

Inventory Management Sustainability: A Case of Carbon Emanation Reduction in Selected Ceramics Manufacturing Firms in Lagos State, Nigeria

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ABSTRACT

Inventory optimality is an option of energy utilization proportionality that can lessen carbon emanations and maximize profitability. This study proposes an inventory management model in which the stock volume is optimally decided to diminish energy per resource utilized in-order to reduce carbon emanations. This will likewise help in concluding renewal volume optimally. Consequently, the study utilized economic order quantity (EOQ) to decide inventory volumes in-order to decrease carbon emanations so as to augment profits of the inventory chain. Partial least square(PLS) was additionally utilized to examine the extent of inventory management frameworks on environmental sustainability. The study, therefore, shows its oddity and pertinency by utilizing economic order quantity (EOQ) and partial least square (PLS) to examine and optimize inventory respectively, as it gives a perspective of decreasing carbon emanations during inventory procedures.

KEYWORDS

Carbon Emanations, Ceramics Manufacturing Firms, Inventory Volumes, Optimality, Profitability, Sustainability

1. INTRODUCTION

The manufacturing industry has thrived in numerous nations, bringing about carbon emanation. Fossil fuel utilization from the cycle of inventory management, production chain, and transportation are the essential sources of green house emanation. Furthermore, processing plants are one of the fundamental sources of carbon that causes ecological damages. This obliteration of the environment will ultimately undermine human well-being and in this way, the manufacturing business should consider eco-friendly production cycles that will lead to environmental sustainability (Mishra, Wu, & Sarkar, 2021). Despite the fact that fossil fuel by-product have increased development, there ought to be ecological policies. However, If the focus is on economic performance only disregarding the ecological effect of inventory storage, it might worsen the situation. Consequently, this peculiarity is a critical source of worry since it undermines societal needs like the quality of air, aqua quality, public

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habitat, and human well-being causing abbreviated life span and health outcomes such as diseases. Moreover, it is turning out to be progressively apparent that carbon emanation brings about critical biodiversity misfortune (Mohapatra, Singhal, & Tripathy, 2021; Meghana, & Pravudatta, 2021).

Confronted with pressures from state-run managers, clients, and various stakeholders, ceramic manufacturing firms in Lagos, Nigeria should make a move to lessen the ecological and social effects of their operations that will adapt to the expanding environmental needs. Furthermore, ceramic manufacturing firms in Lagos State could take on various intra-hierarchical sustainable operations to decrease their ecological effects, for example, utilizing sustainable power sources, and eco-friendly production procedures. To diminish gas emanations, manufacturing firms could also incorporate sustainability into inventory process and set up ecological standards (Pritee, 2021). According to Pattnaik, Nayak, Abbate, and Centobelli (2021), the utilization of environmental management framework (ISO 14001) could improve organizations' environmental outcome by diminishing the waste within the production framework. Other supporting inter-hierarchical practices stringently associated with the production processes, such as inventory management, and energy approach, essentially impact emanations produced by inventory frameworks. In extant literatures little consideration was given to sustainability such as the release of carbon during the process of inventory chain and storage. Given this, inventory is a fundamental echelon within the production chain from the point of production to the point of demand, which makes it a focal point of an organization's resources (Zhang, Huang, & Yuan, 2021; Anilkumar, & Sridharan, 2019). Regardless of the size of the venture or the kind of industry, inventory management is necessary to address the issues of the market and clients. Furthermore, manufacturing firms generally hold stock for two reasons: the principal reason is to diminish the discontinuity between the production and conveying frameworks with the goal that the system and appropriation co-ordinations will not interference with the operations (Pan, Chiu, Wu, Yen, & Wang, 2020). The subsequent reason is to address the issues of clients, and forestall unavailable circumstances. Sadly, ceramics manufacturing firms tend to hold inventories bring about specific costs, such as storage cost, protection cost, and value depreciation. Exorbitant inventories prompts a build-up of resources. On the account of the development of globalisation and different client requests, the cycle of products have been shortened (Tarurhor, & Osazebura, 2021). Therefore, excessive inventories can lead to obsolescence of items over a period (Atnafu, Baldu, & Liu, 2018). From the stand point of business activities, profitability can be optimized from the sale of inventories.

