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IMPROVING INVENTORY MANAGEMENT AT RESTAURANT XYZ: A COMPREHENSIVE ANALYSIS OF SUPPLY CHAIN EFFICIENCY USING ECONOMIC ORDER QUANTITY (EOQ) MODEL

Abstrak

Studi ini menyelidiki implementasi model Economic Order Quantity (EOQ) untuk meningkatkan praktik manajemen inventori di Restoran XYZ. Tujuan utama dari penelitian ini adalah untuk menentukan efikasi dari model EOQ dalam mengoptimalkan rantai pasokan dan mengurangi biaya inventori secara keseluruhan dalam lingkungan yang dinamis dari industri restoran. Mengingat tantangan yang ditimbulkan oleh sifat mudah rusak dari banyak bahan makanan dan permintaan pelanggan yang fluktuatif, penelitian ini menyesuaikan kerangka kerja EOQ tradisional untuk sesuai dengan barang-barang yang mudah rusak dan tidak mudah rusak, dengan tujuan untuk mencapai keseimbangan antara meminimalkan kehabisan stok dan mengurangi kelebihan inventori. Studi ini menggunakan pendekatan kuantitatif, memanfaatkan data penjualan dan inventori historis dari Restoran XYZ untuk menghitung kuantitas pesanan optimal dan membandingkannya dengan praktik inventori yang ada. Temuan menunjukkan bahwa model EOQ, ketika disesuaikan untuk variabel industri tertentu seperti tingkat pembusukan dan variabilitas permintaan, secara signifikan meningkatkan perputaran inventori dan mengurangi pemborosan. Implikasi dari hasil ini menunjukkan bahwa model EOQ, dengan modifikasi tertentu, dapat menjadi alat yang berharga untuk meningkatkan efisiensi finansial dan efektivitas operasional di restoran. Studi ini berkontribusi pada bidang ini dengan menyediakan strategi aplikasi EOQ yang disesuaikan yang meningkatkan manajemen inventori di industri restoran.
Kata Kunci: Manajemen Inventaris, Economic Order Quantity (EOQ), Optimasi Rantai Pasok, Strategi Pengurangan Biaya, Efisiensi Operasional.

Abstract

This research investigates the implementation of the Economic Order Quantity (EOQ) model to enhance inventory management practices at Restaurant XYZ. The primary objective of the study is to determine the efficacy of the EOQ model in optimizing the supply chain and reducing overall inventory costs within the dynamic environment of the restaurant industry. Given the challenges posed by the perishable nature of many food items and the fluctuating customer demand, the research adapts the traditional EOQ framework to suit both perishable and non-perishable items, aiming to achieve a balance between minimizing stockouts and reducing excess inventory. The study employs a quantitative approach, utilizing historical sales and inventory data from Restaurant XYZ to calculate the optimal order quantities and compare them with existing inventory practices. The findings demonstrate that the EOQ model, when adjusted for specific industry variables such as spoilage rates and demand variability, significantly improves inventory turnover and reduces wastage. The implications of these results suggest that the EOQ model, with specific modifications, can be a valuable tool for improving financial efficiency and operational effectiveness in restaurants. This study contributes to the field by providing a tailored EOQ application strategy that enhances inventory management in the restaurant industry.

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Keywords: Inventory Management, Economic Order Quantity (EOQ), Supply Chain Optimization, Cost Reduction Strategies, Operational Efficiency.

INTRODUCTION

Business is an economic activity that involves the production of goods or services that will be sold or exchanged for other goods or services, with one or more people being responsible for or bearing the risk. A restaurant is a business that sells and serves food and beverages to clients, either with or without instruments for processing and storage, and receives legality as a restaurant from related organizations (BPS-Statistics Indonesia, 2023). Food and beverage service activities are growing with tourism development. If it is presented in a modern way and supported by technological developments via social media, it will draw attention and stimulate people's interest in taking part. Furthermore, offering exceptional and unusual meals with a unique and interesting presentation (BPS-Statistics Indonesia, 2023).

Restaurants are commercial establishments where meals are prepared and served to customers. In this context, the concept of the supply chain is implemented to organize and enhance the processes involved in the movement of tangible products (Alt, 2021). The industry has been experiencing rapid growth, compounded by increased consumer demand and evolving dining preferences. However, many restaurants face significant challenges in managing their inventory efficiently, which directly impacts their profitability (Gołaś, 2020). These challenges are not isolated within the restaurant itself but are intricately linked to the broader framework of supply chain management.

Supply chain management encompasses an integrated network that revolves around the central company. It spans from the initial procurement of raw materials to the final product's completion. This extensive network is crucial in addressing the inventory challenges faced by the restaurant industry. Subsequently, it utilizes the company's sales system and transportation network to ensure timely delivery to individual consumers (Fang et al., 2022). This process involves multiple stakeholders, including material suppliers, manufacturers, distributors, retailers, and ultimately, the end-users (Singh & Verma, 2018).

Inventory management is the part of supply chain management that involves planning, implementing, and controlling the flow and storage of goods, services, and related information from origin to consumption to meet customer needs (Singh & Verma, 2018). Inventory (stock) management is a critical operation in manufacturing and supply chain processes (Munyaka & Yadavalli, 2022). The role of inventory management is to ensure that stocks of raw materials or other supplies, i.e., work in progress and finished goods, are kept at levels that provide maximum service levels at minimum costs (MacAs et al., 2021).

