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Inventory Analysis of Spare Part Using Always, Better, Control (ABC) and Economic Order Quantity (EOQ) Method in PT. XYZ - Medan

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ABSTRACT

Inventory plays a pivotal role in a company's logistics, serving both to fulfill external customer demands and to enhance internal production efficiency. However, PT. XYZ in Medan did not address yet several cost factors that could significantly influence the overall procurement expenses of spare parts, particularly given that certain spare parts carry notably high purchase prices. While PT. XYZ has been placing orders for spare parts, these are typically initiated only when stock is depleted, based on the assumption that spare parts fall under the category of slow-moving goods. Consequently, it is imperative to conduct an inventory analysis to identify gap between the existing conditions and the outcomes derived from the proposed methodological approach. The methodology used in this study is Always, Better, Control (ABC) method to classify spare parts based on their cost percentage and Economic Order Quantity (EOQ) method to analyze the economic order size, order frequency and optimal ordering time. From the results of data processing that has been done, there are 7 types of spare parts that fall into category A and there is a decrease in Total Variable Cost (TVC) ranging from 13% to 40% from existing conditions. Ordering costs consist of telecommunications costs, labor costs, fuel costs and loading/unloading costs; while storage costs consist of electricity costs and maintenance costs. Scheduling the time of reordering or sending purchase order (PO) to the vendor, the number of spare part units to be ordered and the estimated arrival of spare parts are carried out based on the EOQ calculation that has been compared and adjusted to the previous existing conditions.

Keywords: *ABC; EOQ; Total Variable Cost; Spare Parts; Purchase Order*

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ABSTRAK

Persediaan memiliki peran penting dalam logistik suatu perusahaan baik untuk dapat memenuhi kebutuhan pelanggan eksternal maupun meningkatkan operasional produksi secara internal. PT. XYZ di Medan belum mempertimbangkan beberapa faktor biaya yang memiliki potensi untuk mempengaruhi total biaya pengadaan spare part secara keseluruhan padahal beberapa jenis spare part memiliki harga beli yang cukup tinggi. Pemesanan spare part pada PT. XYZ sudah dilakukan, namun hanya dipesan jika unit sudah habis dengan asumsi bahwa spare part merupakan jenis slow-moving goods. Oleh karena itu, analisis persediaan perlu dilakukan untuk mengetahui gap antara kondisi eksisting dengan hasil perhitungan dari pendekatan yang akan dilakukan. Metodologi yang digunakan dalam penelitian ini adalah metode Always, Better, Control

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(ABC) untuk mengklasifikasikan spare part berdasarkan persentase biayanya dan metode Economic Order Quantity (EOQ) untuk menganalisis ukuran pemesanan ekonomis, frekuensi pemesanan dan waktu optimal pemesanan. Dari hasil pengolahan data yang telah dilakukan, terdapat 7 jenis spare part yang masuk kategori A dan terjadi penurunan total biaya variabel mulai dari 13% hingga 40% dari kondisi eksisting. Biaya pemesanan terdiri dari biaya telekomunikasi, upah karyawan, biaya bahan bakar dan biaya bongkar muat; sedangkan biaya penyimpanan terdiri dari biaya listrik dan biaya perawatan. Penjadwalan waktu pemesanan kembali atau pengiriman purchase order (PO) ke vendor, jumlah unit spare part yang akan dipesan dan estimasi kedatangan spare part dilakukan berdasarkan perhitungan EOQ yang sudah dibandingkan dan disesuaikan dengan kondisi eksisting sebelumnya.

Kata kunci: *ABC; EOQ; Total Variable Cost; Spare Parts; Purchase Order*

INTRODUCTION

Inventory plays a critical element in the operational management of a company, spanning across manufacturing, trading, and service sectors. The inventory held by a company may include raw materials, work-in-process/semi-finished goods, or finished goods ready for sale. Inventory refers to the stock of raw materials, components, and finished goods maintained by a company to support production processes or to meet customer demand. Effective inventory management is a critical determinant of a company's operational success. Nevertheless, it frequently presents significant challenges for organizations, as it involves complexities such as storage costs, demand variability, and the potential risk of product obsolescence [1].

