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BULLWHIP EFFECT AND SUPPLY CHAIN PERFORMANCE OF LARGE-SCALE RETAIL SUPERMARKETS IN NAIROBI CITY COUNTY, KENYA

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ABSTRACT

The bullwhip effect happens when there is no or little coordination among the supply chain members and therefore bullwhip is considered an undesirable phenomenon in forecast-driven supply chain. The bullwhip effect distorts demand information within the supply chain, with each stage having a different estimate of what demand looks like. The retail business in Kenya has seen a tremendous transformation, with new firms capturing a significant portion of the market. The study sought to determine the relationship between bullwhip effect and supply chain performance of large-scale retail supermarkets in Nairobi City County, Kenya. The specific objectives were to examine effect of demand forecasting and rationing and gaming on supply chain performance of large-scale retail supermarkets in Nairobi City County, Kenya. The study was guided by theory of Constraints and inventory control theory. This study employed a descriptive research design. The target population for this study was six large-scale supermarkets licensed by county government of Nairobi. The unit observation was 324 finance, operations, and inventory managers. Yamane 1967 formula was used obtain a sample of 179 respondents selected using stratified random sampling technique. The study used questionnaires for data collection. In this study the sample for piloting was 18 management staff representing 10% of the sample. This study used content and construct validity. In this study Cronbach's Alpha Coefficient was used to measure questionnaires' reliability. The SPSS version 28 was used to analyze data. Data was analyzed using descriptive (frequencies, percentages, and mean) while inferential statistics (correlation and regression). Findings were tabulated. The university supervisors confirmed the questionnaire's validity, affirming that its items align with the sub-variables outlined in the conceptual framework. Also, demand forecasting exhibited an average variance explained of 0.723, and rationing and gaming 0.778. Additionally, supermarket performance scored 0.768 in average variance explained. Notably, all variables demonstrated AVE values exceeding 0.5, indicating that they satisfied the criteria for construct validity. demand forecasting, and rationing and gaming exhibited strong internal consistency, with Cronbach's Alpha values of 0.805 and 0.826, respectively. These values suggest that the items within each construct reliably measure their intended concepts. The findings revealed that all practices significantly contribute to improved supply chain performance, with rationing and gaming having the strongest impact ($\beta = 0.296$, $p < 0.001$), followed by demand forecasting ($\beta = 0.285$, $p < 0.001$), The study concludes that these practices are essential for optimizing supply chain efficiency and recommends that supermarkets enhance their focus on these areas, particularly on effective rationing and gaming strategies, to achieve superior supply chain performance.

Key Words: Bullwhip Effect, Supply Chain Performance, Large-Scale Retail Supermarkets, Demand Forecasting, Rationing and Gaming

Background of the Study

Jeong and Hong (2019) define the Bullwhip Effect (BWE) as the amplification of order volatility throughout the supply chain. According to Wang and Disney's (2015), the bullwhip effect happens when there is no or little coordination among the supply chain members and therefore bullwhip is considered an undesirable phenomenon in forecast-driven supply chains as it causes inefficiencies and this returns as costs to organizations hence poor performance. The bullwhip effect distorts demand information within the supply chain, with each stage having a different estimate of what demand looks like. Small changes in demand can produce a whip-like effect upstream (Asgary & Li, 2016). The distortion of demand has led to the Bullwhip effect not just in the micro level but also at macro level (Deng & Ma, 2019). At the micro level, the bullwhip effect in supply chain will bring a dual loss for companies i.e. effectiveness and profitability. First, the product stock is to adapt the demand so that the firm try to remove the excessive demand fluctuation caused to supply chain. Second because the demand uncertainty engorged, the difficulty of the firm's ideal forecast to the demand is also enlarged. Third, the demand distortion also affects firm's production. Due to distortion of demand information. At macro level, the Bullwhip effect is a typical "market failure" incident, and may lead to over-investment or investment shortage.

The bullwhip effect does not enhance the performance of a supply chain: increased volatility at any point in the supply chain can lead to product shortages, excess inventory, low utilization of capacity, and poor quality. It is extremely important that its causes be identified so that cures, or at least mitigating strategies, can be developed (Phuoc, 2020). The retail business in Kenya has seen a tremendous transformation, with new firms capturing a significant portion of the market. Previously dominated by Nakumatt and Uchumi supermarkets, strong competition has resulted in significant shifts in customer and brand loyalty during the last five years. The retail industry is getting crowded, so much that the big players are becoming uncomfortable.

Statement of the Problem

Supermarkets are self-service retail establishments that sell a variety of foods, drinks, and household goods. The industry is one of the most significant contributors to Kenya's GDP, with an 8% contribution rate and it is the 3rd largest contributor to private sector employment (KNBS, 2021). The supermarkets contribute to the economy and acts as a convenience to many shoppers since they provide almost all household things under one roof particularly in city counties. Over the years, Kenyan supermarket retail outlets have struggled to earn a major market share and record high annual after-tax profits, but nothing has been accomplished. Major retail chains in Kenya have either closed down, retrenched staff or reduced the number of branches countrywide. In Nairobi County, there is an ever-changing demand fluctuation and customers are looking for substitute products making determination of the stock levels to be difficult. There is also a problem in the accountability and crosschecking of items being received in business and retail enterprises in Nairobi County.

