Available online www.jsaer.com

***Journal of Scientific and Engineering Research*, 2020, 7(7):130-136**

Research Article

ISSN: 2394-2630
CODEN(USA): JSERBR

SPHC Material Inventory Control Analysis in Project VL01 Centralized by the EOQ Method in Automotive Company Indonesia

Bethriza Hanum, Jakfat Haekal, Dian Eko Adi Prasetio

Faculty of Industrial Engineering, Universitas Mercu Buana, Indonesia
Fakulty of Industrial Engineering, Universitas Islam As-syafiíyah, Indonesia
*Corresponding Author: Bethriza@Mercubuana.ac.id

Abstract Financial control is important in specific production activities in manufacturing companies. One of them is PT. IAMI as the Sole Agent of 4 or more wheeled vehicles engaged in commercial vehicles. The production process in the company consists of painting and processing automotive components. The author takes a research on the VL01 project, with the discovery of the problem there is no control on the need for raw materials for production needs are met. This study was conducted to determine the importance of SPHC materials in the VL01 project and to determine the factors needed. The method used by the author is Economic Order Quality with a centralized system. EOQ on SPHC VL01 project materials can calculate the total cost of preparation with a value of Rp 5,392,484 - Rp 17,107,449 in 2017 and 2018. With an optimal purchase value of 181,801 kg and 344,579 kg, safety stock 6,504 kg and 13,525 and Re-Order point value points 46,331 kg and 77,079 kg.

Keywords SPHC, Economic Order Quantity, Production, Manufacturing

Introduction

PT. Isuzu Astra Motor Indonesia (IAMI) is an automotive company that manufactures 4 or more wheeled vehicles for commercial (Commercial Vehicle). The production process is a series of activities that utilize labor resources, materials, equipment, production methods—the production process contained in PT. IAMI is a trimming cabin, painting cabin, an assembling unit. With the mainline in the assembling unit. The variation of vehicle types at PT.AMI is divided into 4 variants, namely, VD00, VL01, TBR54, and VT01. The study was conducted on the VL01 variant, which is a light, medium truck-type vehicle. In carrying out the production process, PT.AMI requires the role of automotive parts component suppliers to produce by pressing the SPHC material sheet.

Supplier press parts get information on the number of units of vehicle production obtained in the form of forecasts (forecast production) based on the type of vehicle within 1 year with a fixed amount (deterministic), this is intended for suppliers to plan material purchases. Material purchasing planning system for suppliers consists of material purchasing conditions carried out by each supplier press part without control from IAMI.

Here is a picture of the flow process ordering automotive components with 1.6 mm thick SPHC material found in PT. IAMI and Press Part Supplier:

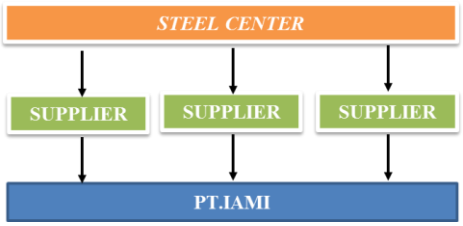

Figure 1: Flow Process of Ordering Part and Steel Plate of PT. IAMI

Figure 1 can show the flow of the process of purchasing materials, as previously explained. The study was conducted by providing a forecast amount of PTIAMI material needs to SPHC sheet material suppliers to meet the needs of IAMI press part suppliers. With the following pictures:

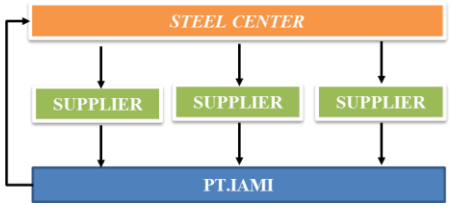

Figure 2: Flow Process Part Ordering and Steel Plate PT. IAMI

To run the centralized SPHC material purchasing system, as shown in Figure 2, PT. IAMI needs to know the amount of SPHC material needs with a thickness of 1.6 mm in 1 year. With the condition is a fixed acceptance lead time, the amount of material agreed upon in the 1 year is fixed, the delivery of the material is done simultaneously to the supplier press part of PT. IAMI, the amount of material purchases in 1 period is known, and the price of material constants in 1 specified period. Therefore PT. IAMI has an obligation to calculate the optimal requirements needed to prevent excess stock or shortages from making an agreement with the material provider (steel center). This is intended so that PT. IAMI can control the purchase of SPHC material VL01 project sheets with a thickness of 1.6 mm can be optimally fulfilled.

