JSTI
Jurnal Sistem Teknik Industri

Analysis of Consumable Material Inventory Control in Brake System Company

Afiqoh Akmalia Fahmi[1], Arinda Soraya Putri[2], and Dani Setiyawan[3]*

[1,2,3]Department of Industrial Engineering, Universitas Muhammadiyah Surakarta, Jl. A. Yani, 57169, Surakarta, Indonesia

Abstract. A good raw material and consumables control planning system is important in the production process so that the process runs according to schedule and target. Brake system company is a manufacturing company engaged in brake systems. Concerning the control of consumable material, this company often experiences overstock in warehouses, causing an overrun in inventory costs and investment cannot develop. One of these conditions can be influenced by the ordering method applied by the company which is still not appropriate. The purpose of this study is to find out and provide proposed to companies related to the cost of consumable inventory by comparing the three methods of determining lots based on Fixed Order Quantity (FOQ), Economic Order Quantity (EOQ), and Fixed Order Quantity Proposed (FOQ Proposed) is the FOQ method combined with the Lot for Lot (LFL) principle to determine the method with the most optimal inventory cost. From the results of the study, it is known that the Proposed FOQ method has the lowest total inventory cost compared to the other two methods. The proposed FOQ approach could reduce inventory costs by up to one-third times the previous cost.

Keyword: Inventory Control, Consumable Material, FOQ, EOQ, Inventory Cost

Abstrak. *Sistem perencanaan pengendalian bahan baku dan bahan habis pakai yang baik penting dalam proses produksi agar proses berjalan sesuai jadwal dan target. Perusahaan sistem rem adalah perusahaan manufaktur yang bergerak di bidang sistem rem. Terkait dengan pengendalian bahan habis pakai, perusahaan ini sering mengalami overstock di gudang sehingga menyebabkan biaya persediaan membengkak dan investasi tidak dapat berkembang. Kondisi tersebut salah satunya dapat dipengaruhi oleh metode pemesanan yang diterapkan oleh perusahaan yang masih kurang tepat. Tujuan dari penelitian ini adalah untuk mengetahui dan memberikan usulan kepada perusahaan terkait biaya persediaan consumable dengan membandingkan ketiga metode penentuan lot berdasarkan Fixed Order Quantity (FOQ), Economic Order Quantity (EOQ), dan Fixed Order Quantity Usulan. (FOQ Proposed) adalah metode FOQ yang dikombinasikan dengan prinsip Lot for Lot (LFL) untuk menentukan metode dengan biaya persediaan yang paling optimal. Dari hasil penelitian diketahui bahwa metode usulan FOQ memiliki total biaya persediaan paling rendah dibandingkan kedua metode lainnya. Pendekatan FOQ yang diusulkan dapat mengurangi biaya persediaan hingga sepertiga kali lipat dari biaya sebelumnya.*

Kata Kunci: Pengendalian Persediaan, Bahan Habis Pakai, FOQ, EOQ, Biaya Persediaan

1. Introduction

Effectiveness and efficiency are the goals of every business actor or business to be able to compete. Increased effectiveness and efficiency can be done in different ways. An organization or enterprise consists of several departments. One of the departments that has an important role in the effectiveness and efficiency of the company is inventory planning and control. Inventories that include raw materials, semi-finished goods, as well as consumables, are critical to the success of a manufacturing organization [1]. A good raw material control planning system is needed for the production process to run smoothly [2]. Well-managed inventory will affect the decrease in the production costs of an enterprise [3]. Inventory needs to consider several factors, including limited storage space, storage costs, purchase costs, and factors of deterioration in the quality of goods [4]. Conditions like this encourage companies to have a strategy in planning the needs of the production process, both for the needs of product raw materials and the needs of consumable materials. Consumable material is a material that is used disposable to support the production process.

There are several methods commonly used to carry out inventory control. The continuous policy approach to inventory control, which assumes that the quantity of products in the warehouse equals the number of goods in a deterministic system, results in constant lot sizes for orders with varying times between them [5]. Economic Order Quantity is a method commonly used in order to achieve optimal inventory levels and be able to minimize stockouts [6]. In addition, an inventory control method that is often applied in companies is fixed order quantity (FOQ). The FOQ system has a fixed number of orders, but the interval between orders may vary [7]. The implementation of inventory control in the company needs to be carried out so as not to interfere with the production process.