Supply chain practices has not been effectively embraced in Kenya retail industry and this has made major supermarkets such as Nakumatt, Uchumi, and Tuskys to fail to achieve performance goals in terms of sales revenue realization, customer satisfaction, right time shelf availability and right time delivery. There are low levels of supply chain integration, information sharing, supply chain characteristics and customer service management) which have contributed to poor performance of retail chain stores (Wakasala, 2020). Poor financial performance has plagued most of large-scale retailers for the past 20 years, forcing some to close some of its outlets. Uchumi supermarket, Tuskys supermarkets among other supermarkets have been making heavy losses leading to the closure of some of their branches. Uchumi has closed 35(95%) branches, Tuskys 61(95.3%) branches, and Choppies 13(87%) branches. According to Kenya Retail Report 2022, there were 334 supermarket branches in Kenya in 2020 but they had declined to 200 by the end of 2022. Kenya Economic Survey (2018) reported that Nakumatt was put under receivership due to breach of the Public

Procurement and Asset Disposal Act (2015). The retail store was unable to pay suppliers within the stipulated 60 days leading to its downfall. According to an external audit report in 2020, Nakumatt owed creditors Ksh.38 billion yet the company gave over Ksh. 1 billion as interest-free soft loans to its directors. The closure of these branches has led to the loss of employment and a decline in the overall economic performance of the industry by 5.7% (Kenya Retail Report, 2021).

There exist several studies on bullwhip effect and performance in various organizations; Aqdas, Shakeel, and Munir (2023) on the impact of bullwhip effect on supply chain performance revealed that bullwhip supply chain information flow, Mathae, Paul, and Mbura (2018) on effect of bullwhip on performance of milk processing firms in Kenya revealed that information sharing, inventory management approaches, shortage gaming and distribution channels hampered the performance of milk processing. Njuguna and Ismael (2017) on the effect of bullwhip on supply chain performance in manufacturing sector in Kenya found that demand forecasting,

rationing game, and information sharing were factors affecting supply chain Performance in the manufacturing sector in Kenya. However, there was limitation of studies on bullwhip effect in the retail supermarkets in Nairobi City County. This study aims at filling this study gap.

Objectives

General Objective of the Study

To determine the relationship between bullwhip effect and supply chain performance of large scale retail supermarkets in Nairobi City County, Kenya.

Specific Objectives of the Study

i. To establish effect of demand forecasting on supply chain performance of large scale retail supermarkets in Nairobi City County, Kenya
ii. To assess effect of rationing and gaming on supply chain performance of large scale retail supermarkets in Nairobi City County, Kenya.

LITERATURE REVIEW

Theoretical Literature Review

Theory of Constraints

Theory of Constraints on demand forecasting techniques contain challenges that can prohibit organizations from anticipating customers demand in a proactive manner developed by Dr. Eliyahu Goldratt in 1984. Goldratt defined constraint as anything that limits the performance of a system relative to its goal. A constraint is any factor that limits the organization from getting more of whatever it strives for, which is usually profit. Every business has at least one constraint and without a constraint a business would earn infinite profit. Since no business does earn infinite profit, each must have a constraint. A constraint might be lack of market, a policy imposed internally or externally, or a resource internal to the company (Boyd & Gupta, 2004). TOC is a management method that aims at reducing the number of constraints and their effects on a particular operation. TOC begins by analyzing the production output of multiple production lines to identify the operation or resource that is limiting the total throughput of the production line. When the constraint has been identified, it must be eliminated by making quick improvements using existing resources. This can include performing maintenance work to increase the throughput of the machine, offloading extra work onto other machines, or re-distributing your labor resources (Zyenep ,2014).

One of the advantages of this theory is that it offers a holistic approach to managing organizations. Thousands of companies have implemented the theory across the globe. TOC has established itself as a humane, effective, and efficient way of managing organizations bearing in mind that it seeks better operational and financial performance using the same

existing resources. The theory also provides solutions, processes, tools, and concepts that are significant in improving the operational and financial performance of a firm by using the same existing resources (Chou, Lu & Tang 2012). The theory supports the variable on demand forecasting. The demand forecasting techniques contain challenges that can prohibit organizations from anticipating customers demand in a proactive manner. Effective demand forecasting and planning requires more than merely selecting the optimal set of statistical forecasting techniques. It also involves a cross-departmental process that leverages enterprise-wide data, qualitative knowledge, and performance feedback at its essence, effective forecasting requires a systems approach. Identifying constraints in demand forecasting however, requires effective and timely identification of demand signals.