Inventory shortage can result in an inability to meet customer demand. This can lead to lost sales to competitors and customer disappointment (Munyaka & Yadavalli, 2022). Mismatches between existing stocks can make efficient stock management difficult this can lead to inventory shortages (MacAs et al., 2021). Supply chain wastes, including overstocking, inefficiencies, and logistical complexity, represent significant challenges for businesses (Ikpe & Shamsuddoha, 2024).

Overstocking in inventory management refers to a situation where a business holds more stock or inventory than is necessary for current or anticipated demand (Hofstra et al., 2022). A stockout is defined as an ineffective shelf restocking process, and it has been recognized as the most significant factor in explaining customer satisfaction (Henrique Rigato Vasconcellos & Sampaio, 2009). The profitability of any business is greatly contingent upon the efficiency of inventory management, achieved through minimizing the costs associated with handling stock and optimizing the production process (Mweshi, 2022). The scope of inventory management encompasses a wide range of activities and processes involved in overseeing and controlling the flow of goods or products within a business (Singh & Verma, 2018).

Therefore, this research aims to conduct a comprehensive analysis of inventory management practices at Restaurant XYZ to optimize supply chain efficiency. Implementing these insights could significantly enhance the restaurant's operational efficiency by ensuring that food and ingredient stocks are maintained at optimal levels, reducing the risk of wastage and minimizing holding costs (Esmail Mohamed, 2024). Through this research, the study will provide actionable insights that could apply to other restaurants facing similar challenges in Indonesia and beyond. This research will not only contribute to the academic field but also offer practical solutions that can lead to substantial improvements in operational practices within the industry.

The Restaurant XYZ aims to maintain an optimal inventory level to meet customer demand, minimize holding costs, and reduce waste. In order to effectively address the issues surrounding inventory management at Restaurant XYZ, it is essential to analyze the existing discrepancies between inventory levels and customer demand across various product categories. The following figures provide a visual representation of the average inventory versus demand for both main dishes and condiments.

Table 1 The Effect of Overstocking on Financial Impact

Effect of Overstocking	Capital	Saving	Percentage
Bakso Kecil	Rp 34.505.769	Rp 8.376.923	24%
Bakso Daging	Rp 47.689.231	Rp 9.874.615	21%
Bakso Urat	Rp 31.197.692	Rp 5.567.692	18%
Bawang Goreng	Rp 1.233.173	Rp 549.519	45%
Saos	Rp 2.509.615	Rp 1.396.154	56%
Kecap	Rp 1.540.385	Rp 963.462	63%
Sambel	Rp 1.238.654	Rp 277.500	22%

Based on Table 1 shows that Kecap and Saos have the highest percentage of savings relative to the capital tied up in overstock, with 63% and 56%, respectively. This indicates a significant opportunity for optimizing inventory levels in these categories to achieve substantial cost savings. Bawang Goreng also shows a high percentage of potential savings at 45%. This data reveals the financial impact of overstocking on the restaurant. For Bakso Daging alone has an overstock saving of Rp 9,874,615, with Rp 47,689,231 in capital tied up.

Based on the result of interviews with the owner of Restaurant XYZ, the authors received information there are significant challenges related to a lack of knowledge about optimal inventory levels for various products. The owner expressed concerns over difficulties in managing inventory accurately, which often leads to either overstocking or understocking both scenarios that negatively impact the restaurant's operations and financial performance.

This misalignment is further evidenced by significant fluctuations in turnover rates for products like Bakso Kecil, suggesting that the inventory system is not effectively synchronized with demand patterns. Inventory generates revenue upon sale; however, unsold inventory ties up capital and excessive stock reduces cash flow (Esmail Mohamed, 2024). Such stockouts not only result in immediate revenue loss but also damage customer trust and satisfaction, which can have long-term negative effects on business reputation and customer loyalty (Lijuan et al., 2023).

METHOD

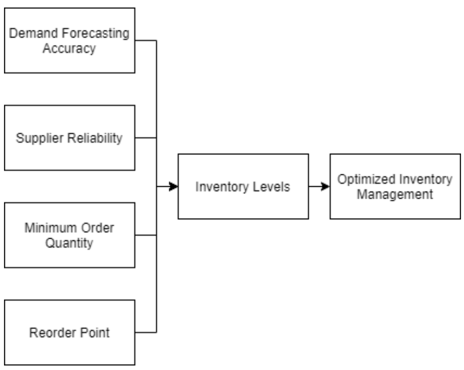

Figure 1 Conceptual Framework

Based on Figure 1 conceptual framework, Economic Order Quantity (EOQ) and Safety Stock are identified as key independent variables that influence Operational Efficiency. The

EOQ model is a cornerstone of inventory management that seeks to determine the optimal order quantity that minimizes the total cost of inventory (Esmail Mohamed, 2024). This includes the costs associated with ordering and holding stock. By calculating the EOQ, restaurants can significantly reduce the cost implications of either ordering too frequently (which increases ordering costs) or ordering too much at once (which increases holding costs). In the context of operational efficiency, implementing EOQ allows the restaurant to streamline its procurement processes, reduce excess expenditure on inventory, and optimize the use of storage space (Lijuan et al., 2023).

Safety stock is a critical component of inventory management, acting as a buffer against uncertainties in demand and supply (Esmail Mohamed, 2024). By maintaining an appropriate level of safety stock, a restaurant can prevent stockouts, ensuring that it can continue to meet customer orders without interruption even when unexpected fluctuations in demand occur or when there are delays in supply. Safety stock is particularly important in the restaurant industry where ingredients are perishable and the cost of a stockout both in terms of lost sales and damaged customer satisfaction can be substantial.