Brake system company is a manufacturing company engaged in braking systems. Control of consumable *materials* this company often experiences overstock in warehouses, causing overruns in inventory costs and investment bottlenecks due to the storage of these goods. The larger the goods in the warehouse, the greater the costs that must be incurred for storage [8]. In addition, because the cost of supplies or funds is bound, warehouse stocks will increase as demand decreases because supplies cannot meet demand [9]. Consumable material*s* used to support the production process at the company has a variety of depending on the needs of each process, such as gloves for the production process, plastic clamps for the packing process, and brushes and thinners for the plating/dyeing process. The consumable *materials* control and ordering system that has been applied in the company uses the Fixed Order Quantity (FOQ) method based on the weekly time reference for ordering goods. When the company implements FOQ, the company will continue to order goods even though the inventory in the warehouse is still available and even sufficient. This condition results in greater inventory costs. The cost of inventory is composed of the cost of storing per unit or holding cost and the cost of ordering per order and makes the investment that could have been allocated to places that are more in need become stuck due to storage on the goods. Based on these problems, alternative inventory control methods are needed that are in accordance with the conditions of the company. This study aims to analyze the

appropriate inventory control methods by comparing three methods, namely EOQ, FOQ, and FOQ proposed,and to provide proposals for appropriate inventory control methods for the company.

2. Related Work

Inventory is the material and supply owned by the company to be sold or used in the production process. Inventory in the company has an important role because it is one of the components that make the company profitable or lose. Inventory can be in the form of raw goods, semi-finished goods, finished goods, and supporting materials in the production process [10]. Inventory control is applied by the company so that the delivery of goods in and out is stable and does not harm the company.

Many researchers have carried out research on inventory control. Inventory control using the EOQ method is widely applied in enterprises. The company uses the EOQ method to control the raw material inventory of the construction company [11][12]. Which results in more economical inventory costs. In addition, this EOQ method is also successfully applied in continuous product companies such as cement companies [13]. EOQ is widely applied because it is easy and effective to control inventory and reduce inventory cost [14]. The entire cost of ordering and holding is minimized using the EOQ model, one of the independent demand models. As the quantity requested rises, the overall number of orders placed each year will drop. As a result, the annual setup or ordering cost will drop as the quantity ordered rises. But because of the higher average inventories that are maintained, the holding cost will additionally increase as the order quantity does [15].

In addition to the EOQ method, some researchers use other methods to control inventory. These methods include Fixed order quantity (FOQ). The FOQ method has succeeded in helping the culinary industry in controlling raw materials. The culinary industry is quite able to reduce inventory costs with this method [16]. This method is also used in various industries to help control inventory, such as PT Freeport uses the FOQ Method also called the Q System to design a carpet inventory system in one of its departments [17], office stationery supplies distributor [18], and raw materials in Muslim clothing manufacturers [19].

In inventory control, the quantity of goods is very important to consider. There are many methods used to determine the lot size that needs to be ordered, one of which is the lot-for-lot (L4L) method. The lot-for-lot method in principle determines the lot sizing of orders whose amount is equal to the quantity of demand in the period, while the order is made in the period before the goods are needed according to the lead time [20]. This method has been widely applied in the control of raw material inventory [16], [21].

3. Methodology

This study will compare three inventory control methods, namely Fixed Order Quantity (FOQ), Economic Order Quantity (EOQ), and Proposed Fixed Order Quantity (FOQ). First, perform data processing using FOQ. Fixed Order Quantity (FOQ) is a method used to place orders for the same number of units. Using trial and error based on the experience of managers [16]. This method is calculated based on the company's minimum amount of inventory. The total order quantity for the minimum inventory as quantity of needs (per day) can be calculated in Equation (1) [22].

$$\text{Quantity of needs (per day)} = (T \times LT) + SS \tag{1}$$

Where T is defined as the average usage/day, LT is defined as lead time, and SS is defined as safety stock. The calculation of FOQ is carried out based on the method already applied by the company, namely determining Secondly, performing calculations with the EOQ method. The Economic Quantity Order (EOQ) approach is used to determine the number of consumable materials based on the cost of storage and the cost of messages with the orientation of minimizing inventory costs. The magnitude of the EOQ unit can be calculated in Equation (2) [23].