Inventory Control Theory

Inventory control theory was developed by Starr and Miller in 1962. Inventory control involves the actual control of inventory; this can mean inventory of raw materials, works-in-progress or finished goods. Regardless of the type of inventory in question, inventory requires storage, and there is always a cost associated with that storage. Therefore, inventory control theory is concerned with all actions related to the storing of items and the consequences, both positive and negative, thereof. One of the most common applications of inventory control theory is in the determination of the optimal quantity of inventory to be held. While inventory control theory tends to be a bit shortsighted regarding the non-monetary costs of storage, and it makes assumptions regarding future demand and delivery that could not be known, inventory control theory is still a cost-saving tool, and is considered part of good business practice in manufacturing environments (O'Farrell 2010). Supermarkets may game the means by which inventory is rationed. In addition to competing for customer demand, retailers must compete for vendor supply. Thus, stores will request excess inventory when they anticipate shortage hoping to end up with the desired amount of product. If the supermarket is in short of supply, they play the rationing game which involves limited the number of products per shopper. This may help to ensure optimum stocks as they push the suppliers to deliver more products. Discounts on various products also help to attract more shoppers hence increasing sales and profit margins since they are able to move many products within a short time.

Conceptual Framework

The conceptual framework in Figure 2.1 demonstrates how the study variables. The independent variables are; bullwhip effects; demand forecasting, and rationing and gaming. The dependent variable is supply chain performance of supermarkets. These variables and relationships are presented in Figure 2.1.

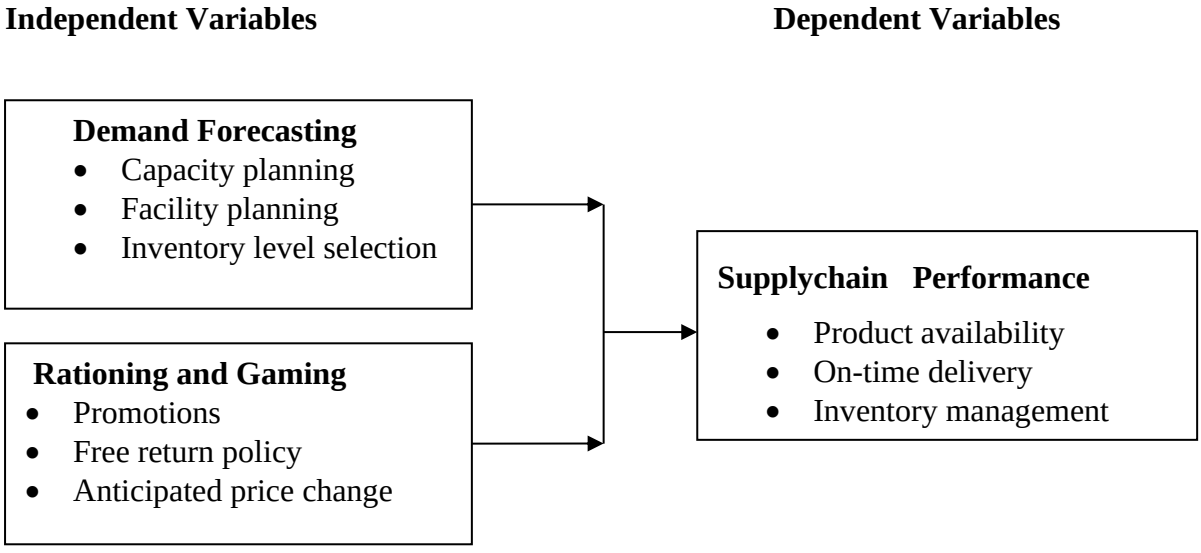

Figure 2. 1: Conceptual Framework

Demand Forecasting

Supplier integration (SI) entails the degree of collaboration between manufacturers and their suppliers when it comes to making decisions concerning capacity planning, demand forecasting, inventory control, replenishment, and the movement of materials (Piprani et al., 2020). Demand forecasting refers to the process of predicting future customer demand for products or services. Abolghasemi et al. (2020) argue that demand forecasting plays a pivotal role in shaping numerous managerial choices within the supply chain. These decisions encompass aspects such as, order fulfillment, production planning, demand planning, and inventory management. Demand forecasting entails the examination of historical sales data, shifts in market, and other pertinent data to project the anticipated quantity of goods or services needed over a defined timeframe.

Also, forecasting is based on historical data, which includes sales figures, customer orders, market trends, and other variables that influence demand. According to Piprani et al. (2020), the data provided by customers regarding precise demand information can further empower companies to be more adaptable and responsive to market needs by enhancing the accuracy of their forecasting. However, Zhu et al. (2021) provide that data scarcity has hindered forecasters from adopting advanced models for demand forecasting. The researcher used the pharmaceutical industry to explain that such challenges persist even when there is an extensive history of demand data, as historical data which is past due may offer limited value due to changing market conditions.