PT XYZ, located in Medan, North Sumatra Province, is a palm oil and rubber plantation company, focusing on the cultivation, processing, and production of Crude Palm Oil (CPO) and palm kernel which are the main raw materials for various industries. Currently, PT XYZ is facing challenges in managing spare parts inventory to meet operational needs without causing excess stock or shortages of materials that can affect production. The company does not employ any systematic method for ordering spare parts because both ordering and holding costs are treated as implicit or invisible costs. As a result, spare parts are replenished only when inventory is depleted, leading to irregular ordering times and fluctuating order quantities (shown at Table 3). Improper inventory management can pose risks at production process if one machine needs to be repaired but the spare parts are not ready yet. The compensation of production losses due to the queuing of repairing time will affect the utility and has possibility to reduce the company's profitability [2]. Therefore, inventory analysis needs to be conducted to prevent the risk that could be happened in term of operational cost and effective strategy to make a plan for how much and when to order.

One approach that can be utilized in inventory analysis is the Always, Better, Control (ABC) method, which categorizes items based on their level of importance and their contribution to total costs [3]. Through this method, companies can classify spare parts according to their usage value and demand level or purchased items and the total cost for spending it in a year, thereby establishing priorities in inventory management. Additionally, the Economic Order Quantity (EOQ) method is applied to determine the optimal order quantity, enabling companies to minimize both ordering and holding costs while ensuring the availability of required spare parts [4].

The ABC method is a technique in logistics management used to classify items into three categories: A, B, and C. Category A comprise approximately 20% of the total number of items but accounts for roughly 80% of the total investment value. Category B consists of about 30% of the items, contributing approximately 15% of the total investment value. Meanwhile, Category C includes around 50% of the items but represents only about 5% of the total investment value. The ABC method can be employed to identify which types of items should be prioritized for control [5] [6].

The EOQ method is one of the oldest classical production scheduling models, developed by Ford W. Harris in 1913. The EOQ model is determined based on ordering costs and holding costs, aiming to minimize the total annual costs incurred by the company [7]. By implementing the EOQ method, companies can optimize order quantities, reduce ordering and holding costs, and ensure the availability of spare parts or raw materials required for the production process [8] [9]. Although the calculation of the Economic Order Quantity (EOQ) appears straightforward as it primarily accounts for ordering and holding costs, it is, in fact, more complex due to the need to identify the fundamental components and derivation of these costs rather than relying solely on assumed values.

In the study conducted by Ricca [10], the ABC method was employed to classify drug inventory based on usage levels, while the EOQ method was utilized to determine the optimal order quantity for each type of drug. Additionally, a Monte Carlo simulation was conducted to predict drug demand, providing insights and considerations for inventory management. The ABC analysis revealed that Category A comprised 19 items (69.11%); Category B included 19 items (20.29%); and Category C consisted of 41 items (10.60%). Based on the EOQ method, the minimum order quantity for drugs was two items, while the maximum was 96 items. Using the reorder point method, the minimum order quantity was zero items, and the maximum was seven items. A similar study was conducted by Nadhifa [11] and Burhan [12], focusing on drug inventory as well related to the emptiness of drugs, but the classification of items in the ABC method was based on investment value. Meanwhile, Supriyadi [13] applied the ABC method to manage beef meatball raw material inventory, using investment value as the basis for classification, and the EOQ method to determine the optimal order quantity.

Nova [14] conducted a study to control spare parts inventory due to frequent occurrences of stock shortages and overstocking. To address this issue, the ABC analysis method was employed to identify priority spare parts, specifically oil types that required control, while the EOQ method was used to determine the optimal quantity of oil-type spare parts to be ordered. Similarly, Wildan [15] utilized the EOQ method to establish an appropriate ordering schedule and quantity for soybean seeds, aiming to minimize the storage costs associated with raw materials.