If this is not feasible the income within the organisation will reduce, and lessen the transient liquidity within the system (Adedugba, Ogunnaike, Adeyemo, & Kehinde, 2021). Subsequently, appropriate inventory management framework optimizes resources and storage. According to Akinlabi (2017), inventory optimality can be attained if the following inventory management practices, such as inventory shrinkage, inventory venture, inventory control, inventory turnover, and inventory record exactness are optimised. Consequently, the utilization of a proficient inventory framework can improve responsiveness and service delivery. Additionally, the optimization of the inventory storage framework should be accomplished to improve the functional effectiveness and rapid response to client requests (Becerra, Mula, & Sanchis, 2021; Anumala, 2021). This will lead to diminished inventory cost and maximise profits. Thus, with the development of the inventory network framework, the most urgent issues include an optimal integration of the inventory echelons, formulation of production models, and requesting techniques for accomplices in the production network, and reduction of the holding costs.

The paradigm of inventory model such as economic order quantity is essentially centred around the amount to order and when to put in a request without linking the storage to ecological variables (Lakshmi, Subbaiah, Vikram, Suresh, & Prasad, 2021). In addition to economic vacillations ceramic manufacturing firms faces ecological bottlenecks, making it a source of concern. Increasing interest has been displayed in developing philosophies that aids decisions towards sustainability. This is twisted given the distinctive aspect of social, environmental, and financial viewpoints (Galli, 2020). To confront these issues, customary inventory models should link holding costs and storage to environmental sustainability. In light of this study, the main presumption is that inventory employee

participants consented to jointly decrease carbon emanations utilizing eco-friendly procedures. This study further explored inventory management bottlenecks that impact ecological sustainability via carbon emanations. The primary novelty of the research is stated below:

- (1) this paper examined inventory and optimal renewal decisions,
- (2) the paradigm of optimal inventory in carbon emanation decrease within the inventory capacity was utilized in the proposed model, and
- (3) the philosophy of an optimal volume was verified utilizing a mathematical model via economic order quantity (EOQ).

The aim of this study was to decide an optimal inventory, and renewal period in other to decrease carbon emanations, consequently meeting the goal of optimizing profit and environmental sustainability. Besides, the study presented a sustainable inventory storage to meet the inescapable pattern of carbon emanation.

2. LITERATURE REVIEW

2.1 Inventory Management

The review is segmented into inventory shrinkage, inventory investment, inventory control, inventory turnover, inventory record exactness, and inventory management sustainability.

2.1.1. Inventory Shrinkage

It implies the measure of stock that exists in account records yet not existing in reality and it is the disparity between the physical goods on the ground and records (Akinlabi, 2017). It is depicted as a shortfall when the determined stock in an organization's records is above the valuation from the physical evaluation. Muchaendepi, Mbohwa, Hamandishe, and Kanyepe (2019) elucidated that inventory shrinkage alludes to the misfortune or the decrease in the stock that a retailer or market administrators face in the interim between the period of production or buying to retail locations. Kumar, Nigam, and Rakesh (2019) elucidated that inventory shrinkage alludes to the misfortune or the decrease in the stock that a retailer or market administrators face in the interim between the period of production or buying to retail locations. The sources of stock shrinkage are profoundly established in the financial hardships that society faces, poor compensation, and the culture of dishonest practices in most ventures.

2.1.2. Inventory Turnover

Islam, Pulugan, and Rochim (2020) attested that inventory turnover is a proportion demonstrating how frequently an organization's stock is sold and supplanted over a period which additionally shows the proficiency of the firm in creating and selling its goods. Generally, higher stock turnover is better as it shows that more deals are being sealed given a specific measure of stock. Inventory turnover appropriation is a vital measure for evaluating precisely how efficient coordination is important at supervising production inventory and making bargains from it. Khan, Deng, and Khan (2016) described the concept of inventory turnover as a period of how often the inventories are turned over, sold, and recreated over a time frame. In retail organizations, it is the general proportion of the price tag, for example, the cost of merchandise offered to the normal measure of inventories for one year. Inventory turnover is commonly known to be a compelling pointer of operational efficiency (Wan, Britto & Zhou, 2020).