Abolghasemi et al. (2020) proposes forecasting approaches including time series analysis, regression modeling, and causal frameworks. The method chosen is determined by the type of the commodities, market dynamics, and available data. Similarly, the accuracy of demand forecasting is essential, as it impacts various aspects of the supply chain, including inventory management, production planning, and order fulfillment. Characteristics of products and industries play a significant role in demand forecasting as it distinguishes between functional products and their demand forecasting challenges, varying depending on their position in the supply chain.

Feizabadi (2022) provide three underlying principles of demand forecasting, including the inevitability of forecast errors and the relationship between forecast accuracy and the time horizon. These principles highlight the complexities and uncertainties involved in forecasting. Globalization and longer lead times in the procurement of products have made accurate demand forecasting even more crucial. Accurate forecasts can lead to efficient supply chain operations. Feizabadi further directly discusses the role of demand forecasting in mitigating the bullwhip effect in supply chains, emphasizing that more sophisticated forecasting methods can improve supply chain efficiency. As a result, demand forecasting the Bullwhip Effect, a supply chain management concept in which small changes in customer needs result in inflated differences in ordering and inventory levels as one advances upwards in the supply chain. As a result, Feizabadi (2022) analyzes demand forecasting directly in minimizing the bullwhip impact in supply networks, highlighting that more complex forecasting approaches can increase the efficacy of supply chains. The researchers demonstrate that retailers may lessen the Bullwhip Effect and enhance overall supply chain performance by exactly forecasting demand. Demand forecasting significantly influence supply chain performance where accurate forecasts can help retailers manage their inventory efficiently, reduce stockouts, and minimize overstock situations. For instance, reducing inventory results in decreased storage and facility expenditures, along with lower transportation costs, all while maintaining the same service level (Attaran; 2020).

Rationing and Gaming

Bray et al. (2019) refer ration gaming as the practice where retailers place inflated orders when they anticipate supply shortages. The goal is to secure an adequate amount of inventory, as they

expect curtailed shipments during times of scarcity. According to the researchers, this anticipation leads to retailers hoarding inventory, which is different from traditional gaming where the store might order more than it needs just to get extra supplies. Also, these inflated orders, based on anticipated shortages, result in the timing of orders being altered. This change in order timing represents a unique form of ration gaming, where retailers modify their orders based on expected future shortages.

According to Rong et al. (2017), when the rationing game develops, the supply aspect of the value chain suffers what a Reverse Bullwhip Effect (RBWE). According to their research, order variation grows as one proceeds downwards in the supply chain in RBWE, resulting in increasing supply volatility. On the other side, the demand side of the supply chain undergoes the standard Bullwhip Effect (BWE), in which variation in orders grows in the opposite direction. Also, when both BWE and RBWE occur concurrently, the intermediate points of the supply chain suffer most severely from such types of uncertainty.

Similarly, Liao-Troth (2013) describes manufacturer order rationing as a method used to allocate inventory fairly and strategically among retailers. The concept involves ranking retailers and fulfilling their orders sequentially based on predetermined rules. This practice aims to minimize the distortions in the supply chain and ensure that inventory is distributed efficiently. Also, when retailers face or anticipate supply shortages, they engage in a strategy is referred as "shortage gaming." This practice involves retailers inflating their orders to secure more inventory than they actually need. Okoth and Getuno, (2020), provide practical examples of rationing and shortage gaming, such as the shortage of DRAM (Dynamic Random-Access Memory) chips in the 1980s in the computer industry. During this period, orders for DRAM chips surged not due to a genuine increase in customer demand but because of anticipation.

Bray et al. (2019) suggest that suppliers can address this subterfuge by adopting lexicographic allocation rules, ranking stores and fulfilling orders sequentially. This policy reduces the likelihood of strategic manipulation by stores, where they inflate orders to secure more inventory. However, it does not prevent inventory runs, which result from stores hoarding inventory in anticipation of future shortages. The scholar underscores that both traditional ration gaming (regarding order size) and the new ration gaming (regarding order timing) can contribute to supply chain disruptions and the Bullwhip Effect. Also, over time, the practice of manufacturer order rationing and retailer shortage gaming creates an information feedback loop within the supply chain. Retailers' order fill experiences can signal supply shortages, leading to more shortage gaming behaviors. Retail orders contribute to the total demand encountered by the supplier, which may result in extra shortage gaming. This feedback cycle can result in greater demand volatility, supply chain inconsistencies, excessive stock spending, unsatisfactory client service, and other issues, all of which are parts of the Bullwhip Effect.

Empirical Review

Demand Forecasting and Supply Chain Performance

Paik and Bagchi (2017) sought to determine the respective significance of each element that generates the bullwhip effect and determine those that have a major impact on variation in orders in supply chains. The researchers created computer simulation models for the study. They used a design based on fractional factorials to gather data from the models and then applied statistical analysis. According to the findings, six factors are statistically significant when all nine potential sources of the bullwhip effect are addressed in the modeling designs: demand prediction updates, order batching, resource delays, information failures, purchase delays, and the degree of echelon. The top three most crucial of these six elements are demand prediction updates, echelons levels, and pricing fluctuations.

