



Economic Order Quantity and Supply Chain Performance of County Governments in Western Region, Kenya

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Abstract

Many organizations have realized the significant role played by Economic Order Quantity in determining Supply Chain performance. This study sought to examine the effect of economic order quantity on supply chain performance in county governments in western region, Kenya. This study adopted descriptive survey research design targeting 120 respondents from the procurement, stores and quality assurance departments. Data was obtained using structured questionnaires and analyzed using descriptive and inferential statistics. Descriptive statistics used were: mean, frequency percentage and standard deviation while for Inferential statistics Pearson correlations and simple linear regression was used. The regression results established that Economic Order Quantity had a positive and significant effect on the Supply chain performance of County Governments in Western Region, Kenya. ($\beta = 0.762$; $p < 0.000$). The findings extends knowledge on inventory management practices and specifically on economic order quantity that can enhance performance. The study recommends for County Governments to adopt as well as integrate Economic Order Quantity (EOQ) into its supply chain strategies.

Keywords: Economic Order Quantity, Supply Chain Performance

1. Introduction

In today's world of intense competition managing inventory efficiently has become an important operational weapon for products and service firms wishing to survive the competitive pressures. Inventory is the largest component of current assets for any business organization. Due to the substantial size of their inventories, a significant amount of funds is allocated to inventory holding. Therefore, it is crucial to use advanced strategies for inventory management in order to prevent missed sales, expenses related to adjusting production rates, overtime charges, subcontracting fees, and fines for backorders during periods of high demand (Lysons & Farrington, 2016). A logistics cost survey conducted in the European Union found that inventory costs accounted for 13% of total logistics costs while warehouse costs accounted for 24% (Lewin, 2017). Several firms have persistently encountered difficulties in managing their inventory. Given the assumption that effective inventory management plays a crucial role in service delivery, customer satisfaction and enhanced performance. Firms of all sizes and types, including both public and private entities, at both local and global levels, are invariably focused on inventory management. Although most firms employ internal inventory procedures to attain organizational goals such as increased efficiency and enhanced procurement processes, the implementation of good internal inventory management methods has proven to be a difficult task for many. Song, van-Houtum and Van- Meighem (2019) opine that inventory management through practices such as EOQ helps an organization meet the set production or sales revenues which is an important component of performance. This study focuses on EOQ which is an inventory management practice.

Economic Order Quantity refers to a model that calculates the ideal quantity to order whenever inventory levels reach depletion. According to Tarver (2020) economic order quantity refers to the ideal quantity a firm should purchase in order to reduce its inventory cost. The Economic Order Quantity Model is a fundamental and the most well-known inventory decision model (Adeyemi & Salami, 2010, Ogbo, Onekanma & Ukpere, 2014). Benefits of implementing EOQ model include minimization of inventory cost minimization and stock out as well as improving overall efficiency (Callarman, 2020). Adawiyah and Umam (2020) confirmed that EOQ enhances organizational

efficiency. According to gitau (2016) EOQ intends to achieve an equilibrium between maintenance of excessive or even insufficient inventory levels.

In the Kenyan context, inventory management challenges are the same as those of other countries in Africa. Public and private institutions face and continue facing stock control challenges. The Kenyan government enacted the Kenya Public Procurement and Asset Disposal Act of (2015) with an aim of controlling the procurement, management and disposal of materials in public institutions (Godana & Ngugi, 2014). Various studies done locally on the influence of stock control techniques on organizational performance include that of Swaleh and Were (2014) who did an assessment to determine the factors influencing effective implementation of material control techniques in public institutions in Kenya. Findings from the study revealed that the main aim of public institutions in Kenya is to stock the correct quantity of materials and maintaining minimum inventory costs. Majority of the companies in Kenya are using internal stock management techniques such as computerized material control systems, material audit and developing organizations stock control policies and procedures (Swaleh & Were, 2014). Economic order quantity allows companies to meet demand without overspending by managers calculating EOQ to minimize holding costs and excess inventory. According to Onkundi *et al.* (2016), counties in the Western region is faced with several challenges, including overstocking, high inventory costs, stock obsolescence, stock-outs, understocking, and poor service delivery in sectors like health and education.

While EOQ has been extensively studied in various industries globally and its adoption and impact on performance in Counties majorly in western region, Kenya remain relatively underexplored thus creating a gap for more research to be undertaken. Thus this study examines the effect of economic order quantity on supply chain performance in County governments within Kenya's western region.