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

Where EOQ is defined as Economic Order Quantity, D is defined as the average number of uses per unit of time, S is defined as the ordering cost, and H is defined as Holding Cost.

Third, perform calculations using the proposed FOQ method. The approach with the proposed FOQ is the FOQ method that has been implemented in the company combined with the Lot for Lot (LFL) principle. The method that has been applied by the company is carried out once a week, while in the proposed method this is carried out every day. Fourth, compare the total cost of inventory between the three methods. The result of the lowest total inventory cost becomes a recommendation method in inventory control.

4. Result and Discussion

4.1. Data Consumable Material

Consumable materials used to support the production process at Brake system Company there are several kinds, such as gloves for the production process, plastic clamps for the packing process, brushes and thinners for the plating / dyeing process. Table 1 shows lead time data, units of material type, and average daily usage.

Table 1 Data Consumable Materials

No	Item Name	Lead time (day)	Unit	Average Usage / day
1	Red Rubber Gloves	1	12 Pcs	45
2	Hair Cap	1	50 Pcs	7
3	Plastic Bambi A4	1	1 Pcs	125
4	Stappler Unoair	1	1000 Pcs	3
5	Pylox CLEAR	1	1 Pcs	2
6	Straping band 0.5	1	1 Pcs	7
7	Clamp Plastic	1	12 Pcs	72
8	Nabakem SR 600	1	1 Bottle	2
9	Stick plastic glue	1	12 Pcs	3
10	Plastic band 5/8	1	5 roll	4
11	Sponge Roller	1	12 Pcs	3
12	Painting brush No 9	1	12 Dozen	3
13	Color majun	1	5 kg	88
14	Thiner ND COBRA	1	1 L	9
15	White marker SNOW	1	12 Pcs	40

4.2. Inventory Cost of Consumable Material

The inventory cost of consumable materials consists of purchasing costs, holding costs, and ordering costs. Purchasing costs and ordering costs are obtained based on company data. Storage costs are assumed to be 1% of the purchase cost [24]. These costs are the constituent components of supply costs. In this case, total cost inventory consists of holding cost and ordering cost. Table 2 describes the cost of each material.

Table 2 Data Cost of Material

No	Item Name	Lead Time (day)	Unit	Purchasing Cost (Rp/unit)	Holding Cost (Rp/unit)	Ordering Cost (Rp/order)
1	Red Rubber Gloves	1	12 Pcs	87,000	870	17,247
2	Hair Cap	1	50 Pcs	15,000	150	2,683
3	Plastic Bambi A4	1	1 Pcs	1,200	12	47,908
4	Stappler Unoair	1	1000 Pcs	2,500	25	1,150
5	Pylox CLEAR	1	1 Pcs	26,000	260	767
6	Straping band 0.5	1	1 Pcs	86,000	860	2,683
7	Clamp Plastic	1	12 Pcs	4,500	45	27,595
8	Nabakem SR 600	1	1 Bottle	135,000	1,350	767
9	Stick plastic glue	1	12 Pcs	14,450	145	1,150
10	Plastic band 5/8	1	5 roll	32,400	324	1,533
11	Sponge Roller	1	12 Pcs	70,000	700	1,150
12	Painting brush No 9	1	12 Dozen	44,000	440	1,150
13	Color Majun	1	5 kg	28,000	280	33,728
14	Thiner ND COBRA	1	1 L	23,000	230	3,449
15	White marker SNOW	1	12 Pcs	126,000	1,260	15,331

4.3. FOQ Method (Company Method)

The FOQ method is commonly used by this company. FOQ completion based on the calculation of average item/month usage over the last 3 months divided by 4 to get the number of orders per week plus a safety stock of 0.2 times the amount per week. This calculation is based on those already applied by the company. The company determines the order quantity calculated using the daily average multiplied by the lead time plus the safety stock. As for the working day in 1 week

is 6 days. The booking time applied by the company is every week once. The calculation of the order quantity of red rubber gloves is using Equation (1). From equation (1), we found that the quantity of needs (per day) of red rubber gloves was 54 and the order quantity (weekly order in 6 days) was 324. Based on these calculations, a total of 6,349 storage for red rubber gloves was obtained. The amount of inventory cost can be seen in Table 3.