Atemauswa (2019) aimed to analyze the influence of both internal and external factors on the apparel industry, focusing on a specific case study involving Apparel Retailer A of South Africa. The research took on an exploratory and descriptive approach and adopted a case study

methodology as its research design. It specifically employed a qualitative case study method. The study's target population was the employees working in the apparel planning department of Apparel Retailer A. The research findings indicated that demand forecasting serves various important purposes, such as aiding in budget management, informing cost-effective investment decisions, monitoring the return on investment, and ensuring efficient inventory management within the organization.

Njuguna and Ismael (2017) investigated the effects of the bullwhip effect on supply chain performance in Kenya's manufacturing sector. The researchers used a descriptive study technique on all Coopers Kenya Limited personnel. The target population consisted of 180 workers who worked on the company's tasks. A sample of 124 people was chosen using the Simple Random sampling approach. Both primary and secondary data were employed in the research. The findings demonstrated that demand forecasts, production techniques, the rationing game, and information sharing all had a substantial impact on supply chain performance in Kenya's manufacturing sector.

Awanga (2018) conducted an investigation to determine the factors influencing demand planning on the efficiency of the supply chain in Nairobi County, Kenya. The research used both descriptive and explanatory designs. The target group were employees with roles in supply chain within 80 retailers dealing with fast moving consumer products. The study's sample size was established at 80 individuals working within these organizations. Data was collected using questionnaire. The study's findings revealed that organizations engaged in supply chain forecasting in period ranging from 6 to 12 months which enhanced supply chain performance.

Rationing and Gaming and Supply Chain Performance on

Panda and Mohanty (2018) sought to research on the influence of multiple factors such as updating demand forecasts, order batching, price fluctuations, and the practices of rationing and storage gaming in generating the bullwhip effect among suppliers of grocery products to prominent retailers in India. The primary data for this study was obtained directly from the suppliers, utilizing a structured questionnaire. The research was conducted in two stages, specifically, at exploratory and descriptive levels. During the initial phase, in-depth interviews were carried out with grocery suppliers to major retailers through telephone and online questionnaires. The subsequent phase of the study employed a structured questionnaire for data collection. According to the findings rationing and shortage gaming practices differed based on the size of the customer.

Faizan and Haque (2015) conducted an investigation into the bullwhip effect phenomenon and its mitigation within the supply chain processes of Trans-border Logistic Canada. The research utilized a hypothetico-inductive deductive model to explore the various research variables. Additionally, the researchers employed a mixed-method approach, which involved the distribution of a matrix-based semi-structured survey questionnaire. The findings revealed that operational obstacles were attributed to factors beyond the bullwhip effect, including price fluctuations, rationing, demand forecast updates, order batching, and short-term gaming.

Okoth and Getuno (2020) aimed to investigate the Bullwhip effect's impact on inventory management within the New Kenya Cooperative Creameries Limited. The research adopted a descriptive research design. The target population encompassed 303 workers of the New Kenya Cooperative Creameries Limited in Nairobi County. Stratified sampling techniques were used for participant selection. Primary data was collected for the study, with questionnaires serving as the primary data collection tool. According to the findings several factors, including demand forecast updating, order batching, price fluctuations, shortage gaming, and rationing, have a significant influence on inventory management at the New Kenya Cooperative Creameries Limited.

Mathae et al. (2018) set out to investigate the bullwhip effect and its repercussions on the performance of milk processing companies in Kenya. The study focused on the substantial

impact of shortage gaming on the operations of New Kenya Cooperative Creameries Limited. The research was executed using a case study approach, which confined the study's focus to the operations of the company. A descriptive research design was adopted to conduct the study. The target population included all the departments operating at the company's headquarters, totaling 167 individuals. To obtain a representative sample, the researchers employed a stratified sampling technique, ultimately selecting 117 respondents from the staff list. Structured questionnaires featuring both closed and open-ended inquiries were used to collect data. According to the findings, shortage gaming, characterized by retailer hoarding, significantly impacts the overall performance of the organization.

RESEARCH METHODOLOGY

This study employed a descriptive research design. According to the Economic Survey of 2023, Nairobi County hosts six large-scale supermarkets, collectively operating 108 branches within the city. Hence, for this study, the 108 branches within Nairobi City County were selected as the unit of analysis. The unit of observation comprised the finance, operations, and inventory managers of these supermarkets. The finance, operations, and inventory managers were chosen as units of observation due to their direct involvement in supply chain activities, access to relevant data, decision-making authority, and ability to provide comprehensive insights into the Bullwhip Effect and supply chain performance within large-scale retail supermarkets in Nairobi City County, Kenya.