2.1.3. Inventory Record Exactness

Shabani, Maroti, Leeuw, and Dullaert (2021) expressed inventory record exactness as a proportion of how intently stock records match with the available stock. The units of estimation within inventory frameworks have various purposes and may provide different outcomes such as cost-based estimations while, the operations manager is unequivocally inspired by the exactness of stock-keeping unit (SKU). Avrahami and Shteren (2016) stated that any organization where the running stock of crude materials and items is sustained conducts an inventory audit. Inventory record accuracy is the proportion of how intently stock records match with the available stock (Amir, Gabor, Sander, & Wout, 2021). However, the units of estimation for exactness are either:

- i. Cost-based or ;
- ii. Tally based

Shteren and Avrahami (2017) stated that any organisation where the running stock of raw materials and items is sustained is called inventory audit. Although in present day organisations inventories are overseen via information technology frameworks. Herein an accurate data about the quantity of inventory is obtained. This typically implies that an organisation's workers (for the most part, directed by a bookkeeper) physically checks the inventory. The estimation of the inconsistency between the projected inventory and the available to be purchased ought not to be excessive

2.1.4. Inventory Investment

Tan and Auci (2020) explicated that surplus inventory investments can withhold capital that might be useful if invested in another aspect of the organization. The non-availability can prompt stock deficiencies and the inability to fulfil the client's request. The procedures and controls of efficient inventory management are the fundamentals for business growth therefore, inventory management includes significant choices about what to purchase, the amount to purchase or deliver, and when to purchase or manufacture amidst scarce resources. Wangri and Kagiri (2015) stated that the specific objective of inventory management practices is the minimization of inventory investments and the maximization of customer service that is associated with costs.

2.1.5. Inventory Control

It is the inventory of products and ventures that spots the optimum amount however, it is a management action focusing on deciding prerequisites, determining, defining objectives, giving requests and vital directions in a reliable way in-order to run the organisation's tasks (Mbohwa & Ndlala, 2017). Arunkumar and Nishad (2018) posited that economic order quantity is an important and insightful instrument engaged to moderate inventories. It can be utilized for complete merchandise inventories, work-in-process stocks, and crude material. It manages the procurement of stock to maintain the progression of manufacturing simultaneously reducing exorbitant interest in inventories.

$$Q = \sqrt{\frac{2 * D * S}{H * C}}$$

Q = request amount, variable to be improved.

D = the yearly request of item in amount per period. This can similarly be known as a rate.

S = the item request cost. This is the cost charged for making any request.

C = Unit cost ; H = holding cost of every product.

2.1.6. Inventory Management Sustainability

According to Mohammadnazari, and Ghannadpour (2021) transportation is the main source of energy utilization, and it assumes a huge part in environmental depletion during the process of conveying materials within and outside the distribution centres. The study further stated that transportation has a linear correlation with inventory management. Therefore, a numerical model was introduced to tackle the issue of requesting the necessary resources required. While, considering an auxiliary distribution centre to minimize the ecological effect. Sarkar, Ahmed, Choi, and Tayyab (2021) formulated a model to decrease the ecological effect and optimize profit by fostering a dynamic economic order quantity framework by adding multi-exchange credit strategy, modification, and deficiencies at the same time. The cost of fossil fuel by-products is channelled to consolidate the ecological effect on the overall profit. Abu, Roy, Daryanto, and Ali (2021) posited that material retrogression seriously hampers retailing, subsequently, an appropriate protection mechanism was utilized. Thus, an optimization model that includes selling value, speculation, and replacement arrangement were used as variables to optimize profitability. The model also considered the impact of crumbling rate and rebate cost of blemished materials. Due to the dynamics of vulnerability, a practical holding cost was included as a variable and consistent aspect. Each time purchased materials are transported ozone-depleting substances such as carbon is produced.

3. METHODOLOGY

Information was sourced utilizing questionnaire and inventory records were utilized for secondary data. The study adopted multi-method that is the combination of survey techniques and operations research techniques such as linear regression analysis, and economic order quantity (EOQ) respectively. The study also adopted purposive technique, and complete method. The primary information was analysed utilising partial least square (PLS) while, the secondary information was analysed utilising economic order quantity (EOQ). The examined populace comprised of 12 ceramics manufacturing firms operating in Lagos State for over fifteen (15) years, so that (659) surveys were dispersed to inventory staff working in these organizations. (528) Questionnaires were recovered and were viable for evaluation.

Economic order quantity (EOQ) Paradigm Assumption:

The following assumptions were utilised in the arrogated model:

1. Request is persistent.
2. The lead-time is steady.
3. There is no restriction.
4. The expense of submitting a request is free of the size of the order.
5. The cost of holding a unit of stock does not rely upon the amount in stock.

$$EOQ = \frac{2AO_c}{C_0}$$

A = Total units required, O_c = Cost per Order, C_0 = Ordering Cost.