Table 3 Calculation of FOQ Method (Company Method)

Item	Unit	Holding Cost			Ordering Cost			Inventory Cost (Rp)
		Holding	Holding Cost (Rp/unit)	Total Holding Cost (Rp)	Order Frequency	Ordering Cost (Rp/order)	Total Ordering Cost (Rp)	
Red Rubber Gloves	12 Pcs	6,349	870	5,523,630	4	17,247	68,988	5,592,618
Hair Cap	50 Pcs	1,116	150	167,400	4	2,683	10,732	178,132
Plastic Bambi A4	1 Pcs	15,903	12	190,836	4	47,908	191,632	382,468
Stappler Unoair	1000 Pcs	389	25	9,725	4	1,150	4,600	14,325
Pylox CLEAR	1 Pcs	203	260	52,780	4	767	3,068	55,848
Straping band 0.5	1 Pcs	988	860	849,680	4	2,683	10,732	860,412
Clamp Plastic	12 Pcs	10,123	45	455,535	4	27,595	110,380	565,915
Nabakem SR 600	1 Bottle	304	1,350	410,400	4	767	3,068	413,468
Stick plastic glue	12 Pcs	361	145	52,345	4	1,150	4,600	56,945
Plastik band 5/8	5 Roll	556	324	180,144	4	1,533	6,132	186,276
Sponge Roller	12 Pcs	503	700	352,100	4	1,150	4,600	356,700
Painting brush No 9	12 Pcs	503	440	221,320	4	1,150	4,600	225,920
Color Majun	5 Kg	11,444	280	3,204,320	4	33,728	134,912	3,339,232
Thiner ND COBRA	1 L	1,255	230	288,650	4	3,449	13,796	302,446
White marker SNOW	12 Pcs	5,310	1,260	6,690,600	4	15,331	61,324	6,751,924
Total Inventory Cost				18,649,465			633,164	**19,282,629**

$$\text{Total Cost} = (\text{Holding} \times \text{Holding Cost}) + (\text{Order Frequency} \times \text{Ordering Cost}) \qquad (3)$$

Where Holding is defined as the number of goods stored in the warehouse, holding cost is defined as the cost of storing goods in the warehouse, Order Frequency is defined as the number of frequencies of purchase of goods, and Ordering Cost is defined as the cost of ordering goods. From equation (3), we found that the total cost for red rubber gloves was Rp5.592.618. Then, we calculated the total inventory cost for all of the goods, we found that the total inventory cost of Rp19.282.629, which is the sum of all inventory costs of items. This cost is based on Company's method for inventory control.

4.4. EOQ Method

The EOQ approach is used to calculate the amount of consumable materials based on the cost of order and storage, with the goal of reducing inventory expenses. Table 4 is the result of calculation EOQ Method.

Table 4 Calculation of EOQ Method

Item	Unit (Pcs)	Holding Cost			Ordering Cost			Inventory Cost (Rp)
		Holding	Holding Cost (Rp/unit)	Total Holding Cost (Rp)	Order Frequency	Ordering Cost (Rp/order)	Total Ordering Cost (Rp)	
Red Rubber Gloves	12 Pcs	-21	-	-	24	17,247	413,929	413,929
Hair Cap	50 Pcs	184	150	27,600	11	2,683	29,512	57,112
Plastic Bambi A4	1 Pcs	12,903	12	154,836	4	47,908	191,634	346,470
Stappler Unoair	1000 Pcs	208	25	5,200	5	1,150	5,749	10,949
Pylox CLEAR	1 Pcs	27	260	7,020	15	767	11,498	18,518
Straping band 0.5	1 Pcs	28	860	24,080	24	2,683	64,389	88,469
Clamp Plastic	12 Pcs	4,015	45	180,675	6	27,595	165,571	346,246
Nabakem SR 600	1 Bottle	-456	-	-	24	767	18,397	18,397
Stick plastic glue	12 Pcs	70	145	10,115	11	1,150	12,648	22,763
Plastic band 5/8	5 Roll	55	324	17,820	13	1,533	19,930	37,750
Sponge Roller	12 Pcs	35	700	24,500	18	1,150	20,696	45,196
Painting brush No 9	12 Pcs	35	440	15,400	18	1,150	20,696	36,096
Color Majun	5 Kg	1,728	280	483,840	15	33,728	505,913	989,753
Thiner ND COBRA	1 L	194	230	44,620	13	3,449	44,842	89,462
White marker SNOW	12 Pcs	-2.370	-	-	24	15,331	367,937	367,937
Total Inventory Cost				995,706			1,893,341	**2,889,047**