Table 3. 1: Target Population

Name of supermarket	Number of branches	Target respondents (finance, operations, and inventory managers)
Naivas	33	99
Quickmatt	34	102
Chandarana Foodplus	13	39
Carrefour	15	45
Khetias	7	21
Eastmatt	6	18
Total	**108**	**324**

Yamane 1967 formula was used to calculate the sample of 179. The study used stratified random sampling technique. The management staff were stratified according to their job category (finance, operations, and inventory managers). The researcher acquired the names of the of managers and randomly pick 179 staff. This ensured that all large supermarkets were represented in the study. The study used questionnaires for data collection. The collected data was cleaned, edited and coded before the analysis. The SPSS version 28 was used to analyze data. Data was analyzed using descriptive (frequencies, percentages, and mean) while inferential statistics (correlation and regression) were used to test the relationship between the study variables. Correlation analysis is a measure of association between two variables while controlling or adjusting the effect of one or more additional variables. The linear regression analysis was used to examine the level of influence the independent variables have on the dependent variable.

RESEARCH FINDINGS AND DISCUSSIONS

Out of the 179 sampled respondents, 18 participated in pilot study. Therefore, a total of 161 questionnaires were distributed, 154 were returned and deemed usable, yielding a response rate of 95.7%. According to Mugenda and Mugenda (2023), a response rate of 50% and above is adequate for analysis and reporting, 60% is good, and 70% and above is excellent. Therefore, the response rate of 95.7% was considered excellent for further analysis and reporting.

Descriptive Statistics

This section presents the findings from Likert scale questions where respondents were asked to indicate their level of agreement or disagreement with various statements regarding the influence of demand forecasting, and rationing and gaming on organizational performance. A 5-point Likert scale was used where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Mean values and standard deviations were calculated to interpret the findings.

Demand Forecasting

The first objective of the study was to establish the effect of demand forecasting on the supply chain performance of large-scale retail supermarkets in Nairobi City County. Respondents indicated their agreement with statements about the impact of demand forecasting on organizational performance. The findings are summarized in Table 4.1.

Table 4.1: Descriptive Statistics for Demand Forecasting

Statements	Mean	Std. Dev.
The supermarket has established close collaborations with other supply chain partners	3.766	0.662
Old forecasts are used to determine the future demand	3.753	0.732
Judgmental method help to increase sales and stock in the firm	3.779	0.714
Suppliers access the marketplace and provide new ideas to the supermarket	3.792	0.685
Our supermarket can provide fast delivery and respond quickly to customer orders	3.766	0.709
Demand forecasting helps to expand the outlet by adding a product line	3.831	0.698
Historical forecasting is effective in identifying customer needs and boosting their retention	3.805	0.671
Market test approach enable to expand and diversify investment opportunities	3.779	0.707
Aggregate Score	**3.784**	**0.722**

The findings generally show that the respondents agreed on average that the supermarket has established close collaborations with other supply chain partners (M= 3.766, SD= 0.662); old forecasts are used to determine the future demand (M= 3.753, SD= 0.732); that judgmental method help to increase sales and stock in the firm (M= 3.779, SD= 0.714); and that suppliers access the marketplace and provide new ideas to the supermarket (M= 3.792, SD= 0.685). They further agreed that their supermarket can provide fast delivery and respond quickly to customer orders (M= 3.766, SD= 0.709); that demand forecasting helps to expand the outlet by adding a product line (M= 3.831, SD= 0.698); that historical forecasting is effective in identifying customer needs and boosting their retention (M= 3.805, SD= 0.671); and that market test approach enable to expand and diversify investment opportunities (M= 3.779, SD= 0.707).

The findings of this study, which show that respondents generally agreed on the positive impact of effective demand forecasting on supply chain performance with an aggregate mean score of 3.784 (SD = 0.722), are strongly supported by the literature. Paik and Bagchi (2017) highlighted the critical role of demand prediction updates in minimizing order variability and improving supply chain performance, emphasizing that accurate forecasting is among the top factors in mitigating the bullwhip effect. Similarly, Njuguna and Ismael (2017) found that demand forecasting significantly influences supply chain outcomes in Kenya's manufacturing sector, underscoring its importance in maintaining a stable and efficient supply chain. Both studies align with the current findings, reinforcing the essential role of accurate demand

forecasting in enhancing the overall performance of large-scale retail supermarkets' supply chains.

Rationing and Gaming

The second objective of the study was to assess the effect of rationing and gaming on the supply chain performance of large-scale retail supermarkets in Nairobi City County. Respondents indicated their agreement with statements about the impact of rationing and gaming on organizational performance. The findings are summarized in Table 4.2.