The conceptual framework underscores the pivotal role that EOQ and safety stock play in enhancing operational efficiency within a restaurant setting. By focusing on these aspects, the restaurant not only optimizes its inventory handling but also boosts its overall operational performance, leading to a more economically efficient and customer-centric operation. This model provides a strategic roadmap for Restaurant XYZ to manage its inventory in a way that supports both cost effectiveness and service excellence.

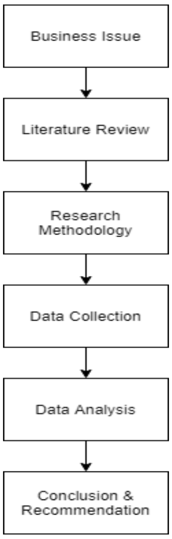

Figure 2 Research Design

The conceptual framework underscores the pivotal role that EOQ and safety stock play in enhancing operational efficiency within a restaurant setting. By focusing on these aspects, the restaurant not only optimizes its inventory handling but also boosts its overall operational performance, leading to a more economically efficient and customer-centric operation. This model provides a strategic roadmap for Restaurant XYZ to manage its inventory in a way that supports both cost effectiveness and service excellence. The Figure 2 outlines the structured approach to the research design intended to assess and optimize inventory management practices at Restaurant XYZ. This design is methodically segmented into six distinct phases, each contributing to a comprehensive understanding of the current challenges and identifying potential improvements through the application of the Economic Order Quantity (EOQ) model.

Each of these phases is crucial and interconnected, ensuring that the research is comprehensive, systematic, and capable of providing actionable insights that could lead to significant improvements in inventory management at Restaurant XYZ. The structured approach not only aids in addressing the specific business issue but also contributes to the broader academic and practical understanding of inventory optimization in the restaurant industry.

Data Collection Method

In the research process aimed at optimizing inventory management at Restaurant XYZ, Interviews with the Owner are instrumental in capturing qualitative insights that quantitative data alone cannot provide. Direct Observations play a crucial role in gathering real-time, tangible data about the restaurant's operations. This method involves systematically observing the day-to-day handling, storage, and replenishment of stock within the restaurant environment. In the research on optimizing inventory management at Restaurant XYZ, a critical component of the data collection process is the examination of Archival Records. This includes a thorough analysis of existing inventory logs, which provide detailed records of stock levels, restocking events, and inventory turnover rates.

Data Analysis Method

The data collected will be analyzed using the following methods:

Statistical Analysis

This subsection will delve into the statistical methods employed to analyze the quantitative data gathered from Restaurant XYZ. It includes the use of descriptive statistics to summarize data points like sales figures, stock levels, and reorder frequencies. The mean is used to calculate the average value of a dataset, providing a central point that summarizes the data. In the context of your research, it's applied to find the average sales volume and inventory levels, which helps identify general trends in data.

$$\bar{x}= \frac{\sum_{i=1}^{n} x_i}{n}$$

Where:

$\bar{x}$ is the mean (average) of the data set,

$\sum_{i=1}^{n}$ xi represent the sum of all data points in the set,

x_i are the individual data points,

n is the total number of data points in the set.

This measure is used to quantify the amount of variation or dispersion of a set of data values. A low standard deviation indicates that the data points tend to be close to the mean, whereas a high standard deviation indicates that the data points are spread out over a wider range.

$$s= \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

Where:

S is the sample standard deviation,

x_i represent each individual data point in the sample,

$\bar{x}$ is the mean of the data points,

n is the total number of data points in the sample.

Inventory Optimization Models

In this research, the focus is strictly on utilizing the Economic Order Quantity (EOQ) model as the primary methodological approach to address the inventory management challenges at Restaurant XYZ. This exclusive concentration on EOQ is deliberate, chosen for its relevancy and potential efficacy in optimizing stock levels in a way that aligns perfectly with the operational and financial nuances of the restaurant. This section focuses on applying key inventory optimization models, including the Economic Order Quantity (EOQ) and Just-In-Time (JIT) systems. The EOQ model is particularly important and is calculated using the formula:

$$EOQ= \sqrt{\frac{2DS}{H}}$$

Where:

D is the demand (quantity of units sold or used annually),

S is the ordering cost per order (cost to place an order or set up equipment),

H is the holding cost per unit per year (cost to hold one unit in inventory for a year).

This model helps determine the optimal order quantity that minimizes the total cost of inventory, including holding and ordering costs. Additionally, safety stock levels are calculated to buffer against variability in demand and supply using the formula:

$$\text{Safety Stock} = Z \times \sqrt{L} \times \sigma$$

Where:
z is the Z-score corresponding to the desired service level,
σ is the standard deviation of demand,
$\sqrt{L}$ is the lead time in days.

These formulas provide a scientific basis for recommending inventory strategies that balance cost and service level effectively. Once the safety stock levels have been established, the subsequent step in refining inventory management practices involves calculating the Reorder Point (ROP). This critical metric ensures that inventory replenishment aligns seamlessly with operational demands and lead times, thereby preventing stockouts and ensuring uninterrupted service. The reorder point is strategically calculated to trigger a new order just as the inventory level reaches a point where it only includes the safety stock. This careful timing is essential, as it balances maintaining enough inventory to meet customer demands against the costs associated with holding excessive stock. The following is used to calculate the reorder point (ROP):

$$ROP = SS + (LT \text{ x } d)$$

Where:
SS is Safety Stock,
LT is Lead Time,
d is the demand.