2. Literature Review

2.1 Theoretical Review

This study was anchored on economic order quantity theory. This model was developed by Ford Harris in 1913, is a fundamental inventory management theory aimed at reducing total inventory holding costs and ordering costs. This model determines the optimal size of each inventory order to achieve the lowest total cost of inventory investment. The model calculates the ideal quantity to order whenever inventory levels reach depletion. It balances the trade-off between ordering costs and holding (or storage) costs. Ordering larger quantities reduces the frequency of orders and thus lowers ordering costs, but it increases average inventory levels and holding costs. Conversely, ordering smaller quantities decreases average inventory and holding costs, but it requires more frequent orders and higher ordering costs. The EOQ model provides a quantitative approach to finding the optimal inventory level that minimizes the total costs associated with inventory management, thereby helping organizations make efficient decisions regarding inventory replenishment. Bachetti, Plebani, Saccani and Syntetos (2010) argued that inventory management should be organized in a logical way so as to enable the organization to know when to order and how much to order. Part of the challenges with classic EOQ applications may be due to lack of the practical parameters to properly reflect some of the model's highly restrictive / deterministic assumptions. The relevance of the fundamentals of the EOQ particularly in the public-sector organizations of less-developed economies such as those of Asia and sub-Saharan Africa has been discussed as recent research suggests the possibility of a 20 percent reduction in the total variable costs by using the EOQ model. The technique used to estimate the highest amount of inventory order by equalizing stock and reclassification conflicts, is the optimal ordering amount of an item that minimizes expense in brief financial order quantities (Lyson & Farrington, 2014).

2.2 Empirical Review on Economic Order Quantity and Supply Chain Performance

Numerous studies have examined the impact of Economic Order Quantity (EOQ) on organizational performance. A study by Agum, Olanrewaju and Anyuabaga (2018) done in the College of Education Akwanga showed that EOQ had a significant effect on the quality and quantity of products and it also minimised costs for organizations. Structured questionnaires were used for data collection and as for data analysis regression was done. Atnafu and Balda (2018) investigated how EOQ influences the competitive strength and operational performance of small and micro enterprises (MSEs) in Ethiopia. Their descriptive research, which involved 188 MSEs in the manufacturing sector, found a positive correlation between EOQ and organizational performance. Essien and Effiong (2022) conducted a review of relevant literature in EOQ by assessing the impact it has on organizational performance. Twenty articles were reviewed, and the findings revealed that EOQ had a significant association with organizational performance. Magaji, Kabiru and Hassan (2024) assessed the Inventory Control Analysis by utilizing Economic Order Quantity (EOQ) Method at Nina Plastic Ltd in Nigeria. Data was collected using preliminary surveys, literature review and field survey methods. Descriptive analysis was utilized for data analysis. Findings revealed that EOQ resulted to cost savings.

Wafula (2016) researched the effect of inventory management on operational performance in oil marketing companies in Kenya and found that Economic Order Quantity positively influenced operational performance. The study used a descriptive research design targeting 75 oil marketing companies, a different sector from the current study. Nzioka *et al.* (2017) examined how inventory management affects performance in Kenya's education sector. The study emphasized the importance of effective stock-level management, specifically using EOQ, to prevent stockouts. Data were collected from all 100 supply chain officers at the Ministry of Education headquarters in Nairobi using a descriptive research design, with data analysis including both descriptive and inferential statistics.

Kiboko (2017) examined inventory management practices in hotels in Mombasa, Kenya, and assessed the relationship between these practices and operational performance. The study used a descriptive survey approach targeting 37 hotels categorized as 3-star, 4-star and 5-star establishments. Data were collected through questionnaires and analyzed using descriptive statistics and regression analysis. The findings showed that FIFO (First In, First Out) was the most commonly used inventory management practice, while other methods like marginal analysis, Enterprise Resource Planning (ERP), EOQ model, Just-In-Time (JIT), and Vendor Managed Inventory (VMI) were also widely utilized. ABC Analysis and stochastic models were moderately applied, and Radio Frequency Identification Systems (RFIS) were minimally used. However, the study concluded that these practices did not sufficiently explain the relationship between inventory management and operational performance in Mombasa hotels.

Okumu and Bett (2019) explored the impact of inventory management on organizational performance in the steel industry, identifying a strong positive correlation between EOQ and organizational performance in steel manufacturing firms in Nairobi County. The study also found a significant positive relationship between quality control measures and organizational performance. Data were collected using questionnaires from both primary and secondary sources.