Table 4.2: Descriptive Statistics for Rationing and Gaming

Statements	Mean	Std. Dev.
The supply chain partners are flexible on the size of orders they make	3.779	0.699
The supermarket does not limit the orders made by the customers	3.753	0.732
Rationing during stock run outs ensures that all customers are served well	3.766	0.688
The supermarket has strict product return policy	3.805	0.662
The supermarket runs promotions to increase sales	3.792	0.707
Customers are allowed to return faulty products which are replaced within short time	3.766	0.709
The anticipated price changes are communicated to shoppers in advance	3.792	0.685
The supermarket organizes competitions and gaming to clear stock faster	3.766	0.714
Aggregate Score	**3.778**	**0.699**

Based on the findings, respondents generally agreed that the supply chain partners are flexible on the size of orders they make (M= 3.779, SD= 0.699); that the supermarket does not limit the orders made by the customers (M= 3.753, SD= 0.732); that rationing during stock run outs ensures that all customers are served well (M= 3.766, SD= 0.688); and that the supermarket has strict product return policy (M= 3.805, SD= 0.662). They were further in agreement that the supermarket runs promotions to increase sales (M= 3.792, SD= 0.707); that customers are allowed to return faulty products which are replaced within short time (M= 3.766, SD= 0.709); that the anticipated price changes are communicated to shoppers in advance (M= 3.792, SD= 0.685); and that the supermarket organizes competitions and gaming to clear stock faster (M= 3.766, SD= 0.714).

The findings indicate that respondents agreed that rationing and gaming practices positively influence the supply chain performance of large-scale retail supermarkets, with an aggregate mean score of 3.778 (SD = 0.699). This result is supported by Panda and Mohanty (2018) highlighted the impact of rationing and gaming behaviors on mitigating the bullwhip effect, particularly in the grocery supply chains, by adjusting supply based on anticipated demand fluctuations. Their study underscores how effective rationing and gaming strategies can smooth out inconsistencies in supply chain operations, thereby improving performance. Similarly, Faizan and Haque (2015) explored how rationing and gaming practices, along with other factors like price fluctuations and order batching, help mitigate operational challenges in supply chains. They found that these practices are integral in managing supply and demand mismatches, ultimately enhancing supply chain performance. These studies affirm the current findings, emphasizing the importance of strategic rationing and gaming in optimizing the supply chain efficiency of large-scale retail supermarkets.

Supply Chain Performance

The general objective was to establish the influence of demand forecasting, order batching, price fluctuations, and rationing and gaming on the supply chain performance of large-scale retail supermarkets in Nairobi City County. Respondents rated their agreement with statements regarding the performance of these supermarkets. The findings are summarized in Table 4.3.

Table 4.3: Descriptive Statistics for Supply Chain Performance

Statements	Mean	Std. Dev.
Product availability is consistently high.	3.831	0.709
On-time delivery is a priority for our supermarket.	3.792	0.685
Inventory management is efficient.	3.805	0.662
Operational efficiency is continuously improving.	3.766	0.709
Aggregate Score	**3.798**	**0.691**

Respondents agreed on average that product availability is consistently high (M= 3.831, SD= 0.709); that on-time delivery is a priority for our supermarket (M= 3.792, SD= 0.685); that inventory management is efficient (M= 3.805, SD= 0.662); and that operational efficiency is continuously improving (M= 3.766, SD= 0.709). The findings indicate that respondents generally agreed that the supply chain performance of large-scale retail supermarkets in Nairobi City County is positively influenced by effective demand forecasting, order batching, price fluctuations, and rationing and gaming, with an aggregate mean score of 3.798 (SD = 0.691). This result is consistent with Paik and Bagchi (2017) who emphasized the critical role of demand forecasting and order batching in reducing variability and inefficiencies in supply chains, highlighting that these practices are fundamental to maintaining stable and efficient supply chain operations. Additionally, Panda and Mohanty (2018) and Faizan and Haque (2015) both recognized the significant impact of managing price fluctuations and implementing rationing and gaming strategies on enhancing supply chain performance, particularly by mitigating the bullwhip effect and optimizing supply-demand balance. These studies collectively underscore the importance of integrating these key practices—demand forecasting, order batching, price management, and rationing and gaming—to achieve superior supply chain performance, which aligns closely with the findings of the current study in the context of large-scale retail supermarkets in Nairobi City County.

Correlation Analysis

The Pearson correlation coefficients were calculated to assess the linear relationships between the study variables. The relationship was considered to be small if $\pm 0.1 < r < \pm 0.29$; medium if $\pm 0.3 < r < \pm 0.49$; and strong if $r > \pm 0.5$. The strength and significance of these relationships are presented in Table 4.4.

Table 4.4: Correlation Analysis

Variables		Supply Chain Performance	Demand Forecasting	Rationing and Gaming
Supply Chain Performance	Pearson Correlation	1.000		
	Sig. (2-tailed)			
	N	154		
Demand Forecasting	Pearson Correlation	0.675**	1.000	
	Sig. (2-tailed)	.000		
	N	154	154	
Rationing and Gaming	Pearson Correlation	0.712**	0.388	1.000
	Sig. (2-tailed)	.000	.108	
	N	154	154	154

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

Demand Forecasting

The correlation analysis reveals a significant positive relationship between demand forecasting and supply chain performance, with a Pearson correlation coefficient of 0.675 ($p<0.05$). This suggests that as the effectiveness of demand forecasting increases, so does the overall performance of the supply chain in large-scale retail supermarkets. The importance of accurate demand forecasting is emphasized by Atemauswa (2019), who found that in the apparel industry, effective demand forecasting contributes to better inventory management, cost-effective investments, and overall improved supply chain performance. Similarly, Njuguna and Ismael (2017) highlighted that demand forecasting is crucial in reducing the bullwhip effect, which in turn enhances the efficiency and effectiveness of supply chain operations. The positive correlation in this study underscores the critical role of demand forecasting in ensuring that supply chains are responsive and efficient, aligning with the findings of these studies.