4. STUDY RESULTS

Table 1. Descriptive analysis of inventory management

Inventory Management Framework	Yes	No
Inventory shrinkage	291 (55.1)	237 (44.9)
Inventory investment	330 (62.5)	198 (37.5)
Inventory control	324 (60.4)	204 (38.6)
Inventory turnover	319 (60.4)	209 (39.6)
Inventory record exactness	197 (37.3)	331 (62.7)

The descriptive examination of inventory management was estimated utilizing five (5) variables, as displayed in Table 1. One of the variables utilized for this estimation was to see whether inventory shrinkage is the most adopted inventory management operations that the ceramics manufacturing firms embraced. 291(55.1%) of the respondents accepted that inventory shrinkage was the most utilized inventory management operations, while 237(44.9%) had an opposite opinion. Additionally, the study intended to find out whether the respondents understood the concept of inventory investment. Consequently, 330(62.5%) of the respondents concurred, while 198(37.5%) had a contradicting opinion. It was additionally discovered that 324(60.4%) of the respondents accepted that inventory control was the most adopted inventory practice that the ceramics manufacturing firms embraced. While, 204(38.6%) had a contradicting perspective. Also, 319 (60.4%) concurred with the utilization of inventory turnover while, 209(39.6%) had an opposite opinion. 197(37.3%) concurred with the assertion of inventory record accuracy, while 331(62.7%) had a contradicting view.

Table 2. Descriptive analysis of inventory management frameworks and sustainability

	Very Great Extent.	Great Extent	Moderate Extent	Small Extent	Not at all
Inventory Management Frameworks					
Inventory shrinkage	104 (19.7)	113 (21.4)	133 (25.2)	146 (27.7)	32 (6.1)
Inventory investment	31 (5.9)	146 (27.7)	134 (25.4)	81 (15.3)	136 (25.8)
Inventory control	33 (6.3)	143 (27.1)	216 (40.9)	121 (22.9)	15 (2.8)
Inventory turnover	13 (2.5)	121 (22.9)	175 (33.1)	204 (38.6)	15 (2.8)
Inventory record exactness	106 (20.1)	182 (34.5)	128 (24.2)	77 (14.6)	35 (6.6)
Sustainability(environmental)					
Reduce the release of carbon during inventory storage.	14 (2.7)	78 (14.8)	206 (39.0)	218 (41.3)	12 (2.3)
Reduce the utilization of fossil fuel during the process of inventory chain	38 (7.2)	84 (15.9)	281 (53.2)	68 (12.9)	57 (10.8)

Table 2 continued on next page

Table 2 continued

	Very Great Extent.	Great Extent	Moderate Extent	Small Extent	Not at all
Reduce the use of quick or indirect utilization of mechanical handling device	20 (3.8)	192 (36.4)	185 (35.0)	123 (23.3)	8 (1.5)
Enhance the operational mechanism in inventory operations to fit environmental objectives.	56 (10.6)	137 (25.9)	122 (32.1)	201 (38.1)	12 (2.3)
Encourage consistency with ecological outlines and norms during inventory operations	10 (1.9)	131 (24.8)	238 (45.1)	140 (26.5)	9 (1.7)
Reduce the release of carbon during inventory storage.	13 (2.5)	61 (11.6)	244 (46.2)	129 (24.4)	81 (15.3)

Descriptive analysis of inventory management frameworks and inventory management sustainability(environmental) was measured using five (5) variables respectively, as shown in Table 2 are the items used for the estimation of inventory management framework and sustainability(environmental). Descriptive analysis of inventory management sustainability was measured using six (5) items, as shown in table 2. One of the items used for this measurement was to find out if the respondents reduced the release of carbon during inventory storage. It was discovered that 14(2.7%) of the respondents believed that ceramics manufacturing firms reduced the release of carbon during inventory storage to a very great extent. 78(14.8%) of the respondents believed that ceramics manufacturing firms reduced the release of carbon during inventory storage to a very great extent. 206(39.0%) of the respondents believed that ceramics manufacturing firms moderately reduced the release of carbon during inventory storage.