RESULT AND DISCUSSION

In this chapter, the analysis focuses on evaluating the application of the Economic Order Quantity (EOQ) model to optimize inventory management at Restaurant XYZ. By integrating the EOQ calculations, the restaurant aims to balance the dual objectives of minimizing holding costs and avoiding stockouts, thereby enhancing operational efficiency. The study carefully examines the discrepancies between current inventory levels and the theoretical optimal levels suggested by EOQ, revealing areas of potential improvement. This analytical approach not only aids in identifying cost-saving opportunities but also helps in streamlining the supply chain to better meet consumer demand.

Data Analysis

Inventory and Demand at Restaurant XYZ

Table 2 Inventory and Demand for Main Dishes

Description	Bakso Kecil		Bakso Daging		Bakso Urat	
	Inventory	Demand	Inventory	Demand	Inventory	Demand
TOTAL	5981	4529	5636	4469	3687	3029
Average	115	87	108	86	71	58

The inventory levels for main dishes like Bakso Kecil, Bakso Daging, and Bakso Urat generally exhibit a trend of overstock relative to actual demand, particularly noticeable during certain weeks where inventory significantly exceeds sales. This pattern suggests a potential inefficiency in inventory control, leading to higher holding costs and the risk of spoilage or waste.

Table 3 Inventory and Demand for Condiments

	Bawang Goreng		Saos		Kecap		Sambel	
	Inventory	Demand	Inventory	Demand	Inventory	Demand	Inventory	Demand
TOTAL	1425	790	870	386	534	200	2147	1666
Average	27	15	17	7	10	4	41	32

Product such as Bawang Goreng, Saos, Kecap, and Sambel shows a more variable correlation between inventory and demand. While some weeks align closely with actual sales, other periods show a clear overage or shortage. Sambel often shows a greater variance, indicating a mismatch that could lead to either unmet customer demand or excess inventory, both of which can affect customer satisfaction and cost management.

Unit Costs of Inventory

A. Purchase Costs

Table 4 Purchase Costs

Product	Price	Unit
Bakso Kecil	Rp 300.000	Pack
Bakso Daging	Rp 440.000	Pack
Bakso Urat	Rp 440.000	Pack
Bawang Goreng	Rp 45.000	Kg
Saos	Rp 150.000	Pack
Kecap	Rp 150.000	Pack
Sambal	Rp 30.000	Kg

In this section, we analyze the average purchase costs for key products at Restaurant XYZ, which are critical components in our overall cost structure. Understanding these costs is fundamental for efficient inventory management.

The Table 4 below provides a detailed breakdown of the average costs per unit for various items sold by the restaurant. This includes three types of Bakso (a traditional Indonesian meatball dish) and essential condiments and ingredients used in their preparation. Each item's cost reflects the expense incurred to purchase one unit of the respective ingredient or product.

B. Ordering Costs

Table 5 Ordering Costs for Main Dishes

Description	Price	
Transportation	Rp	20.000
Labor (Porter)	Rp	30.000
Total	Rp	50.000

Table 5 shows ordering costs, particularly transportation expenses, play a significant role in the overall inventory management strategy at Restaurant XYZ. These costs are directly associated with the procurement of goods and ingredients essential for daily operations. The transportation cost listed above represents the fixed cost incurred each time an order is placed, regardless of the order size. The following is the ordering costs for main dishes at Restaurant XYZ.

Table 6 Ordering Costs for Condiments

Description	Price	
Transportation +Porter	Rp	30.000
Total	Rp	30.000

Table 5 highlights the ordering costs associated with the main dishes at Restaurant XYZ. The total ordering costs amount to Rp 50,000, which represents a significant portion of the operational expenses for main dishes. The following is the ordering costs for condiments at Restaurant XYZ. Table 6 presents the ordering costs associated with the condiments at Restaurant XYZ, the total ordering cost for condiments amounts to Rp 30,000, markedly lower than the costs associated with the main dishes

C. Holding Costs

In this section, we examine the annual storage costs at Restaurant XYZ, which include rent, utilities (electricity and water), security, and depreciation costs associated with cold storage facilities. The following is the holding costs at Restaurant XYZ:

Table 7 Holding Costs

Description	Price/Year	
Rent	Rp	35.000.000
Electricity & Water	Rp	54.000.000
Security	Rp	6.000.000
Depreciation Cost of Cold Storage	Rp	2.380.000
Total	Rp	97.380.000

Table 7 outlines the holding costs associated with maintaining the inventory at Restaurant XYZ over a year. The total holding costs sum up to Rp 97,380,000 per year. This breakdown demonstrates the significant recurring expenses the restaurant incurs merely to hold inventory, irrespective of sales. Managing these costs effectively is pivotal to maintaining profitability, emphasizing the importance of optimal inventory levels to minimize unnecessary expenditure on underutilized storage space and resources. The following is the holding costs per product at Restaurant XYZ:

Table 8 Holding Costs per Product

Product	Annual		Per-Week	
Bakso Kecil	Rp	16.282	Rp	313
Bakso Daging	Rp	17.278	Rp	332
Bakso Urat	Rp	26.412	Rp	508
Bawang Goreng	Rp	68.337	Rp	1.314
Saos	Rp	111.931	Rp	2.153
Kecap	Rp	182.360	Rp	3.507
Sambal	Rp	45.356	Rp	872

Table 8 offers a detailed view of the holding costs associated with each product category at Restaurant XYZ. This detailed cost analysis is crucial for Restaurant XYZ to identify areas where cost-saving measures could be implemented, such as optimizing storage practices or reducing inventory levels without impacting product availability. Managing these costs effectively can lead to improved operational efficiency and reduced financial strain from overstocking or under-utilized resources.