Rationing and gaming practices also show a strong positive correlation with supply chain performance, with a Pearson correlation coefficient of 0.712 ($p<0.05$). This indicates that effective rationing and gaming strategies significantly contribute to improved supply chain performance. The study by Okoth and Getuno (2020) supports this correlation, as it found that rationing during stock shortages and managing gaming behaviors are crucial for inventory management and overall supply chain efficiency. Their research on inventory management in Kenya's manufacturing sector demonstrated that these practices help mitigate the negative effects of supply chain disruptions, which is consistent with the findings of the current study. The strong correlation here suggests that well-implemented rationing and gaming strategies are vital for maintaining the performance and resilience of supply chains in large-scale retail supermarkets.

Multiple Regression Analysis

Multiple regression analysis was conducted to evaluate the combined effect of the independent variables on the dependent variable, supply chain performance. The results of the regression analysis, including the model summary, ANOVA, and regression coefficients, are presented below.

The beta coefficients provide the magnitude and direction of the impact each independent variable has on supply chain performance.

Table 4. 5: Beta Coefficients of the Study Variables

Variables	Unstandardized Coefficients (B)	Standard Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	1.035	0.174		5.949	0.000
Demand Forecasting	0.285	0.063	0.345	4.524	0.000
Rationing and Gaming	0.296	0.055	0.389	5.364	0.000
Dependent Variable: Supply chain Performance					

The regression equation based on the beta coefficients is as follows:

$Y = 1.035 + 0.285 X1 + 0.296X2$

Where: Y = Supply Chain Performance

X1 = Demand Forecasting

X2 = Rationing and Gaming

The beta coefficient for demand forecasting is 0.285, indicating that for every one-unit increase in the effectiveness of demand forecasting, the supply chain performance of large-scale retail supermarkets improves by 0.285 units, holding all other factors constant. The t-value of 4.524 and the p-value of 0.000 suggest that this relationship is statistically significant. This finding emphasizes the critical role of accurate demand forecasting in enhancing supply chain performance. It aligns with the work of Awanga (2018), who demonstrated that effective demand forecasting leads to better inventory management and more efficient supply chain operations by enabling supermarkets to better anticipate and meet customer demands.

The beta coefficient for rationing and gaming is the highest among the variables at 0.296, indicating that for every one-unit increase in the effectiveness of rationing and gaming practices, supply chain performance improves by 0.296 units, with all other factors held constant. The t-value of 5.364 and the p-value of 0.000 show that this relationship is highly significant. This result highlights the substantial impact of rationing and gaming on supply chain performance. Mathae et al. (2018) support this finding, showing that effective rationing and gaming strategies, especially during periods of supply instability, play a crucial role in ensuring consistent supply chain performance by managing demand fluctuations and preventing stockouts.

Conclusions

The study concludes that effective demand forecasting significantly enhances the supply chain performance of large-scale retail supermarkets. Accurate demand forecasting allows supermarkets to better anticipate customer needs, optimize inventory levels, and reduce the bullwhip effect, leading to improved supply chain efficiency.

Rationing and gaming practices have the most significant impact on the supply chain performance of large-scale retail supermarkets. Effective management of these practices helps mitigate supply chain disruptions, ensure efficient inventory management, and enhance overall supply chain performance.

Recommendations

Demand Forecasting

To maximize the benefits of demand forecasting, large-scale retail supermarkets in Nairobi City County should invest in advanced forecasting tools that incorporate both historical data analysis and market trends. These tools should be integrated with the supermarkets' inventory management systems to ensure accurate and timely predictions. Additionally, supermarkets should conduct regular reviews of their forecasting models and adjust them based on market dynamics and consumer behavior patterns.

Rationing and Gaming

Supermarkets should implement robust rationing and gaming strategies to manage supply and demand effectively during periods of scarcity or excess. These strategies should include clear communication with customers about anticipated stock levels and pricing changes. Additionally, supermarkets should explore the use of promotions and loyalty programs to manage inventory levels and encourage customer retention. Regular monitoring and adjustment of these strategies will help maintain supply chain stability and performance.

Suggestions for Further Studies

While this study has provided valuable insights into the impact of specific supply chain practices on the performance of large-scale retail supermarkets, further research could explore these practices in different retail sectors or regions. Additionally, future studies could investigate the role of emerging technologies, such as artificial intelligence and machine learning, in enhancing demand forecasting. Qualitative research could also be conducted to gain a deeper understanding of the challenges and best practices in implementing rationing and

gaming strategies. Such studies would contribute to a more comprehensive understanding of the factors that influence supply chain performance in various contexts.

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