The study on the inventory patterns of generic drugs conducted by Denada [16] utilized the ABC analysis, EOQ, and Reorder Point methods at a pharmacy, yielding varying Q values for 16 types of generic drugs. The Q values were influenced by differing demand rates, ordering costs, and holding costs for each drug. Similarly, Ayub [17] conduct the ABC analysis and EOQ in the case of wood-based household appliance manufacturing industry which has the problem of stock out for the raw materials (woods), they are Mahoni, Bayur, MDF and Veneer. This combination method is also used by Nendi [18] to analyze the problem of inventory for SME's which produce cookies in Karawang which the raw materials classified as perishable product. The ordering cost consists of telecommunication cost and delivery cost, while the holding cost has merely come from the electricity bill.

In line with previous study utilizing the ABC and EOQ methods either independently or jointly, this study applies both techniques considering more factors and deep calculation approach for its ordering and holding cost to formulate optimal inventory management strategies. The ABC method serves to classify spare parts according to their relative investment significance (shown at Table 1), while the EOQ method facilitates the determination of efficient order timing and quantities. This integrated approach is intended to ensure more systematic and forward-looking spare parts inventory planning. Therefore, this study emphasizes the analysis of inventory control for spare parts to find the best solution of the economic order quantity, order frequency and optimal order time. By considering the ordering cost, holding cost, and the existing condition toward the optimalization of the cost itself; the aims of this study are: (1) to determine spare parts which classifed in category A as the largest contributor in total procurement cost by using ABC method, (2) to compare and analyze total variable cost between existing condition and adjusted EOQ, (3) to determine the schedule of ordering time and estimated material arrival during t-period.

LITERATURE REVIEW

The analytical methods used to address the problem at PT. XYZ are ABC and EOQ. In the initial phase, data is collected concerning the types of stored spare parts and frequently utilized in the warehouse, along with their purchase prices derived from invoices for purchase orders (PO) during t-period. The flowchart provided below illustrates the process for identifying the most effective solution regarding inventory management and its expenses.

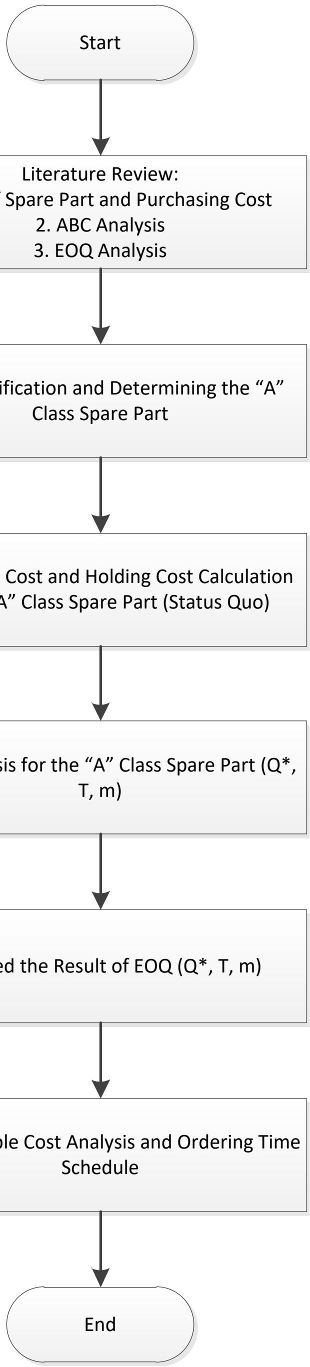

Figure 1. Flowchart of Research Methodology at PT XYZ

According to Table 1, there are seven types of spare parts classified as category A, where the individual purchase prices are relatively high, ranging from Rp450.000 to Rp2.910.000. Those data are taken from a whole year in 2024 for spare parts refer to the closed PO during that year. Furthermore, Table 2 illustrates that the largest share of procurement expenses is attributed to these 7 items in category A which represents 70% of the total procurement cost. Moreover, there are 10 items fall into category B and 13 items in category C. Since the unit price of category A is more expensive than other, this study will examine this category for more detail by using EOQ method. Beside that, it will also concern about overstock and understock condition in determining the use of EOQ in practical level.