218(41.3%) of the respondents believed that ceramics manufacturing firms reduced the release of carbon during inventory storage to a small extent. While 12(2.3%) of the respondents believed that ceramics manufacturing firms never reduced the release of carbon during inventory storage. This suggests that most of the respondents believed that ceramics manufacturing firms reduced the release of carbon during inventory storage. The researcher also wanted to find out if ceramics manufacturing firms reduced the utilization of fossil fuel during the process of inventory chain. 38 (7.2%) of the respondents believed that ceramics manufacturing firms reduced the utilization of fossil fuel during the process of inventory chain to a very great extent. 84(15.9%) of the respondents opined that ceramics firms reduce the utilization of fossil fuel during the process of inventory chain to a great extent. 281(53.2%) of the respondents believed that ceramics manufacturing firms moderately utilised reduced the utilization of fossil fuel during the process of inventory chain. 218(41.3%) of the respondents believed that ceramics manufacturing firms barely Reduce the utilization of fossil fuel during the process of inventory chain. 12(2.3%) of the respondent opined that ceramics manufacturing firms never reduced the utilization of fossil fuel during the process of inventory chain. This reveals that most of the respondents believed that ceramics manufacturing firms moderately reduce the utilization of fossil fuel during the process of inventory chain. It was also in the interest of the researcher to know the extent to which ceramics firms reduce the use of quick or indirect utilization of mechanical handling device. 20(3.8%) of the respondents believed that ceramics manufacturing firms reduced the use of quick or indirect utilization of mechanical handling device.

192(36.4%) of the respondents believed that ceramics manufacturing firms reduced the use of quick or indirect utilization of mechanical handling device. to a great extent. 185(35.0%) of the respondents believed that ceramics manufacturing firms reduce the use of quick or indirect utilization of mechanical handling device. moderately. 123(23.3%) of the respondents believed that ceramics manufacturing firms barely reduce the use of quick or indirect utilization of mechanical handling device. 12(2.3%) of the respondent believed that ceramics manufacturing firms never reduced the use of quick or indirect utilization of mechanical handling device. It was also discovered from the descriptive analysis that 56(10.6%) of the respondents believed that ceramics manufacturing firms enhance the operational mechanism in inventory operations to fit environmental objectives. to a very great extent. 137(25.9%) of the respondents believed that textile manufacturing firms enhance the operational mechanism in inventory operations to fit environmental objectives to a great extent.

122(32.1%) of the respondents believed that ceramics manufacturing firms enhance the operational mechanism in inventory operations to fit environmental objectives moderately. 201(38.1%) of the respondents believed that ceramics manufacturing firms barely enhance the operational mechanism in inventory operations to fit environmental objectives. 12(2.3%) of the respondent believed that ceramics manufacturing firms never enhance the operational mechanism in inventory operations to fit environmental objectives. This suggests that most of the respondents were of the opinion that ceramics manufacturing firms barely enhance the operational mechanism in inventory operations to fit environmental objectives. However, in an attempt to discover the ability of ceramics manufacturing firms to encourage consistency with ecological outlines and norms during inventory operations. It was discovered that 10(1.9%) of the respondents believed that ceramics manufacturing firms encourage consistency with ecological outlines and norms during inventory operations to a very great extent. 131 (24.8%) of the respondents were of the view that ceramics manufacturing firms encourage consistency with ecological outlines and norms during inventory operations to a great extent. 238(45.1%) of the respondents were of the view that ceramics manufacturing firms encourage consistency with ecological outlines and norms during inventory operations moderately. 140(26.5%) of the respondents were of the view that ceramics manufacturing firms barely encourage consistency with ecological outlines and norms during inventory operations. 81(15.3%) of the respondents were of the view that ceramics manufacturing firms never encourage consistency with ecological outlines and norms during inventory operations. This suggests that the majority of the respondents were of the opinion that ceramics manufacturing firms moderately encourage consistency with ecological outlines and norms during inventory operations.