From equation (2), we found that the EOQ of red rubber gloves was 43. Based on these calculations, we found that the total storage of red rubber gloves was -21. It means that this is a stock-out condition for red rubber gloves. Then, we calculated the total cost using Equation (3). The amount of inventory cost can be seen in Table 4. Total inventory cost of Rp2.889.047, which is the sum of all inventory costs of items. This cost is based on the EOQ method for inventory control, but there are 3 items that are stockout, such as red rubber gloves, Nabakem SR 600, and White marker SNOW.

4.5. FOQ Proposed Method

The proposed FOQ approach is almost the same as the FOQ method used by the company. The proposed FOQ method is to combine the FOQ method with the Lot for Lot (LFL) principle. Lot for Lot (LFL) is a method of ordering/lot sizing so that orders are arranged according to the number of net needs in a period [25]. With the application of the LFL principle in the company's FOQ, orders for consumable materials are made daily. Later, the number of weekly orders commonly used by the company will be divided by 6 according to the existing working days and added with a safety stock of 0.2 times the amount per day. Based on these calculations, a total of 2.527 storage for red rubber gloves was obtained. Table 5 is the result of Calculation FOQ proposed.

Table 5 Calculation of FOQ Proposed

Item	Unit (per Pcs)	Holding Cost			Ordering Cost			Inventory Cost (Rp)
		Holding	Holding Cost (Rp/unit)	Total Holding Cost (Rp)	Order Frequency	Ordering Cost (Rp/order)	Total Ordering Cost (Rp)	
Red Rubber Gloves	12 Pcs	2,527	870	2,198,490	24	17,247	413,928	2,612,418
Hair Cap	50 lbr	756	150	113,400	24	2,683	64,392	177,792
Plastic Bambi A4	1 Pcs	7,475	12	89,700	24	47,908	1,149,792	1,239,492
Stappler Unoair	1000 Pcs	269	25	6,725	24	1,150	27,600	34,325
Pylox CLEAR	1 Pcs	203	260	52,780	24	767	18,408	71,188
Straping band 0.5	1 Pcs	628	860	540,080	24	2,683	64,392	604,472
Clamp Plastic	12 Pcs	5,083	45	228,735	24	27,595	662,280	891,015
Nabakem SR 600	1 Botol	304	1,350	410,400	24	767	18,408	428,808
Stick plastic glue	12 Pcs	241	145	34,945	24	1,150	27,600	62,545
Plastic band 5/8	5 roll	316	324	102,384	24	1,533	36,792	139,176
Sponge Roller	12 Pcs	383	700	268,100	24	1,150	27,600	295,700
Painting brush No 9	12 Pcs	383	440	168,520	24	1,150	27,600	196,120
Color Majun	5 kg	5,204	280	1,457,120	24	33,728	809,472	2,266,592
Thiner ND COBRA	1 ltr	655	230	150,650	24	3,449	82,776	233,426
White marker SNOW	12 Pcs	2,430	1,260	3,061,800	24	15,331	367,944	3,429,744
Total Inventory Cost				8,883,829			3,798,984	**12,682,813**

From equation (3), we found that the total cost for red rubber gloves was Rp2.612.418. Then, we calculated the total inventory cost for all of the goods, we found that the total inventory cost of Rp12.682.813, which is the sum of all inventory costs of items. This cost based on proposed method (Company method combine with lot for lot) for inventory control.

4.6. Comparative Analysis of Total Inventory

Based on the calculation of inventory costs with three methods, the results were obtained that FOQ has a total cost of Rp19.282.629, the EOQ method of Rp2.889.047, and the proposed FOQ method of Rp12.682.813. From these results, it can be seen that the FOQ method that has been applied by the company has a large amount of storage so the total inventory cost is large. The EOQ method has the lowest total inventory, but there are three items that were stocked out. This condition will make a new problem for inventory. Good inventory when no stockout and no overstock. Meanwhile, the total inventory cost of the proposed FOQ method results in lower costs than the methods the company has already implemented. In this method, no item is stocked out. Inventory control is carried out as an effort to minimize inventory costs. In this case, we propose to the company use the proposed FOQ method because based on the results of the analysis and calculations, the proposed FOQ method has a lower total inventory cost compared to other methods.

