there is limited awareness and expertise on sustainable sourcing and distribution, green or reverse logistics, and waste management. This is a major barrier in implementing GSC.

In addition, the financial involvement or implication; weak regulatory enforcement and insufficient green suppliers are other key challenges faced by private hospitals in adopting green supply chain practices. The nature of the relationship between green supply chain management practices and the operational performance of private hospitals was tested using the Multiple Linear Regression test. This was guided by the research question.

**Table 7.** Coefficient Analysis

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | | | | | |
| **Model** | | **Unstandardized Coefficients** | | **Standardized Coefficients** | **t-value** | **Sig.** | **95.0% Confidence Interval for B** | | **Collinearity Statistics** | |
| **B** | **Std. Error** | **Beta** | **Lower B** | **Upper B** | **Tolerance** | **VIF** |
| 1 | (Constant) | 2.162 | 0.330 |  | 6.542 | 0.000 | 1.510 | 2.814 |  |  |
| GPurchasing | -0.465 | 0.121 | -0.471 | -3.836 | 0.000 | -0.704 | -0.226 | 0.219 | 4.564 |
| GDistribution | 0.170 | 0.064 | 0.186 | 2.678 | 0.008 | 0.045 | 0.296 | 0.689 | 1.452 |
| RLogistics | 0.624 | 0.104 | 0.772 | 6.015 | 0.000 | 0.420 | 0.829 | 0.201 | 4.977 |
| WManagement | 0.201 | 0.064 | 0.188 | 3.139 | 0.002 | 0.075 | 0.328 | 0.918 | 1.090 |
| a. Dependent Variable: Operational Performance | | | | | | | | | | |

*Source: Field Work – Data Analysis*

***RQ1:*** Is there a relationship between green procurement (or purchasing) practice and the operational performance of private hospitals?

The moderate positive relationship between green purchasing and operational performance, ***(r = 0.351),*** as shown by Pearson’s correlation analysis, indicates that higher adoption of green procurement, independently, will yield to higher operational performance. However, with a deeper analysis, using the multiple regression, as shown in Table 7 (*Coefficient Analysis*), which included other GSCM practices (Green Distribution, Reverse Logistics, and Waste Management), the result shows a statistically significant negative relationship between green purchasing and operational performance ***(β=-0.471, p<0.001),*** suggesting that when all these practices were taken into account, increasing green purchasing actually lowered performance. In other words, for every unit increase in green purchasing, performance dropped by ***0.465*** units, based on the unstandardized coefficient. The negative results from the regression may reflect the specific challenge of lack of green-certified suppliers, or higher costs associated with purchasing eco-friendly products, faced in the Niger Delta region. Understanding this local obstacle is important for making sense of the decrease in performance despite good intentions for green procurement. Further research would be needed to unravel the complexities of this relationship and determine the underlying factors.

***RQ2:*** How does reverse logistics practice affect the overall operational performance of private hospitals in the Niger Delta region of Nigeria?

The Pearson correlation coefficient, r = 0.508, indicates there is a strong positive relationship between reverse logistics (RL) and operational performance, meaning that if private hospitals improve their reverse logistics activities (return of medical equipment, recycling of disposable items, and recalling expired drugs, etc.), their operational performance, especially in terms of cost efficiency and quality care delivery, is expected to improve. This is supported by the multiple regression model, as shown in Table 7 (*Coefficient Analysis*), which shows that RL significantly and positively affects overall operational performance with a standardized beta coefficient ***(β) of 0.772*** and a p-value of ***less than 0.001***. Among other variables, RL stands out as the most impactful predictor. Hence, an effective reverse logistics practice not only helps in reducing environmental risks and also improves operational efficiency and service quality. With a well-organized reverse logistics, private hospitals in the Niger Delta region are likely to achieve better results in performance, showing more cost efficiency and quality care delivery.

***RQ3:*** To what extend does waste management affects quality of care and cost efficiency in private hospitals in the Niger Delta region?

The Pearson correlation coefficient, r = 0.304, indicates there is a moderate positive link between waste management (WM) and operational performance, suggesting that with a proper medical waste management (segregating, treating, recycling and disposal) care delivery and cost efficiency would generally improve. The multiple regression analysis results, as shown in Table 7 (*Coefficient Analysis*), shows a statistically significant and positive relationship between waste management (WM) and operational performance of private hospitals ***(β = 0.188, p = 0.002).*** It can be deduced from the analysis that Waste Management plays a key role in boosting private hospitals operational performance. Good and proper waste management system lowers the chances of regulatory charges, cuts down infection risks, improve patient safety, and reduces environmental harm, which all enhances the quality of care and cost efficiency. Summarily, improving hospital wastes handling can result in notable gains in service or care delivery and cost control for private hospitals in the Niger Delta region.