Table 3. Construct validity and Reliability

	Loading	Outer Weights	VIF	t-statistics	P Value	AVE	Composite Reliability	Cronbach's Alpha
Constructs	≥ 0.6		<3.0	>1.96	<.05	≥0.5	≥ 0.8	> 0.7
Inventory Management Frameworks						0.622	0.888	0.838
Inventory shrinkage	0.660	0.193	1.593	7.847	0.000			
Inventory investment	0.880	0.282	2.467	27.914	0.000			
Inventory control	0.912	0.291	2.788	41.875	0.000			
Inventory turnover	0.895	0.297	2.714	33.887	0.000			
Inventory record exactness	0.518	0.180	1.373	5.660	0.000			
Sustainability(environmental)						0.609	0.903	0.869
Sus1	0.825	0.220	2.184	20.632	0.000			
Sus2	0.747	0.175	2.761	10.862	0.000			

Table 3 continued on next page

Table 3 continued

	Loading	Outer Weights	VIF	t-statistics	P Value	AVE	Composite Reliability	Cronbach's Alpha
Sus 3	0.727	0.186	2.287	13.228	0.000			
Sus4	0.843	0.209	3.008	17.975	0.000			
Sus5	0.874	0.255	2.849	22.549	0.000			
Sus6	0.644	0.238	1.591	8.505	0.000			

Table 3 depicts the factor loadings for inventory management frameworks and sustainability, as well as the standardised regression and correlation coefficients. In the formative measurement of everything related to inventory management frameworks and sustainability, the outer weight acquires the relative value of each indicator. The composite reliability, average variance extracted (AVE) calculation, and Cronbach Alpha were also statistically tested to evaluate the cogency and dependability of the investigation. The loading factor, composite reliability, AVE, and Cronbach Alpha statistical values were all within the permissible value. Convergent and discriminant validity were also considered for determining construct validity in the report. Convergent validity refers to evidence of a relation between inventory management and innovative performance, whilst discriminant validity does not require a measure to be strongly correlated with the measures it is supposed to distinguish. All the factor loading of the specific items of measurement are above the recommended thresholds. The consequence is that all the items have a significant amount of variation in common. Furthermore, in assessing discriminant validity, the analysis equated AVE with the squared correlation for each of the constructs. The latent variable's AVE exceeds the squared correlations between the dormant variable and the model's constructs.

4.1 Common Method Bias

Variance inflation factor (VIF) was used to check for common method bias. It should be noted that if a VIF occurs more than 3.3 times, the model is likely to be influenced by common method bias. If all factor-level VIFs from a complete collinearity test are equal to or less than 3.3, the model does not suffer from common method bias. As a result, the VIF values for each of the measurement items and constructs for **inventory management frameworks and sustainability (environmental)** are all less than 3.3. This implies the model is free of common method bias.

H_0 . Inventory management has no significant effect on sustainability(environmental) of selected ceramics manufacturing firms in Lagos State.

Based on the hypothesis, the examination investigated the impact of inventory management on sustainability(environmental) of selected ceramics manufacturing firms in Lagos State. For the model interpretation of the hypothesis in the review, the coefficients outcome, the t-values, the R^2 value, and the p-value were utilized. Given this, the level of connection between inventory management and sustainability(environmental) was decided by the coefficient values via partial least square (PLS). The coefficient value of 0.554 shows the effect of inventory management on sustainability(environmental). The R^2 value is delegated substantial, moderate, or frail (>0.75 , >0.50 , and 0.25). Sequel to the R^2 value in the model which is 30.7% of the variation in inventory management. This implies that inventory management has a considerate effect on sustainability(environmental) via carbon emanations.

Table 4. Path Coefficients for Inventory Management and Sustainability(environmental)

	Coefficient Value	R ²	Std. Dev	T-statistics	P-value
Inventory Mgt Sustainability (environmental)	0.554	0.307	0.123	4.510	0.000

Table 4 depicts the smart partial least square(PLS) statistical results of hypothesis H₀, which focused on the influence of inventory management on sustainability(environmental). The findings show that inventory management has a significant effect on sustainability(environmental) at ($\beta=0.554$, $R^2=0.307$, $t\text{-value}=4.510 > 1.96$, $P\text{-value}=0.000 < 0.05$). The coefficient of 0.554 indicates that inventory management and sustainability(environmental) has a significant connection. The R² value of 0.307 indicates that a 30.7% variance in sustainability(environmental) can be explained by inventory management framework.