5. Conclusion

Based on the results and analysis above, the conclusion of the consumable materials ordering system method used in Brake system company is a FOQ method with a reference message time of 1 week. After calculations and comparisons, the approach that has the smallest total inventory cost is the proposed FOQ method with the order time being daily. The proposed FOQ method

becomes a recommendation method for controlling Brake system company in order to reduce inventory costs up to one-third times less than the previous cost.

REFERENCES

[1] N. Nemtajela and C. Mbohwa, "Relationship between Inventory Management and Uncertain Demand for Fast Moving Consumer Goods Organisations," *Procedia Manuf.*, vol. 8, no. October 2016, pp. 699–706, 2017, doi: 10.1016/j.promfg.2017.02.090.

[2] A. Mahardhika, A. Rahman, and R. Y. Efranto, "Analisis Perbandingan Pengendalian Persediaan Bahan Baku Dengan Pendekatan Metode Economic Order Quantity Dan Metode Kanban," *Tek. Ind.*, vol. 2, no. 2, pp. 454–463, 2018.

[3] E. Hertini, N. Anggriani, W. Mianna, and A. K. Supriatna, "Economic Order Quantity (EOQ) Optimal Control Considering Selling Price and Salesman Initiative Cost," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 332, no. 1, 2018, doi: 10.1088/1757-899X/332/1/012013.

[4] W. Adiani, D. Lesmono, and T. Limansyah, "Model Persediaan dengan Permintaan Bergantung pada Harga Jual dan Tingkat Persediaan dengan Faktor Deteriorasi," *J. Ilm. Tek. Ind.*, vol. 18, no. 2, pp. 183–191, 2019, doi: 10.23917/jiti.v18i2.8749.

[5] R. Afrizal and U. Linarti, "A Stochastic Integrated Inventory Model Single Supplier-Single Retailer in Periodic Review with Losing Flexibility Cost," *J. Ilm. Tek. Ind.*, vol. 6869, 2019, doi: 10.23917/jiti.v21i2.19752.

[6] I. Rizkya and Fernando, "Optimalisasi Persediaan Bahan Baku Atap Spandex dengan Metode Q," *J. Sist. Tek. Ind.*, vol. 23, no. 1, pp. 1–8, 2021, doi: 10.32734/jsti.v23i1.4906.

[7] S. Akhtari, T. Sowlati, D. G. Siller-Benitez, and D. Roeser, "Impact of inventory management on demand fulfilment, cost and emission of forest-based biomass supply chains using simulation modelling," *Biosyst. Eng.*, vol. 178, pp. 184–199, 2019, doi: 10.1016/j.biosystemseng.2018.11.015.

[8] D. M. Utama, "Penentuan Lot Size Pemesanan Bahan Baku Dengan Batasan Kapasitas Gudang," *J. Ilm. Tek. Ind.*, vol. 15, no. 1, p. 64, 2016, doi: 10.23917/jiti.v15i1.1664.

[9] A. S. Putri and B. I. Rosydi, "Analysis of Raw Material Inventory for Insecticide Packaging Bottle with MaterialRequirement Planning: A Case Study," *J. Sist. dan Manaj. Ind.*, vol. 4, no. 2, pp. 93–98, 2020, doi: 10.30656/jsmi.v4i2.2765.

[10] V. M. Rao and D. Mangal, "Economic order quantity - A Tool for Inventory Management - A Case Study," *Int. J. Supply Chain Invent. Manag.*, vol. 3, no. 1, p. 56, 2018, doi: 10.1504/ijscim.2018.10019608.

[11] A. Nasution and C. Indriya, "Pembelian Bahan Baku Optimal Ready Mix Concrete dengan Metode Economic Order Quantity," *J. Sist. Tek. Ind.*, vol. 22, no. 2, pp. 25–32, 2020, doi: 10.32734/jsti.v22i2.3827.