PT will examine the number of SPHC automotive parts suppliers with a thickness of 1.6 mm in the VL01 project. IAMI, there are 4 companies. Supervision of material inventory is essential, because the amount of inventory will determine or influence the smooth running of the production process and the effectiveness and efficiency of the company. By determining the most appropriate steel plate, material inventory will guarantee the smooth production activities, and the cost incurred in providing the material is not excessive. Also, the purchase price of each supplier varies.

The following is an explanation of the material needs of each supplier accompanied by a purchase price per kg in table 1 consisting of 3 suppliers of press parts for the 2017 period:

Table 1: Demand SPHC VL01 Project

Supplier *Press Part*	**Amouth (Part Number)**	**Demand *SPHC* tebal1.6 mm (Kg)**	**price(Rp) / Kg**
PT. Adhi Wijaya Citra	10	13,088	11,000
PT. Citra Nugraha Karya	10	100,710	12,500
PT. Sarana Unggul Pratama	3	343,219	11,500

The research was conducted on these 3 companies, and In order to increase competitive advantage, companies must support both their internal functions and the exchange of their information with supply chain partners in an effective way. Then this problem affects the determination of (1) how much quantity will be purchased in a certain period, (2) how much quantity will be purchased in every time an order is made, (3) when ordering SPHC material with a thickness of 1.6mm must be done, (4) what is the minimum quantity of SPHC material that must always be in a safety stock so that PT. IAMI can avoid production disruptions due to material delays. To minimize these things, the researchers used an "Economic Order Quantity" (EOQ) analysis. EOQ is the most economical volume or amount of purchases to be made at each time of purchase (Prawirosentono, 2001: 49). Furthermore, from the analysis of the results of the study, a collaboration will be formed between PT. IAMI, Steel Center, and Supplier Press Part.

Materials and Methods

Data or information collection techniques used are as follows:

a. Direct observation or direct observation, is an activity carried out on the object of research, in this case, is to make direct observations of the SPHC material supply system with a thickness of 1.6 mm in the VL01 project set by PT. IAMI to its suppliers. Data collection is carried out starting in October 2017.

b. Interview, namely question and answer directly to the object of research through interviews with people representing the company PT. IAMI by asking a few questions that have been prepared beforehand. Interviews were conducted using a semistructured interview (Semistructured interview), which is an interview included in the in-depth interview category, which aims to find problems more openly, where the informants/informants who are invited to the interview are asked for their opinions and ideas. During the interview process, the researcher listens carefully and records and records what was said by the resource person/respondent.

c. A literature study is data collection using literature, internet facilities, and data from institutions or related institutions to support the research process.

In this study, researchers used the Trend Projection method. This technique adjusts to the trend line of a series of historical data points of a company and is then projected to forecast the coming period. The form of a linear line equation is:

$$\hat{Y} = a + bX$$

Where :

$\hat{Y}$ = Forecasting raw material requirements

a = constant

b = Time number for unit time

X = Unit of time

To be able to determine the optimal number of orders or purchases of materials each time an order is needed, there is a calculation of the optimal purchase quantity that is economical or Economic Order Quantity (EOQ).

a. Analysis of Economic Order Quantity

The steps are as follows:

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

Where :

EOQ = economical optimal number of purchases

S = order fee per order

D = Material requirements per period

H = Cost of storage per unit per year.