Chebet and Kitheka (2019) established that economic order quantity affected organizational performance through a literature review of previous studies. The study found that EOQ was an important technique used in inventory management and recommended for firms to order recommended lot size as had been determined by EOQ. Using descriptive research design, Ndiwa (2022) assessed the impact inventory management methods had on supply chain performance in Kiambu County's dairy processing enterprises. Closed-ended questionnaires were used for data collection. Findings revealed that Economic Order Quantity (EOQ) had a significant effect on the performance of the supply chain.

Mikhago, Nurwin and Atieno (2024) conducted a study on Kenyan sugar manufacturing firms analyzing the effect economic order quantity had on organizational performance. This study used correlational research design. Both Primary and secondary data was collected using questionnaires and financial statements. The results showed that economic order quantity positively and significantly affected organizational performance.

From the reviewed studies it can be noted that the studies have been done on economic order quantity and performance however they were done in diverse contexts and sectors thus prompting further studies on the same. Thus hypothesizing the study as;

H0₁: Economic order quantity has no significant effect on the supply chain performance of county governments in the western region, Kenya

2.3 Conceptual Framework

A conceptual framework elucidates the relationships between study variables, offering a visual representation of these associations. Fundamentally, a conceptual framework explores the connections that link independent variable (Economic Order Quantity) with the dependent variable (supply chain performance), helping to structure and interpret the research findings effectively.

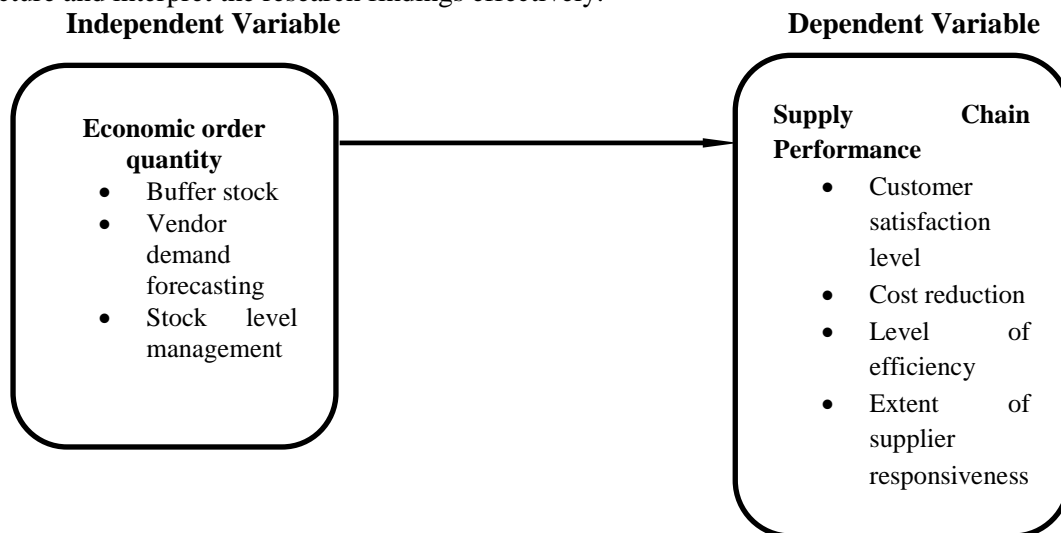


Figure 1: Conceptual framework.

Source: Adapted from other studies (Wafula, 2015; Nzioka & Were, 2017, Hussein & Makori, 2018

3. Materials and Methods

3.1. Materials

This study adopted descriptive survey research design targeting 120 respondents from different departments such as procurement, stores as well as quality assurance in four county governments in western region Kenya. Descriptive survey design is often used in primary studies, aiding in the collection and clear summarization of findings. The study utilized stratified random technique. The study employed census approach. Census involves a systematic approach collecting and recording data from every member of the population.

3.2. Methods

For data collection, close ended questionnaires were used. The questionnaires were designed on a five-point Likert scale for the closed-ended questions. They were used to gather accurate and consistent information from the respondents. Data collection instrument used was designed into three parts where part A had questions about respondents' backgrounds, part B containing questions about inventory management practices while part C containing questions pertaining supply chain performance. A pilot study was done in Kisumu County where twelve (12) respondents were selected. This represented 10% of the target population of 120 respondents which according to Creswell (2014) is deemed appropriate for the study. For Validity content validity was employed where the questionnaire was discussed with experts in procurement (procurement Managers) and also with study supervisors. Cronbach's alpha test was used to test for the reliability to assess the instrument's internal consistency. According to Yin (2017), a score of 0.7 indicates acceptable reliability. Data was analyzed using descriptive and inferential statistics. Descriptive statistics used were: mean, frequency percentage and standard deviation while Inferential statistics used Pearson correlations and simple linear regression. Results were presented in form of tables. Consequently, the regression model was as follows:

$$Y = b_0 + b_1 X_1 + \varepsilon$$

Where:

Y = Supply chain management performance

b_0 = Y intercept when x is zero (Constant)

b_1 = Regression Coefficient

X_1 = Economic Order Quantity

ε = Error term

4. Results and Discussion

4.1 Response Rate

The study distributed questionnaires to 120 respondents and successfully collected 118 data from participants, resulting in a response rate of 98.33%. There were 2 unused questionnaires, accounting for 1.67%. Reasons for these unused questionnaires were as a result of misplaced questionnaires by the respondent. Despite these instances, the response rate was considered satisfactory.

4.2 Pilot Study Results

The questionnaire tool underwent a pilot study to assess its reliability. This pilot study was done on 12 respondents in Kisumu County government. Economic order quantity and supply chain performance had Cronbach Alpha value of 0.918 and 0.879 respectively. All of the Cronbach's Alpha values exceeded 0.7, indicating that all of the constructions were deemed dependable.

4.3 Descriptive Statistics Results

The presentation of descriptive statistics is founded on the frequencies, percentages, means, standard deviations of the variables under consideration

4.3.1 Economic Order Quantity

The study sought to examine the respondent's level of agreement on statements on economic order quantity on a scale of 1-5 where 1=strongly disagree to 5=strongly agree. The study findings were presented in Table 1.

Table 1: Descriptive results on Economic order quantity

| No. | Statements on Economic order quantity | Percentage (Frequency) | | | | | Mean | SD |
|-----|---|------------------------|-----------|---------------|----------------|---------------|-------------|-------------|
| | | 1 | 2 | 3 | 4 | 5 | | |
| 1 | County has greatly reduced the buffer (excessive) stock level. | 0 (0%) | 0 (0%) | 18 (15.3%) | 47 (39.87%) | 53 (44.9%) | 4.29 | 0.71 |
| 2 | My county strike a balance between ordering cost and in choosing quantity of goods to be purchased. | 0 (0%) | 0 (0%) | 15 (12.7%) | 48 (40.7%) | 55 (46.6%) | 4.33 | 0.69 |
| 3 | My county engages in demand forecasting which aids in determining when goods/services will be required. | 0 (0%) | 0 (0%) | 13 (11.0%) | 50 (42.4%) | 55 (46.6%) | 4.35 | 0.67 |
| 4 | My county monitor's stock levels frequently. | 0 (0%) | 0 (0%) | 12 (10.2%) | 39 (33.%) | 67 (56.8%) | 4.46 | 0.67 |
| 5 | My county determines in advance the quality of goods to be purchased. | 0 (0%) | 0 (0%) | 12 (10.2%) | 39 (33.1%) | 67 (56.8%) | 4.46 | 0.67 |
| 6. | My County determines in advance the period when to make an order. | 0 (0%) | 0 (0%) | 9 (7.6%) | 44 (37.3%) | 65 (55.1%) | 4.47 | 0.63 |
| 7 | My county determines in advance services required. | 0 (0%) | 0 (0%) | 15 (12.7%) | 37 (31.4%) | 66 (55.9%) | 4.43 | 0.70 |
| 8. | My county avoids scenarios where there is stock out. | 0 (0%) | 0 (0%) | 15 (8.5%) | 39 (38.1%) | 64 (53.4%) | 4.41 | 0.70 |
| 9 | My County uses store ledgers and stock control cards in managing inventories. | 0 (0%) | 0 (0%) | 15 (12.7%) | 39 (33.1%) | 64 (54.2%) | 4.41 | 0.70 |
| | Aggregate Scores | | | | | | 4.41 | 0.68 |

Note: 1=Strongly Disagree, 2=Disagree, 3=Fairly Agree, 4=Agree, 5=Strongly Agree. The aggregate mean and standard deviation (M=4.1, S

Source; *Field Data (2024)*

The survey findings showed majority of the respondents agreed on the statements on EOQ. Specifically, 44.9% and 39.8% strongly agreed and agreed respectively that their county had significantly reduced excessive stock levels. This implied that Economic order quantity enables organizations to order sizeable level of quantity that is able to meet customers' demand as well as reducing the cost associated with storing large inventory. Similarly, a majority 46.6% strongly agreed and 40.7% agreed that their county balances ordering cost with the quantity of goods purchased, highlighting the importance of economic order quantity. Additionally, a significant number 46.6% strongly agreed and 42.4% agreed that their county's use of demand forecasting to determine when goods and services are needed. This also implied that Economic order quantity enables organizations to order sizeable level of quantity that is able to meet customers' demand.