[12] H. Hidayat, "Application of the EOQ (Economic Order Quantity) Method in Determining Chemical Supplies in PT. Semen Indonesia," *Int. J. Sci. Eng. Inf. Technol.*, vol. 5, no. 1, pp. 226–230, 2020, doi: 10.21107/ijseit.v5i1.8911.

[13] M. Riza, H. Hardi Purba, M. Riza, and H. Purba, "The implementation of economic order quantity for reducing inventory cost," *Res. Logist. Prod.*, vol. Vol. 8, No, no. 3, pp. 207–216, 2018, doi: 10.21008/j.2083-4950.2018.8.3.1.

[14] S. Margono and Y. D. Lestari, "Determine the appropriate inventory model in tang company," *J. Bus. Manag.*, vol. 4, no. 4, pp. 501–509, 2015.

[15] F. M. Puspita, N. A. Primadani, and E. Susanti, "Application of Material Requirement Planning with ARIMA Forecasting and Fixed Order Quantity Method in Optimizing the Inventory Policy of Raw Materials of Sederhana Restaurant in Palembang," *Adv. Econ. Bus. Manag. Res.*, vol. 142, no. Seabc 2019, pp. 71–76, 2020, doi: 10.2991/aebmr.k.200520.014.

[16] A. Chandradevi and N. B. Puspitasari, "Penerapan Material Requirement Planning (MRP) dengan Mempertimbangkan Lot Sizing dalam Pengendalian Bahan Baku pada PT. Phapros, Tbk.," *PERFORMA Media Ilm. Tek. Ind.*, vol. 15, no. 1, pp. 77–86, 2016, doi: 10.20961/performa.15.1.13760.

[17] J. Wenda and L. Fitria, "Rancangan Sistem Persediaan Karpet Menggunakan Model Q Probabilistik Di Department Town Management Pt. Freeport Indonesia," *Reka Integr.*, vol. 02, no. 04, pp. 405–414, 2014.

[18] D. S. Pulungan and E. Fatma, "Analisis Pengendalian Persediaan Menggunakan Metode Probabilistik dengan Kebijakan Backorder dan Lost sales," *J. Tek. Ind.*, vol. 19, no. 1, p. 38, 2018, doi: 10.22219/jtiumm.vol19.no1.40-51.

[19] N. Z. Nuffus and N. P. Waluyowati, "Perencanaan Persediaan Bahan Baku Kain dengan Sistem Q (Continuous Review System) dan Sistem P (Periodic Review System)," *J. Ilm. Mhs. FEB Univ. Brawijaya*, vol. 9, no. 2, pp. 1–18, 2021.

[20] S. N. Bahagia, *Sistem Inventori*. Bandung: ITB Press, 2006.

[21] N. D. Rizkiyah and R. Fadhlurrahman, "Analisis Pengendalian Persediaan Dengan Metode Material Requirement Planning (MRP) pada Produk Kertas It170-80Gsm Di PT Indah Kiat Pulp & Paper Tbk," *J. PASTI*, vol. 13, no. 3, p. 311, 2020, doi: 10.22441/pasti.2019.v13i3.008.

[22] A. Pasca Hendradewa and I. Aditiyana, "Analisis Pengendalian Persediaan Bahan Baku Menggunakan Metode Min-Max Stock Pada Produk Semen Bima (Studi Kasus: Pt Sinar Tambang Arthalestari) Analysis of Raw Material Inventory Control Using Min-Max Stock Method on Bima Cement Products (Case Study: Pt," *J. Disprotek*, vol. 13, no. 2, pp. 146–153, 2022, doi: 10.34001/jdpt.v12i2.

[23] J. Heizer and B. Render, *Production and Operations Management Strategic and Tactical Decisions*, 4th ed. New Jersey: Prentice-Hall, 1996.

[24] N. Ghasemi and B. Afshar Nadjafi, "EOQ Models with Varying Holding Cost," *J. Ind. Math.*, vol. 2013, pp. 1–7, 2013, doi: 10.1155/2013/743921.

[25] B. Akyuz, A. Araújo, and L. Varela, "Management Tool based on MRP and Lot-sizing – A case study for comparing different cases," *Bus. Sustain. III*, no. January, pp. 0–6, 2013.