***RQ4:*** How does green distribution practice contribute to the overall operational performance of private hospitals?

The moderate positive relationship between green distribution and operational performance, ***(r = 0.423),*** as shown by Pearson’s correlation analysis, suggests that when private hospitals use better eco-friendly distribution methods (smarter route planning, fuel efficient transport, and sustainable delivery systems), they generally experience better operational performance. The result of the multiple linear regression analysis, as shown in Table 7 (*Coefficient Analysis*), reveals there is statistically significant positive relationship between green distribution and operational performance at a standardized beta coefficient ***(β) of 0.186*** and a p-value of ***0.008***, meaning that green distribution has a clear positive effect on operational performance. If green distribution practice increases by one-unit, operational performance is likely to rise of 0.170 ***(B).*** This means that green distribution plays a noticeable role in enhancing operational performance in private hospitals. Incorporating environmentally friendly practices (better delivery scheduling, reducing carbon footprints, cold chain management, etc.) attributes to positive outcomes such as improved inventory turnover, faster deliveries and reduced operational costs. This is supported by earlier study from [3] who noted green distribution as key to sustainable healthcare logistics and high performance.

**Conclusion**

The study makes clear just how tightly GSCM practices are woven into the everyday operations of private hospitals in Nigeria’s Niger Delta region. The work dug deep to see if these eco-friendly measures help hospitals run more efficiently and to identify ways for providers to blend sustainability with better service. The findings of the study revealed strong connections between GSCM practices and improved performance. Waste Management (WM) has a significant and positive impact, indicating that proper segregating, treating, recycling and disposal of medical wastes can enhance quality of care and cost efficiency in private hospitals. The study shows that reverse logistics (RL) is the most influential variable, suggesting its crucial role in reducing environmental risks, operational cost and improving service quality. Hence, if effectively adopted, reverse logistics largely affects the overall operational performance of private hospitals. According to the study, green distribution significantly and positively contributes to improved operational performance, in terms of cost efficiency and quality care delivery in private hospitals. However, the study shows that Green Procurement (or purchasing) has a statistically significant negative relationship with hospitals operational performance. While GP, on its own, positively correlates with hospitals operational performance, it has a no direct influence on operational performance when combined with other variables or practices (Green Distribution, Reverse Logistics, and Waste Management). And this may reflect the challenge of lack of green-certified suppliers and/or higher costs associated with purchasing eco-friendly products faced by private hospitals in the Niger Delta region. Hence, there is need for further research or study to determine the underlying factors.

The study also identified challenges such as limited awareness and expertise, and huge financial implications as major barriers to effective implementation of GSCM. Hence, a closer look or study at the everyday hurdles private hospitals face when trying to implement GSCM would be valuable.

**Recommendation**

Green Supply Chain Management (GSCM) is grabbing more interest every day—especially in healthcare, where going green and keeping costs down really matter. In private hospitals around the Niger Delta, our recent work shows that when hospitals roll out these GSCM strategies, things like waste handling, resource use, and overall service tend to improve. The study shows that going green isn’t just about squeezing more from available resources; it also holds the promise of boosting patient care and cost efficiency. First, private hospitals should invest in reverse logistics, which involves setting up systems for taking back, recycling, and safely disposing of old medical items. Second, the study recommended private hospitals to consider better waste management policies and infrastructure. Investing in proper disposal technology (e.g. incinerator, autoclave, etc.), implementing waste segregation, treatment and environmental regulations will enhance care quality and reduce costs. Third, the study recommended private hospitals to improve on green distribution practices by planning delivery routes better, using low-emission transport system, and coordinating logistics more effectively. This will make supply chain more efficient and reduce environmental harm. Although, the multiple regression analysis model shows that green procurement has a negative effect on operational performance, when combined with other practices, the study recommends private hospitals to reassess their purchasing strategies, performing better cost-benefit analysis and group purchasing from green-certified suppliers to lower procurement risks and costs.

Additionally, for GSCM practice to be successful, the study recommends private hospitals to staff training and awareness campaigns. Developing knowledge and capacity in sustainable practices will raise adoption and long-term results. Finally, private hospitals should actively work with policymakers, donors and regulatory agencies to access funding, align with environmental policies and gain support for their sustainability initiatives. On the other hand, policymakers are advised to fix the hurdles slowing down wider GSCM adoption in the Niger Delta region where unique environmental challenges call for local fixes tailored to the area’s specific needs.

**Conflict of Interest**

There is no conflict of interest regarding the publication of this research work. All the data were collected objectively to ensure the credibility of the research.

**Acknowledgement**

I would like to thank my local guide, Dr. Martin Otuedon. for his guidance through the entire process.

I would also like to thank my student mentor at Texila American University for the much-needed support. My sincere thanks go to the private hospitals in the Niger Delta Region for their participation.

In addition. I would like to thank my wife, Grace Prince for her unwavering support, love and understanding through every stage of this research work. Finally, I appreciate the encouragement from friends and colleagues, and I acknowledge the scholars whose work contributed to this study.