Table 1. Result of ABC Inventory Control

No.	Item Code	Item's Name	Usage (Unit/Year)	Price/Unit (x1000 in Rp)	Total Cost/Year (x1000 in Rp)	Percentage	Cumulative	Category
1	7004076	SPEHERICAL ROLLER BEARING 22216 EK "SKF"	70	2.910	203.700	17,0%	17,0%	A
2	7003983	BALL BEARING 6312 2Z/C3 "SKF"	400	450	180.000	15,0%	32,0%	
3	7004945	SPHERICAL BEARING 23022 Cc/C3W33 "SKF"	43	2.700	116.100	9,7%	41,6%	
4	7004305	BEARING 6412 SKF	100	1.115	111.500	9,3%	50,9%	
5	7004103	ALIGNING BALL BEARING 2311K "SKF"	58	1,705	98.890	8,2%	59,1%	
6	7004730	CYLINDRICAL ROLLER BEARING NU 308 ECJ SKF	78	915	71.370	5,9%	65,1%	
7	7004163	BEARING 32213J2/Q SKF	98	580	56.840	4,7%	69,8%	
8	7003923	ALIGNING BEARING 2212 EKTN9 "SKF"	45	1.093	49.185	4,1%	73,9%	B
9	7003923	BALL BEARING 2212 EKTN9 "SKF"	78	600	46.800	3,9%	77,8%	
10	7004075	SPEHERICAL ROLLER BEARING 22213 EK "SKF"	51	872	44.497,5	3,7%	81,5%	
11	7004171	TAPER ROLLER BAERING 33208/Q SKF	80	391	31.280	2,6%	84,1%	
12	7043684	BOLT & NUT C/W RUBBER COUPLING FCL 250	500	58,59	29.295	2,4%	86,6%	
13	7003980	GROVE BALL BEARING 6310-2Z "SKF"	76	350	26.600	2,2%	88,8%	
14	7049063	BOLT & NUT C/W RUBBER COUPLING FCL 200	489	45	22.005	1,8%	90,6%	
15	7003958	BALL BEARING 6012 "SKF"	60	320	19.200	1,6%	92,2%	
16	7005397	BOLT & NUT 1" X 4"	500	39,9	19.950	1,7%	93,9%	
17	7049062	BOLT & NUT C/W RUBBER COUPLING FCL 450	450	35	15.750	1,3%	95,2%	

Table 1. Result of ABC Inventory Control (extended)

No.	Item Code	Item's Name	Usage (Unit/Year)	Price/Unit (x1000 in Rp)	Total Cost/Year (x1000 in Rp)	Percentage	Cumulative	Category
18	7005399	BOLT & NUT 1" X 6" WAJA	321	44,9	14.412,9	1,2%	96,4%	C
19	7013368	TUTUP ASPOTEN U/BEARING 6211	56	250	14.000	1,2%	97,5%	
20	7004187	BEARING 395S/394A TIMKEN	30	375	11.250	0,9%	98,5%	
21	7043685	BOLT & NUT C/W RUBBER COUPLING FCL 160	90	100	9.000	0,7%	99,2%	
22	7005405	BOLT & NUT 1/2" X 3" EYE BRAND	678	4,49	3.044,22	0,3%	99,5%	
23	7005414	BOLT & NUT 3/4" X 3" "MERK TMS	440	4,49	1.975,6	0,2%	99,6%	
24	7005401	BOLT & NUT 1/2" X 1.1/2"	396	3	1.188	0,1%	99,7%	
25	7005417	BOLT & NUT 3/4" X 6" MERK TMS	700	1,151	805,7	0,1%	99,8%	
26	7067195	BOLT & NUT 3/8 X 2"	272	2,59	704,48	0,1%	99,9%	
27	7005394	BOLT & NUT 3/8"X 1"	288	1,89	544,32	0,0%	99,9%	
28	7015202	BAUT SENG 1/4" X 1 1/2"	1000	0,42	420	0,0%	100,0%	
29	7005427	BOLT & NUT 3/8 X 2 1/2"	284	1,18	335,12	0,0%	100,0%	
30	7005415	BOLT & NUT 3/4 " X 4	255	1,038	264,69	0,0%	100,0%	