The Calculation of Economic Order Quantity (EOQ)

In this subchapter, we delve into the quantitative aspects of inventory management at Restaurant XYZ, focusing specifically on the Economic Order Quantity (EOQ). EOQ is a fundamental formula used in inventory management that determines the most cost-effective quantity of stock to order, considering various costs involved. This section provides a mathematical analysis based on the data collected, aiming to determine the optimal order sizes that will minimize the combined costs of ordering and holding inventory. By calculating the EOQ for each key product at the restaurant, we can establish ordering policies that help balance the inventory costs while maintaining sufficient stock to meet customer demands. This analytical approach not only aids in reducing unnecessary expenditures but also enhances the overall efficiency of the supply chain operations at Restaurant XYZ. The following is a result of the number of product purchases (orders) at restaurant XYZ:

Table 9 Result of Economic Order Quantity

Product	EOQ	Frequency
Bakso Kecil	166,78	28
Bakso Daging	160,83	28
Bakso Urat	107,09	29
Bawang Goreng	26,34	30
Saos	14,38	27
Kecap	8,11	25

Sambel	46,95	36

The results displayed in Table 9 demonstrate the Economic Order Quantity (EOQ) calculations for a variety of products at Restaurant XYZ. The EOQ values vary significantly across different products, indicating the distinct inventory needs and consumption patterns for each. For example, "Bakso Kecil" and "Bakso Daging" show relatively high EOQ values of 166.78 and 160.83 units respectively. This suggests a higher turnover rate and potentially higher demand for these items. In contrast, products like "Kecap" and "Saos" have much lower EOQ values of 8.11 and 14.38 units, respectively, which might reflect less frequent usage or lower sales volume.

The disparity in EOQ values can be attributed to several factors, including the perishability of the items, the storage space required, and the cost implications of holding too much inventory versus the cost of placing frequent orders. For perishable items like "Bawang Goreng" and "Sambel," with EOQ values of 26.34 and 46.95 units respectively, the lower figures likely aim to minimize waste and spoilage, whereas non-perishable items can afford larger quantities without such risks. These results underscore the importance of tailored inventory strategies that consider both economic efficiency and the operational realities of managing a diverse and dynamic inventory in the restaurant industry.

Safety Stock

In inventory management, safety stock acts as a crucial buffer against uncertainties in demand and supply chain disruptions. It ensures that Restaurant XYZ can continue to meet customer orders without interruption, even when faced with unexpected demand surges or delays in replenishment. This section delves into the calculation and importance of safety stock for the restaurant's main dishes and condiments, highlighting how maintaining an optimal safety stock level can prevent stockouts, enhance customer satisfaction, and improve overall operational efficiency. By systematically determining safety stock requirements, Restaurant XYZ can better navigate the challenges of inventory variability and maintain a consistent level of service. To find the safety stock calculation, we must first calculate the standard deviation of demand. The following is the formula used to calculate the standard deviation of demand:

$$\sigma d = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(X-\bar{X})^2}$$

Where:

The following is the standard deviation of demand for each product at Restaurant XYZ:

Table 10 Result of Standard Deviation of Demand

Product	Std
Bakso Kecil	21,507
Bakso Daging	16,239
Bakso Urat	14,378
Bawang Goreng	7,478
Saos	4,286
Kecap	2,531
Sambel	11,910

After determining the standard deviation of demand for each product at Restaurant XYZ, the next step involves calculating the safety stock. Safety stock is crucial in inventory management as it acts as a buffer against variability in demand and supply lead times. By incorporating the standard deviation of demand into the safety stock formula, which typically includes factors such as service level and lead time variability, the restaurant can ensure a sufficient reserve to cover unexpected peaks in demand or delays in replenishment from suppliers. This calculation aims to strike a balance between inventory cost and customer service level, optimizing operational efficiency while minimizing the risk of stockouts. The following is the formula used to calculate Safety Stock:

$$SS = Z \text{ x } \sqrt{LT}(\sigma d)$$

Where:

Z is the z-score corresponding to the desired service level (e.g., Z-score for 95% service level is approximately 1.645),

√LT represents the square root of lead time, which accounts for variability in the time it takes to replenish inventory.

σd is the standard deviation of demand during lead time.

The following is the safety stock for each product at Restaurant XYZ

Table 11 Result of Safety Stock

Product	Safety Stock
Bakso Kecil	13,3721
Bakso Daging	10,0966
Bakso Urat	8,93983
Bawang Goreng	4,64957
Saos	2,66459
Kecap	1,57381
Sambel	7,40489

This calculation results in a safety stock of approximately 14 packs for Bakso Kecil. This safety stock level ensures that the restaurant has enough buffer inventory to cover unexpected increases in demand or delays in supply. This calculation indicates that the safety stock for Bakso Daging should be approximately 11 packs. Maintaining this level of safety stock is essential to mitigate the risks associated with demand variability and lead time uncertainties. By keeping a safety stock of 11 packs for Bakso Daging, the restaurant can minimize the chances of stockouts, which can lead to lost sales and customer dissatisfaction. This calculation shows that the safety stock for Bakso Urat should be approximately 9 packs. This level of safety stock is crucial for managing the risks associated with fluctuations in demand and lead times. Maintaining a safety stock of 9 packs for Bakso Urat helps to prevent stockouts, which can lead to missed sales opportunities and customer dissatisfaction.