**References**

1. Adeniran, A. E., Ojo, O. O., & Yusuf, Y. Y., 2024, Green supply chain management in Nigerian healthcare: Drivers and barriers. Sustainability, 16(3), 1125.
2. Akgul, A. K., Gozlu, S., & Tatoglu, E., 2015, Linking operations strategy, environmental dynamism and firm performance: Evidence from Turkish manufacturing companies. Kybernetes, 44(3), 406–422.
3. Azevedo, S., Carvalho, H., & Cruz Machado, V., 2011, The influence of green practices on supply chain performance: A case study. Transportation Research Part E: Logistics and Transportation Review, 47(6), 850–871.
4. Campos, E. A. R. D., Paula, I. C. D., Pagani, R. N., & Guarnieri, P., 2017, Reverse logistics for the end-of-life and end-of-use products in the pharmaceutical industry: a systematic literature review. *Supply Chain Management: An International Journal*, 22(4), 375-392.

Chartered Institute of Procurement & Supply (CIPS)., 2022, *Sustainability*. <https://www.cips.org/knowledge/procurement-topics-and-skills/sustainability/> (Accessed January 30, 2023)

1. Dubey, R., Gunasekaran, A., & Papadopoulos, T., 2017, Green supply chain management: Theoretical framework and further research directions. Benchmarking: An International Journal, 24(1), 184–218.
2. Garg, A., & Vemaraju, S., 2025, Green Logistics Management Effect on Sustainable Logistics Performance. *Journal of Environmental & Earth Sciences* Volume, 7(02).
3. Govindan, K., Soleimani, H., & Kannan, D., 2015, Reverse logistics and closed-loop supply chain: A comprehensive review to explore the future. *European journal of operational research*, 240(3), 603-626.
4. Green, K. W., Jr., Zelbst, P. J., Meacham, J., & Bhadauria, V. S., 2012, Green supply chain management practices: Impact on performance. Supply Chain Management: An International Journal, 17(3), 290–305.
5. Guang Shi, V., Koh, S. C. L., Baldwin, J., & Cucchiella, F., 2012, Natural resource-based green supply chain management. Supply Chain Management: An International Journal, 17(1), 54–67. <https://doi.org/10.1108/13598541211212203>
6. Habidin, N. F., Zubir, A. F. M., Conding, J., Jaya, N. A. S. L., & Hashim, S., 2013, Sustainable manufacturing practices, sustaining lean improvement and sustainable performance in Malaysian automotive industry. World Review of Entrepreneurship, Management and Sustainable Development, 9(4), 444–459.
7. Jacobs, F. R., Chase, R. B., & Lummus, R. R., 2011, Operations and supply chain management (Vol. 567). *McGraw-Hill Irwin*.
8. Wiredu, J., 2024, Exploring sustainable supply chain management practice and environmental performance: A systematic review perspective. Deleted Journal. <https://doi.org/10.37256/ujcr.2120244083>
9. Kaplan, R. S., & Porter, M. E., 2011, How to solve the cost crisis in health care. Harvard Business Review, 89(9), 46–52.
10. Kothari, C. R., & Garg, G., 2014, Research methodology: Methods and techniques *(3rd ed.).* *New Age International Publishers*.
11. Laari, S., Töyli, J., & Ojala, L., 2017, Supply chain perspective on competitive strategies and green supply chain management strategies. Journal of Cleaner Production, 141, 1303–1315.
12. Mitra, S., & Datta, P. P., 2014, Adoption of green supply chain management practices and their impact on performance: An exploratory study of Indian manufacturing firms. International Journal of Production Research, 52(7), 2085–2107.
13. Mousa, S. K., & Othman, M., 2020, The impact of green human resource management practices on sustainable performance in healthcare organizations: A conceptual framework. *Journal of cleaner production*, 243, 118595.
14. National Environmental Standards and Regulations Enforcement Agency (NESREA)., 2022, Guidelines for the management of healthcare waste in Nigeria. Abuja: Federal Ministry of Environment.
15. Olaifa, A., Okareh, O. T., & Coker, A. O., 2023, Medical waste management practices in Nigeria: A case study of the Niger Delta region. Journal of Environmental Health Science and Engineering, 21(1), 45–58.
16. Parmigiani, A., Klassen, R. D., & Russo, M. V., 2011, Efficiency meets accountability: Performance implications of supply chain configuration, control, and capabilities. Journal of Operations Management, 29*(3),* 212–223.
17. Santoso, R. W., Siagian, H., Tarigan, Z. J. H., & Jie, F., 2022, Assessing the benefit of adopting ERP technology and practicing green supply chain management toward operational performance: An evidence from Indonesia. *Sustainability*, 14(9), 4944.
18. Shou, Y., 2013, Perspectives on supply chain management in the healthcare industry. 2nd International Conference on Science and Social Research (ICSSR 2013), 1–4.
19. World Health Organization (WHO)., 2022, Global analysis of healthcare waste in the context of COVID-19: Status, impacts, and recommendations. *Geneva: WHO Press*.
20. World Health Organization (WHO)., 2023, Safe management of wastes from healthcare activities(2nd ed.). *Geneva: World Health Organization*.
21. Zhu, Q., & Geng, Y., 2013, Drivers and barriers of extended supply chain practices for energy saving and emission reduction among Chinese manufacturers. Journal of Cleaner Production, 40, 6–12.
22. Mayer, A., 2013, Supply chain metrics that matter: A focus on hospitals. Supply Chain Insights LLC.