Table 2. Resume of ABC Inventory Control

Category	Amount of Materials	Percentage of Materials (%)	Purchasing Cost (Rp)	Percentage of Purchasing Cost (%)
A	7	23.3%	838.400.000	70%
B	10	33.3%	304.562.500	25%
C	13	43.3%	57.945.030	5%
Total	30	100%	1.200.907.530	100%

Table 3. Order Distribution for Single Purchase in t-Period

No	"A" Category Item's Name	Month												Total (pcs)
		Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec	
1	SPEHERICAL ROLLER BEARING 22216 EK "SKF"				24				23				23	70
2	BALL BEARING 6312 2Z/C3 "SKF"		80		80		40		80		40		80	400
3	SPHERICAL BEARING 23022 Cc/C3W33 "SKF"				15				13				15	43
4	BEARING 6412 SKF		25			25			25			25		100
5	ALIGNING BALL BEARING 2311K "SKF"						29						29	58
6	CYLINDRICAL ROLLER BEARING NU 308 ECJ SKF			26				26				26		78
7	BEARING 32213J2/Q SKF			27				25			19		27	98
8	BAUT SENG 1/4" X 1 1/2"		300		200		83		150		117		150	1000
9	BOLT & NUT C/W RUBBER COUPLING FCL 250	100		150		100		100				50		500
10	BOLT & NUT 1/2" X 3" EYE BRAND		200		200				100			200		700
Jumlah		100	605	203	519	125	152	151	391		176	301	324	3047

Table 4. Order Distribution for Single Purchase in t-Period

No	Ordering Cost (Rp)	"A" Category Item's Name						
		SPEHERICAL ROLLER BEARING 22216 EK "SKF"	BALL BEARING 6312 2Z/C3 "SKF"	SPHERICAL BEARING 23022 Cc/C3W33 "SKF"	BEARING 6412 SKF	ALIGNING BALL BEARING 2311K "SKF"	CYLINDRICAL ROLLER BEARING NU 308 ECJ SKF	BEARING 32213J2/Q SKF
1	Telecommunication Cost/ Year	2.400.000	2.400.000	2.400.000	2.400.000	2.400.000	2.400.000	2.400.000
	Daily	8.000	8.000	8.000	8.000	8.000	8.000	8.000
	Per Order	469	2,.668	289	777	1.121	1.031	980
2	Labor Cost/ Month	3.000.000	3.000.000	3.000.000	3.000.000	3.000.000	3.000.000	3.000.000
	Daily	120.000	120.000	120.000	120.000	120.000	120.000	120.000
	Per Order	7.042	24.566	4.338	11.650	16.818	15.466	14.696
3	Fuel Cost/Year	31.248.000	31.248.000	31.248.000	31.248.000	31.248.000	31.248.000	31.248.000
	Daily	104.760	104.760	104.760	104.760	104.760	104.760	104.760
	Per Order	6.148	21.446	3.787	10.170	14.682	13.502	12.829
4	Loading/Unloading Cost per Year	2.500.000	2.500.000	2.500.000	2.500.000	2.500.000	2.500.000	2.500.000
	Daily	100.000	100.000	100.000	100.000	100.000	100.000	100.000
	Per Order	5.868	20.472	3.615	9.708	14.015	12.888	12.246
	Total Per Order	19.528	69.153	12.029	32.304	46.636	42.886	40.751