This calculation shows that the safety stock for Bawang Goreng should be approximately 5 kg. Maintaining a safety stock of 5 kg for Bawang Goreng is crucial for preventing stockouts, which can lead to missed sales opportunities and customer dissatisfaction. Maintaining a safety stock of 3 packs for Saos is crucial to mitigate the risks associated with demand variability and potential delays in the supply chain. Maintaining a safety stock of 2 packs for Kecap is essential to accommodate variations in demand and potential supply chain disruptions. Maintaining a safety stock of 8 Kg for Sambel is essential to accommodate variations in demand and potential supply chain disruptions.

Reorder Point

Determining the reorder point (ROP) is critical for maintaining seamless operations at Restaurant XYZ. The ROP represents the specific inventory level at which a reorder is necessary to replenish stock before it depletes to a level that could disrupt daily operations. This section will delve into how the ROP is calculated for each product based on the established safety stock and the average lead time. By optimizing the ROP, the restaurant aims to ensure that there is always enough inventory on hand to meet customer demands without holding excessive stock, which ties up capital and space. This strategic approach helps in avoiding potential sales losses due to stock-outs and in maintaining operational efficiency. The following is the formula to calculate the reorder point (ROP):

$$\mathrm{ROP} = \mathrm{SS} + (\mathrm{LT} \times \mathrm{d})$$

Where:

SS is Safety Stock,

LT is Lead Time,

d is the demand.

The following is the reorder point for each product:

Table 12 Estimated Reorder Point

Product	SS	LT (days)	d	ROP
Bakso Kecil	13,372 Packs	$\frac{1}{7}$	87 Packs	25,814 Packs
Bakso Daging	10,097 Packs	$\frac{1}{7}$	86 Packs	22,374 Packs
Bakso Urat	8,940 Packs	$\frac{1}{7}$	58 Packs	17,261 Packs
Bawang Goreng	4,650 Packs	$\frac{1}{7}$	15 Kg	6,820 Packs
Saos	2,665 Packs	$\frac{1}{7}$	7 Packs	3,725 Packs
Kecap	1,574 Packs	$\frac{1}{7}$	4 Packs	2,123 Packs
Sambel	7,405 Packs	$\frac{1}{7}$	32 Kg	11,982 Packs

The Table 12 presents the estimated Reorder Point (ROP) for various products at Restaurant XYZ. This estimation helps ensure that the restaurant maintains a sufficient level of stock to meet the demand without encountering shortages or overstocking, thus optimizing their inventory management. For products like Bakso Kecil and Bakso Daging, with relatively high ROP values of 25,814 and 22,374 packs respectively, the high safety stock and daily demand reflect their popularity and critical role in daily operations. Conversely, items with lower demand like Saos and Kecap show much lower ROP values, suggesting less frequent replenishments are needed.

Comparison of Total Cost

In Subsection, then evaluate the financial implications of differing inventory management strategies. This analysis aims to underscore the contrast between the existing inventory cost structure and the projected outcomes following the adoption of the Economic Order Quantity (EOQ) model. By doing so, we provide a detailed assessment of how the strategic application of EOQ affects the Total Inventory Costs (TIC) across various product lines. The subsection explores the dynamics between Total Ordering Costs (TOC) and Total Carrying Costs (TCC) under each scenario, offering insight into the cost-effectiveness and operational efficiencies gained through EOQ. This comparative analysis not only highlights potential savings but also aligns with broader operational goals, facilitating a deeper understanding of inventory management's impact on overall business performance. The following is the formula to calculate the Total Inventory Costs:

TIC=TOC+TCC

Where:

TIC is Total Inventory Cost,

TOC is Total Ordering Cost and

TCC is Total Carrying Cost.

The following is the Total Inventory Cost Existing:

Table 13 Total Inventory Cost Existing

Product	TOC	TCC	TIC
Bakso Kecil	Rp 4.800.000	Rp 529.151	Rp 5.329.151
Bakso Daging	Rp 4.800.000	Rp 544.264	Rp 5.344.264
Bakso Urat	Rp 4.800.000	Rp 528.234	Rp 5.328.234
Bawang Goreng	Rp 1.440.000	Rp 683.368	Rp 2.123.368
Saos	Rp 720.000	Rp 1.119.310	Rp 1.839.310
Kecap	Rp 660.000	Rp 911.798	Rp 1.571.798
Sambel	Rp 3.660.000	Rp 408.207	Rp 4.068.207

The Table 13 outlines the Total Inventory Costs (TIC) for various products, encompassing both Total Ordering Costs (TOC) and Total Carrying Costs (TCC) within a company before the implementation of the Economic Order Quantity (EOQ) method. Particularly noticeable are the high ordering costs for products like "Bakso Kecil," "Bakso Daging," "Bakso Urat," and "Sambel," which suggest either a high frequency of orders or an inefficient ordering process that could be streamlined with EOQ. Furthermore, "Saos" and "Bawang Goreng" exhibit notably high carrying costs, indicating that these items may require special storage conditions or are held in inventory for longer periods, thereby escalating the associated costs. The following is the Total Inventory Cost using the EOQ model:

Table 14 Total Inventory Cost Using EOQ Model

Product	TOC	TCC	TIC
Bakso Kecil	Rp 1.400.000	Rp 1.357.748	Rp 2.757.747,93
Bakso Daging	Rp 1.400.000	Rp 1.389.391	Rp 2.789.391,30
Bakso Urat	Rp 1.450.000	Rp 1.414.223	Rp 2.864.223,20
Bawang Goreng	Rp 900.000	Rp 899.884	Rp 1.799.884,20
Saos	Rp 810.000	Rp 805.035	Rp 1.615.034,59
Kecap	Rp 750.000	Rp 739.648	Rp 1.489.647,65
Sambel	Rp 1.080.000	Rp 1.064.638	Rp 2.144.638,07

The Table 14 provided illustrates the Total Inventory Costs (TIC) for various products, broken down into Total Ordering Costs (TOC) and Total Carrying Costs (TCC) after the implementation of the Economic Order Quantity (EOQ) model. This data is crucial for evaluating the efficacy of the EOQ model in optimizing inventory management.

Upon implementing EOQ, notable reductions in TOC across products such as "Bakso Kecil," "Bakso Daging," and "Sambel" suggest that EOQ has significantly streamlined the ordering process, reducing costs by minimizing the number of orders needed and thus lowering related administrative and handling expenses. For example, "Bakso Kecil" and "Bakso Daging" have seen their TOC reduced to Rp 1.400.000, demonstrating a more efficient ordering strategy under the EOQ model.

Moreover, the TCC has also shown improvements. "Bawang Goreng" and "Saos," for instance, have experienced a decrease in carrying costs, with "Bawang Goreng" now at Rp 899.884 and "Saos" at Rp 805.035. This reduction can be attributed to better inventory turnover and reduced overstocking, indicating that EOQ has effectively optimized how much inventory is held balancing the need to meet demand without incurring unnecessary holding costs.

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Table 15 Comparison Between Existing and EOQ Model

Product	Existing	Using EOQ Model	Difference	Percentage
Bakso Kecil	Rp 5.329.151	Rp 2.757.748	Rp 2.571.402,72	48%
Bakso Daging	Rp 5.344.264	Rp 2.789.391	Rp 2.554.872,36	48%
Bakso Urat	Rp 5.328.234	Rp 2.864.223	Rp 2.464.011,14	46%
Bawang Goreng	Rp 2.123.368	Rp 1.799.884	Rp 323.484,22	15%
Saos	Rp 1.839.310	Rp 1.615.035	Rp 224.275,76	12%
Kecap	Rp 1.571.798	Rp 1.489.648	Rp 82.150,10	5%
Sambel	Rp 4.068.207	Rp 2.144.638	Rp 1.923.568,73	47%

The Table 15 provides a detailed comparison between the existing inventory costs and those incurred after implementing the Economic Order Quantity (EOQ) model across various products. The data clearly illustrates substantial cost reductions across nearly all product categories, underscoring the effectiveness of the EOQ model in optimizing inventory management.

For products like "Bakso Kecil" and "Bakso Daging," there is a notable cost reduction of 48%, demonstrating that the EOQ model significantly decreases both ordering and holding costs by optimizing order sizes and reducing the frequency of orders. Similarly, "Bakso Urat" shows a 46% decrease in total inventory costs, indicating a successful implementation of EOQ principles that likely minimized overstocking and improved stock turnover.

"Bawang Goreng" exhibits a smaller reduction at 15%, suggesting that while there is an improvement, the product may have specific characteristics or demand patterns that provide less scope for cost reduction through EOQ. It's possible that "Bawang Goreng" requires a different inventory strategy or faces less variability in demand.

On the other hand, "Saos," "Kecap," and "Sambel" also show positive outcomes with the implementation of EOQ, though the reductions are more modest at 12%, 5%, and 47% respectively. The substantial 47% reduction in "Sambel" emphasizes significant efficiency gains, potentially through better alignment of order quantities with actual demand patterns.

Overall, the implementation of the EOQ model across these products has proven to be highly beneficial, leading to a marked decrease in total inventory costs. These reductions not only reflect lower carrying and ordering costs but also suggest an enhanced alignment of inventory levels with market demand, reducing waste and increasing resource utilization efficiency. This performance highlights the strategic value of EOQ in reducing operational costs and improving the financial health of the company.

Business Solution

Based on the previous analysis and calculations, several business solutions can be implemented to optimize inventory management at Restaurant XYZ. The focus will be on utilizing the Economic Order Quantity (EOQ) model, managing safety stock, and establishing appropriate reorder points to enhance efficiency and reduce costs.