In terms of stock monitoring and procurement decisions, majority of 56.8% strongly agreed that their county frequently monitors stock levels and decides on the quality and timing of purchases in advance. Furthermore, most respondents 55.1% strongly agreed that their county plans the timing of orders in advance. This implies that Economic order quantity enables organizations to order sizeable level of quantity that is able waste reduction, meeting of customers' demand as well as cost reduction associated with over stocking.

The survey yielded an overall mean score of 4.41 and an average standard deviation of 0.68, indicating a generally positive perception of Economic Order Quantity (EOQ) among the surveyed counties.

4.3.2. Supply Chain performance

Results that sought to determine respondent's agreement level on statements on Supply Chain performance on a scale of 1-5 where 1=strongly disagree to 5=strongly agree. The study findings were presented in Table 2.

Table 2: Supply Chain Performance

| No. | Statements on supply chain performance | Percentage (Frequency) | | | | | Mean | SD |
|-------------------------|---|------------------------|-----------|---------------|---------------|---------------|-------------|-------------|
| | | 1 | 2 | 3 | 4 | 5 | | |
| 1 | Inventory Management practices has increased customers satisfaction. | 0 (0%) | 0 (0%) | 11 (9.3%) | 47 (39.8%) | 60 (50.8%) | 4.41 | 0.65 |
| 2 | Inventory Management practices has led to Cost reduction. | 0 (0%) | 0 (0%) | 14 (11.9%) | 34 (28.8%) | 70 (59.3%) | 4.47 | 0.70 |
| 3 | Inventory management practices leads to efficiency. | 0 (0%) | 0 (0%) | 18 (15.3%) | 30 (25.4%) | 70 (59.3%) | 4.44 | 0.74 |
| 4 | There are less complaints in regards to goods supplied in the last three years. | 0 (0%) | 0 (0%) | 8 (6.8%) | 43 (36.4%) | 67 (56.8%) | 4.50 | 0.62 |
| 5 | Inventory management practices leads to responsiveness. | 0 (0%) | 0 (0%) | 13 (11.0%) | 41 (34.7%) | 64 (54.2%) | 4.43 | 0.68 |
| Aggregate Scores | | | | | | | 4.45 | 0.68 |

Note: 1=Strongly Disagree, 2=Disagree, 3=Fairly Agree, 4=Agree, 5=Strongly Agree. The aggregate mean and standard deviation (M=4.1, SD

Source; Field Data (2024)

In terms of whether Inventory Management practices have increased customer satisfaction, the majority of respondents 50.8% strongly agreed with the statement, 39.8% agreed, and 9.3% fairly agreed. Regarding whether Inventory Management practices have led to cost reduction, the majority of respondents (59.3%) strongly agreed, followed by 28.8% who agreed and 11.9% who fairly agreed. When it comes to whether Inventory Management practices lead to efficiency, the majority of respondents 59.3% strongly agreed, 25.4% agreed and 15.3% fairly agreed with the statement that economic order quantity has a positive and significant impact on supply chain performance. In terms of whether there have been fewer complaints about goods supplied in the last three years, 56.8% of respondents strongly agreed, 36.4% agreed and 6.8% fairly agreed. Additionally, 54.2% of respondents strongly agreed that Inventory Management practices lead to responsiveness, 34.7% agreed and 11.0% fairly agreed with the statement. The mean results indicate a strong mean score of 4.45 (SDV = 0.68), which suggests a generally positive disposition towards the significance of supply chain performance among the surveyed counties.

4.4 Inferential Statistics

4.4.1 Correlation Analysis Results

Pearson correlation analysis was done to determine the interrelation between economic order quantity and supply chain performance with results shown in table 3.