Upon identifying the spare parts classified under category A, the Economic Order Quantity (EOQ) calculation is conducted, incorporating two primary cost components: ordering costs and holding costs. In the case study at PT. XYZ, ordering costs consist of telecommunications costs, labor costs, fuel costs, and loading/unloading costs. Conversely, holding costs within the warehouse include electricity and maintenance expenses. Table 3 illustrates the distribution of orders for each type of spare part in category A, derived from the PO history of the preceding year. The quantity of spare parts ordered per period is aggregated horizontally to ascertain the annual demand for each spare part type and vertically to identify the spare parts included in a single PO. This data is subsequently utilized to compute the ordering cost (shown at Table 4), based on the percentage weight of each material per order whether annually or monthly. Each component of the ordering cost is calculated in proportion to its weight so that the cost per order can be determined.

Table 5. Holding Cost

No	"A" Category Item's Name	Demand/Year	∑Unit/Slot	Dedicated Slot	Holding Cost (Rp/unit/year)
1	SPEHERICAL ROLLER BEARING 22216 EK "SKF"	70	10	7	3.500
2	BALL BEARING 6312 2Z/C3 "SKF"	400	20	20	1.750
3	SPHERICAL BEARING 23022 Cc/C3W33 "SKF"	43	20	15	2.442
4	BEARING 6412 SKF	100	7	15	2.450
5	ALIGNING BALL BEARING 2311K "SKF"	58	4	29	2.414
6	CYLINDRICAL ROLLER BEARING NU 308 ECJ SKF	78	7	12	3.141
7	BEARING 32213J2/Q SKF	98	5	20	1.786

The storage cost of each type of spare parts (shown at Table 5) is calculated by considering the demand in a year, the number of dedicated storage slots on the shelves needed in a year, and the number of units in each slot. The storage cost components come from electricity and warehouse maintenance costs. After obtaining the ordering cost and storage cost for each type of spare part, the optimal order size (Q*), ordering frequency (m), and optimal ordering time (T) are calculated. The initial calculation results of the EOQ method are adjusted by considering the demand per year and the cost of purchasing spare parts if there is overstock (shown at Table 6). Meanwhile, Table 7 shows the existing conditions of the ordering frequency and optimal ordering time that PT. XYZ has carried out.

Table 6. Adjusted EOQ

No	"A" Category Item's Name	Original			Adjusted			Demand/ Year
		Q*	m	T	Q*	m	T	

1	SPEHERICAL ROLLER BEARING 22216 EK "SKF"	28	3	120	24	3	100	70
2	BALL BEARING 6312 2Z/C3 "SKF"	178	3	133	134	3	100	400
3	SPHERICAL BEARING 23022 Cc/C3W33 "SKF"	21	3	144	15	3	100	43
4	BEARING 6412 SKF	51	2	154	50	2	150	100
5	ALIGNING BALL BEARING 2311K "SKF"	47	2	245	29	2	150	58
6	CYLINDRICAL ROLLER BEARING NU 308 ECJ SKF	46	2	178	39	2	150	78
7	BEARING 32213J2/Q SKF	67	2	205	49	2	150	98

Table 7. Existing Frequency and Lead Time of PT XYZ

No	"A" Category Item's Name	Order Frequency/Year	Lead Time (month)	Lead Time (days)
1	SPEHERICAL ROLLER BEARING 22216 EK "SKF"	3	4	100
2	BALL BEARING 6312 2Z/C3 "SKF"	6	2	50
3	SPHERICAL BEARING 23022 Cc/C3W33 "SKF"	3	4	100
4	BEARING 6412 SKF	4	3	75
5	ALIGNING BALL BEARING 2311K "SKF"	2	6	150
6	CYLINDRICAL ROLLER BEARING NU 308 ECJ SKF	3	4	100
7	BEARING 32213J2/Q SKF	4	3	75