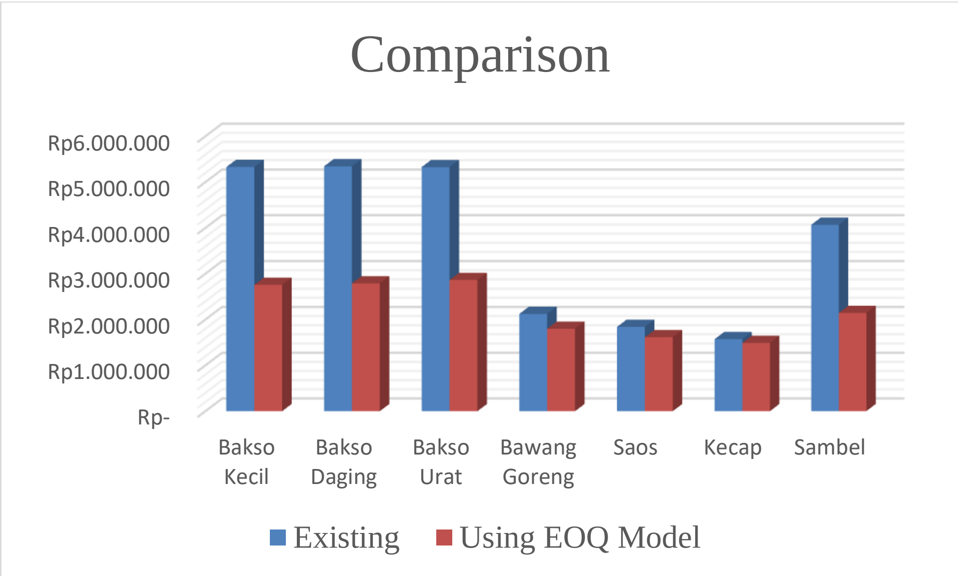

Figure 3 Comparison Between Existing and Using EOQ Model

To begin with, adopting the EOQ model will ensure that each product is ordered in optimal quantities, thus minimizing total inventory costs, which include both holding and ordering costs. The Figure 3 clearly shows substantial cost reductions for products like "Bakso Kecil," "Bakso Daging," and "Bakso Urat" where the differences between the existing and EOQ model costs are most pronounced. This indicates that the EOQ model is particularly effective for these product lines. Thus, a strategic expansion of EOQ implementation to other product categories within the company, or even a deeper integration into these existing categories, could yield even greater savings.

In addition to optimizing order quantities, maintaining safety stock is crucial to buffer against demand fluctuations and supply chain uncertainties. By keeping the calculated safety stock levels, the restaurant can avoid stockouts and ensure a consistent availability of products. For instance, maintaining 14 packs of Bakso Kecil as safety stock will help manage unexpected spikes in demand, thus ensuring that customer needs are met without interruption.

Establishing reorder points is another critical component of the proposed solution. Reorder points trigger the procurement process before stock levels fall too low, ensuring timely replenishment and avoiding the risk of running out of essential items.

Strengthening relationships with suppliers is another vital aspect of the business solution. By ensuring reliable and timely deliveries, and possibly negotiating better terms, the restaurant can maintain optimal inventory levels and reduce lead times. Reliable suppliers are essential for the smooth operation of the supply chain, and collaborating with them can also help in achieving bulk purchase discounts, further reducing costs. Moreover, conducting training sessions for staff on inventory management best practices is crucial. These sessions should cover the importance of EOQ, safety stock, and reorder points, ensuring that the team understands and adheres to these principles. Well-trained staff will improve consistency and efficiency in inventory management, contributing to the overall operational success of the restaurant.

Lastly, it is essential to periodically review and adjust the EOQ, safety stock, and reorder points based on changing demand patterns, seasonality, and market trends. Continuous monitoring and adjustment will help the restaurant adapt to evolving business conditions and maintain optimal inventory levels, ensuring long-term sustainability and efficiency. In conclusion, by implementing these business solutions, Restaurant XYZ can achieve a more efficient and cost-effective inventory management system. The use of the EOQ model, combined with appropriate safety stock and reorder points, will help minimize costs, reduce waste, and ensure that customer demand is consistently met. Investing in technology, strengthening supplier relationships, and training staff will further enhance the restaurant's ability to maintain optimal inventory levels and improve overall operational performance

CONCLUSION

The research conducted on optimizing inventory management at Restaurant XYZ through the implementation of the Economic Order Quantity (EOQ) model has yielded significant insights. The primary objective was to address the inventory challenges faced by the restaurant, characterized by overstocking and misalignment between inventory levels and customer demand. The analysis and calculations provided concrete data to develop an effective inventory management strategy.

The application of the Economic Order Quantity (EOQ) model at Restaurant XYZ involved a detailed analysis and recalibration of inventory practices, focusing specifically on the balancing act between ordering frequency and inventory holding costs. This strategic implementation began with an exhaustive evaluation of historical sales data, demand patterns, and inventory turnover rates for each product category. By integrating these data insights, the EOQ formula was customized to reflect the unique operational dynamics and cost structures of the restaurant.

For instance, "Bakso Kecil" and "Bakso Daging" both exhibited significant reductions in Total Inventory Costs (TIC), with savings amounting to Rp 2,571,402.72 and Rp 2,554,872.36 respectively. These figures demonstrate the effectiveness of the EOQ model in minimizing costs by optimizing order quantities and reducing unnecessary inventory holdings. Similarly, "Sambel" showed a remarkable cost reduction of Rp 1,923,568.73, highlighting the model’s adaptability to different types of inventory, including those with fluctuating demand patterns.

The data underscores that the application of the EOQ model not only aligns inventory levels with actual market demand but also substantially lowers the financial burden associated with overstocking and understocking. "Bawang Goreng" and "Saos," with savings of Rp 323,484.22 and Rp 224,275.76 respectively, further validate the model's utility in managing both high and low turnover products efficiently.

Through the effective application of the EOQ model, Restaurant XYZ was able to create a more resilient and responsive inventory system. This not only streamlined operations but also maximized financial efficiency by precisely aligning inventory investment with business needs. The adoption of EOQ has set a foundational approach for continuous improvement in inventory management, paving the way for future enhancements and adaptations as market conditions evolve.

In conclusion, the research has successfully demonstrated that applying the EOQ model, along with appropriate safety stock and reorder points, can optimize inventory management at Restaurant XYZ. This systematic approach reduces costs, minimizes waste, and ensures that customer demand is consistently met, thereby enhancing the overall efficiency and financial performance of the restaurant

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