Table 3: Pearson’s Correlation Analysis results

| | | Economic order quantity | Supply chain performance |
|--------------------------|---------------------|-------------------------|--------------------------|
| Economic order quantity | Pearson Correlation | 1 | |
| | Sig. (2-tailed) | 0.000 | |
| | N | 118 | |
| Supply chain Performance | Pearson Correlation | 0.719** | 1 |
| | Sig. (2-tailed) | 0.000 | |
| | N | 118 | 118 |

Source: Research Data, (2024)

The economic order quantity exhibited a strong positive and significant correlation with counties’ supply chain performance. This was demonstrated by a correlation coefficient of (0.719) and a p value of (0.000), which is statistically significant at the 0.05 level. These findings are in line with those of Mikhago, Nurwin and Atieno (2024) who established that economic order quantity exhibited a strong and significant correlation with organizational performance as demonstrated by a correlation coefficient of 0.611 and a p value of 0.010.

4.4.2 Simple Linear Regression Results

The objective of this study was to examine the effect of economic order quantity on supply chain performance. The results of the model summary of the study are presented.

Table 4: Model Summary Results

| Model | R | R ² | Adjusted R ² | Std. Error of the Estimate |
|-------|--------------------|----------------|-------------------------|----------------------------|
| 1 | 0.719 ^a | 0.517 | 0.513 | 0.39211 |

a. Predictors: (Constant), Economic Order Quantity
 Source: *Field Data (2024)*

Table 4 displays an R-square value of .517. This suggests that the economic order quantity accounts for 51.7% of the variations in supply chain performance. Moreover, the findings indicate that 48.3% of the variability in performances remains unaccounted for by economic order quantity and is accounted for by other factors not covered by the study.

Table 5: ANOVA Results

| Model | Sum of Squares | df | Mean Square | F | Sig. | |
|-------|----------------|-------|-------------|-------|--------|--------------------|
| 1 | Regression | 19.07 | 1 | 19.07 | 124.09 | 0.000 ^b |
| | Residual | 17.83 | 116 | 0.154 | | |
| | Total | 36.91 | 117 | | | |

a. Dependent Variable: DV - Supply Chain Performance
 b. Predictors: (Constant), Economic Order Quantity

Source: *Field Data (2024)*

The ANOVA results showed that the regression model significantly predicts supply chain performance based on Economic Order Quantity (EOQ), with an F-statistic of 124.09 and a p-value of 0.000. This is supported by statistical analysis showing a highly significant F-statistic of 124.09 with a low p-value of 0.000. Therefore, it can be confidently concluded that EOQ significantly influences supply chain performance in this context.

Table 6: Coefficient Results on Economic Order Quantity and Supply Chain Performance

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|-------|-------------------------|-----------------------------|------------|---------------------------|-------|------|
| | | B | Std. Error | | | |
| 1 | (Constant) | 1.09 | 0.304 | | 3.60 | 0.00 |
| | Economic Order Quantity | 0.762 | 0.068 | 0.71 | 11.14 | 0.00 |

a. Dependent Variable: _ DV
 b. Supply Chain Performance.
 Source: *Field Data (2024)*

The regression analysis shows that Economic Order Quantity (EOQ) significantly improves SCP, with a coefficient of 0.762 (p = 0.000). This means that for each unit increase in EOQ, supply chain performance increases by 0.762 units. The findings established significant effect of Economic Order Quantity on Supply Chain Performance ($\beta = .762$; $p < .05$). Hence null hypothesis that Economic order quantity has no significant effect on the supply chain performance of county governments in the western region, Kenya is therefore rejected as Economic Order Quantity has a positive

and significant effect on Supply Chain Performance. Substitution of regression equation $Y=b_0+b_1X_1+e$, becomes: $Y=1.094+0.762X_1+e$.

These findings concurred with other findings such as Wafula (2016), Agum, Olanrewaju and Anyuabaga (2018), Atnafu and Balda (2018) and Ndiwa (2022) in as much as the studies were done in different sectors and contexts. Similarly

Okumu and Bett (2019) and Ndiwa (2022) confirmed that EOQ influenced performance.

5. Conclusion

Findings revealed that Economic Order Quantity (EOQ) positively and significantly affects supply chain performance and this was achieved through reduction of buffer stock levels, Vendor demand forecasting and lastly stock level management. The study makes a contribution to literature in inventory management by affirming that economic order quantity impacts on supply chain performance of county governments in the western region, Kenya. The findings can be used as a guide to develop policies on economic order quantity. This research recommends for the adoption of Economic Order Quantity (EOQ) into the supply chain strategies of county governments as this enhances supply chain performance. Further the study recommends that Counties should greatly reduce the buffer (excessive) stock level, should engage in demand forecasting which aids in determining when goods/services will be required, should determine in advance the quality of goods to be purchased, should determine in advance services required as well as considering between stocking too much and maintain an adequate inventory which will ultimately lead to optimum stock level stored.

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