Table 8. Total Variable Cost

No	"A" Category Item's Name	TVC Company (Rp)	TVC Adjusted EOQ (Rp)	Percentage Decrease (%)

1	SPEHERICAL ROLLER BEARING 22216 EK "SKF"	100.584	100.584	0
2	BALL BEARING 6312 2Z/C3 "SKF"	532.168	324.709	39
3	SPHERICAL BEARING 23022 Cc/C3W33 "SKF"	54.400	54.400	0
4	BEARING 6412 SKF	159.842	95.233	40
5	ALIGNING BALL BEARING 2311K "SKF"	128.271	128.271	0
6	CYLINDRICAL ROLLER BEARING NU 308 ECJ SKF	169.493	147.023	13
7	BEARING 32213J2/Q SKF	185.326	125.252	32

Based on the outcomes of the adjusted Economic Order Quantity (EOQ) calculation from Table 6 and the current operational practices implemented at PT. XYZ, the Total Variable Cost (TVC) is computed for both scenarios to evaluate the extent of potential cost reduction achievable for each spare part classified under category A. The mathematical formulations by Tersine [19] employed to determine the EOQ and TVC are outlined as follows:

$$Q^* = \sqrt{\frac{2CR}{H}} \quad \text{.... (1)}$$

$$m = \frac{R}{Q^*} \quad \text{.... (2)}$$

$$T = \frac{1}{m} \quad \text{.... (3)}$$

$$TVC\,(Q^*) = \frac{CR}{Q^*} + \frac{HQ^*}{2} \quad \text{.... (4)}$$

where,

Q* = economic order quantity
R = annual demand in units
C = ordering cost per order
H = holding cost per unit per year
m = number of orders during year
T = order interval
TVC (Q*) = Total Variable Cost

As illustrated in Table 8, a notable reduction in costs is observed for several spare parts, with the percentage decrease ranging from 13% to 40%. The most significant reduction at 40% is observed for the BEARING 6412 SKF, where the ordering frequency decreased from 4 times per year to 2 times per year. Similarly, the BALL BEARING 6312 2Z / C3 "SKF" has 39% reduction, with its ordering frequency decreasing from 6 times per year to 3 times per year. The BEARING 32213J2 / Q SKF has 32% reduction, as its ordering frequency was adjusted from 4 times per year to 2 times per year. In contrast, the smallest reduction of 13% was recorded for the CYLINDRICAL ROLLER BEARING NU 308 ECJ SKF, where the ordering frequency decreased from 3 times per year to 2 times per year. For the remaining three spare parts, no percentage reduction was observed, as their Total Variable Cost (TVC) remained unchanged, and their adjusted ordering frequencies aligned with the existing conditions. This significant decrease in the TVC percentage, when compared with the studies conducted by Pararach [6]; Ariana [2]; and Wardana [20], reflects the company’s condition before implementing a formal ordering system such as EOQ. The robustness of this calculation is expected to strengthen as more detailed data are utilized to accurately determine the fundamental basis of ordering and holding costs.

Table 9. Proposed Order Release and Estimated Arrival Schedule

No	Spare Part	Dec (T-1)	Jan (T)	Feb (T)	March (T)	Apr (T)	May (T)	June (T)	July (T)	August (T)	Sept (T)	Oct (T)	Nov (T)	Dec (T)	Jan (T+1)
1	SPEHERICAL ROLLER BEARING 22216 EK "SKF"					Material Arrival				Material Arrival				Material Arrival	
		PO Release				PO Release				PO Release				PO Release	
2	BALL BEARING 6312 2Z/C3 "SKF"					Material Arrival				Material Arrival				Material Arrival	
		PO Release				PO Release				PO Release				PO Release	
3	SPHERICAL BEARING 23022 Cc/C3W33 "SKF"					Material Arrival				Material Arrival				Material Arrival	
		PO Release				PO Release				PO Release				PO Release	
4	BEARING 6412 SKF							Material Arrival						Material Arrival	
		PO Release						PO Release						PO Release	
5	ALIGNING BALL BEARING 2311K "SKF"							Material Arrival						Material Arrival	
		PO Release						PO Release						PO Release	
6	CYLINDRICAL ROLLER BEARING NU 308 ECJ SKF							Material Arrival						Material Arrival	
		PO Release						PO Release						PO Release	
7	BEARING 32213J2/Q SKF							Material Arrival						Material Arrival	
		PO Release						PO Release						PO Release	