Table 5. Economic order quantity (EOQ) Initial Table

S/N	Demand (D)	Setup / Ordering Cost (S)	Holding Cost (H)	Unit Cost (C)
Firm 1	N1,980,307	N550,764	N4,5351	N300,127
Firm 2	N2,272	N7,677	N2,938	N300,127
Firm 3	N39,752	N1,5648	N2,5670	N300,127
Firm 4	N21,838,790	N1,826,669	N134,425	N300,128
Firm 5	N5,2845	N3,8840	N5,1607	N300,128
Firm 6	N1,940,600	N722,760	N63,852	N300,127
Firm 7	N165,923	N892,933	N394,503	N300,127
Firm 8	N699,975	N3,263,832	N3,880,326	N300,127
Firm 9	N3,200,023	N450,231	N4,000,341	N300,127
Firm 10	N891,671	N160,645	N114,806	N300,127
Firm 11	N105,000	N1,600,000	N1,300,000	N300,127
Firm 12	N5,976,000	N821,000	N2,681,000	N300,271

N = Naira

Table 6. Optimal inventory using economic order quantity (EOQ) output via QM software

S/n	Organisation	Optimal Inventory
1	Firm 1	6935
2	Firm 2	109
3	Firm 3	220
4	Firm 4	24362
5	Firm 5	282
6	Firm 6	6628
7	Firm 7	867
8	Firm 8	3432
9	Firm 9	849
10	Firm 10	1580
11	Firm 11	508
12	Firm 12	1913

Table 6 shows that economic order quantity (EOQ) model can be utilized by supervisors to lessen holding costs. By utilizing this model the selected ceramics manufacturing firms can know the specific measure of materials to arrange and when to submit new requests for every material herein an optimal inventory is obtained. Therefore, the reordering point computation tends to be resolved when the next request is optimal.

5. RESULT OF FINDINGS

The result shows that a considerable relationship do exist between inventory management frameworks and sustainability (environmental) that catalyses carbon emanation. The influence of inventory management frameworks on sustainability (environmental) accounted for a coefficient value of 0.554. Also, the T-value for all the observed variables is above the critical value of 1.96 at the confidence level of 95. However, inventory turnover has the most predictive value, followed by inventory control, inventory investment, inventory shrinkage, and inventory record exactness in that order. This finding implies that the management of the ceramics manufacturing firms can leverage on inventory management by utilising mathematical inventory models that will optimize inventory volumes. In this way the degree of carbon emanation during the procedure of inventory storage and distribution will be reduced because inventory will be based on request. In addition, inventory management can propel ceramics manufacturing firms to use the latest technology for new product development and increase the number of new products introduced to the market via inventory models. The utilization of economic order quantity model to optimize inventory volumes from the suppliers and warehouse is an important decision variable that will optimize environmental sustainability. This is based on the dynamics of inventory volumes and energy utilization in inventory storage procedure that will proportionally reduce carbon emanations.

6. CONCLUSION

Immoderate carbon emanations add to environmental depletion thus, decreasing fossil fuel by-products has turned into a widespread objective. Manufacturing firms and States have adopted various policies to minimize carbon emanations. Consequently, carbon emanation minimization will impact

the inventory chain, renewal, and transportation operations of the ceramic manufacturing firms. The aim of this study was to decide an optimal inventory, and renewal period in order to decrease carbon emanations, consequently meeting the goal of optimizing profit and environmental sustainability within the inventory network framework. The conceptual results revealed that when considering carbon emanations the optimal inventory volumes are based on requests for the inventory chain framework. This implies that a proportionate optimal inventory volume will reduce carbon emanations that will impact the overall profit of the integrated production chain and reorder period. Furthermore, a lower energy utilization per unit product storage via a mathematical inventory model will positively impact environmental sustainability. This is based on the partial least square (PLS) outcome indicating a considerable effect of inventory management framework on environmental sustainability. This study acquainted a pragmatic structure to aid the academia and experts. Scholastically, the contribution of this review includes obtaining of an optimal inventory volume to reduce carbon emanations. Consequently, this review provides a reference for future investigations. From a practical perspective, the outcome of this study demonstrates that production ought to be based on just-in-time philosophy that depends on demand is more valuable for sustainability. Also, the inventory volume will be based on optimal renewal requests that is proportional to the storage capacity. This will relatively decrease carbon emanations and assumes an essential role in the sustainability of the inventory management framework. The accompanying parts of the study can be extended in future exploration. The review recognizes that other variables aside from the recognized variables in this research may be instrumental to an integrated inventory management framework that will consider sustainability. Additionally, a coordinated inventory framework was also considered. Nevertheless, echelons within the inventory chain may not cooperate generally. Therefore, future studies can consider the perspective of disagreement within the inventory framework utilizing analytical hierarchical programming (AHP) to decide an optimal outcome.

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