plan and material arrival schedule were developed to assist the purchasing and PPIC (Production Planning and Inventory Control) staff at PT. XYZ in comprehending the analysis outcomes aimed at enhancing the inventory control process for category A spare parts. The ordering period, as outlined in Table 9, was determined by considering the optimal ordering frequency over a one-year horizon, along with the time intervals between orders as specified in Table 6. Given that the warehouse operates on a 25-working-day month, receiving and storage activities are scheduled exclusively on weekdays to align with operational constraints. This structured approach ensures a systematic and efficient inventory management process, contributing to improved cost-effectiveness and operational performance.

CONCLUSION

This study addresses a practical case in the field of inventory control for spare parts at PT. XYZ, focusing on product categorization and analytical optimization of order frequency and quantity to minimize total costs. The spare parts are classified as slow-moving goods, which implies that the reorder point does not need to be explicitly considered. This assumption is based on the premise that the remaining stock will be depleted by the time the next purchase order is fulfilled within the specified time period (t-period). As a result, the reorder point effectively aligns with the Economic Order Quantity (EOQ), leading to a unique saw-tooth inventory pattern that reflects this relationship.

In addressing this problem, two analytical methodologies were employed: the ABC and the EOQ method. The ABC method facilitates the categorization of inventory items based on their relative value contribution, where items accounting for approximately 70% of the total inventory value are classified into distinct categories. Through this analysis, it was determined that 7 spare parts fall into Category A, 10 into Category B, and 13 into Category C. Category A, representing the highest value items, constitutes 70% of the total annual purchasing expenditure, despite comprising a smaller proportion of the total inventory volume. This indicates that the spare parts in Category A represents a significantly higher unit value compared to those in other categories. Furthermore, the EOQ method was utilized to optimize inventory management by determining the most cost-effective order quantity, order frequency, and lead time for future procurement. This model takes into account both ordering costs and holding costs to minimize total inventory-related expenses while ensuring adequate stock levels.

The ordering costs consist of several components, including telecommunication expenses, labor costs, fuel costs, and loading/unloading costs. Telecommunication costs arise from activities such as the purchasing staff contacting vendors to negotiate terms, including minimum order requirements, bulk order discounts, spare part quality, delivery timelines and others. Labor costs are derived from the monthly salary of drivers, while fuel costs are calculated based on the annual fuel consumption of a single vehicle. Loading/unloading costs are associated with the handling of materials during the transfer process between trucks and warehouses, both at the vendor and customer locations. On the other hand, holding costs include expenses related to electricity and warehouse maintenance, which are incurred for storing the spare parts.

The results of the ordering and holding costs are utilized to determine the total variable cost by analyzing key parameters such as the economic order quantity (Q^*), order frequency (m), and order interval (T). This analysis enables a comparison between the adjusted calculations derived from the EOQ method and the existing inventory management scenario. The findings reveal that the total relevant cost is significantly influenced by the frequency of orders, with a notable percentage reduction observed when transitioning from the existing scenario to the adjusted EOQ calculations. Specifically, four types of spare parts demonstrated substantial cost reductions, ranging from 13% to 40%. Based on this analysis, a proposed order schedule and estimated delivery timeline have been developed to assist the company in better understanding and implementing the ABC and EOQ methods for effective inventory process control. This approach aims to optimize inventory management, reduce costs, and enhance operational efficiency.

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