B. storage = 10% x purchase price per unit of raw material.

b. Order frequency (I)

$$I = \frac{R}{EOQ}$$

Where :

I = order frequency

R = amount of raw materials needed

EOQ = economical optimal number of purchases

B. storage = 10% x purchase price per unit of raw material.

This analysis is to find out how much the total inventory consists of the cost of purchasing raw materials, storage costs and ordering costs. The formula is:

Total cost of raw material inventory = cost of purchasing raw materials + ordering costs + storage costs

$$TIC = \sqrt{2.DSH}$$

Where :
TIC (Q) = total annual inventory costs
D = number of items needed in units (m3)
H = storage fee (units per period)
S = cost of ordering each time an order
Reorder points can be determined by setting usage during lead time and adding to usage during certain periods as safety stock, using the formula:
Reorder point = usage during lead time + safety stock
Use during lead time = lead time x use of raw materials
Safety Stock = ml. standard deviation of the requirement level x 1.65
Standard deviation formula:

$$SD = \sqrt{\frac{\Sigma(X-Y)^2}{n}}$$

Where :
SD = Standard deviation
X = actual usage
Y = forecasting / estimated usage
n = amount (amount of data)

Results & Discussion

1. Cost Analysis of Material Needs

With centralized material procurement, SPHC material purchases from PT. IAMI to material providers (Steel Center) for the needs of suppliers of press parts, there are differences in material costs obtained, the following comparison table:

Table 2: Comparison of the Cost of the EOQ Method with the Previous Method

Year	Description	*Supplier Press Part*			IAMI
		PT. AWC	PT. CNK	PT. SUP	
2017	Amount of Material Purchase (Kg)	13,752	105,451	358,722	477,926
	Purchase Price (per Kg)	11,000	12,500	11,500	11,000
	Total cost	151,276,215	1,318,138,956	4,125,307,819	5,257,185,105
			5,594,722,989		
2018	Amount of Material Purchase (Kg)	19,132	167,240	576,271	762,643
	Purchase Price (per Kg)	11,000	12,500	11,500	11,000
	Total cost	210,456,991	2,090,494,082	6,627,118,698	8,389,074,886
			8,928,069,772		

From the results of the comparison above, the centralization of the material gets more profit in terms of the purchase price of the material to have a difference of Rp 337,537,884 in 2017 and Rp 538,994,885 in 2018.

2. Analysis of the EOQ Method

From the data obtained from the company shows that the relationship between EOQ, Safety Stock and SPHC ROP material in the VL01 project is as follows:

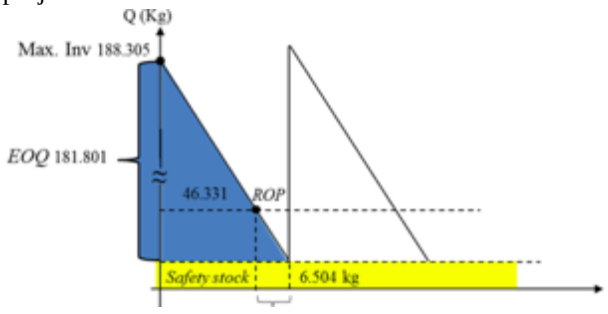

Figure 3: SPHC Project VL01 EOQ Chart and Re Order Point Material

Indicate that the company can purchase material at the Maximum Inventory point of 188,305 kg and start making requests for SPHC material when the inventory touches the Re-Order Point, which is 46,331 kg with the terms of the Safety Stock safety limit as agreed in this study that is 95% service level = 1.65. Thus the amount of ordering material when it touches the Re-Order Point is an EOQ value of 181,801 kg. for more details can be seen in Figure 3.

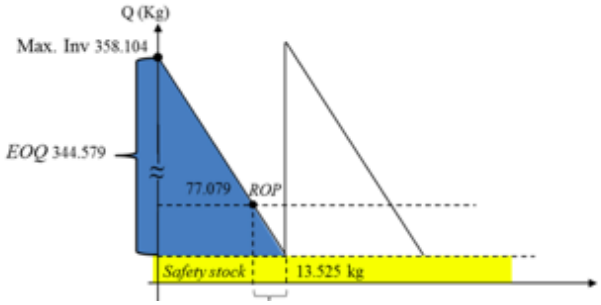

Figure 4: Graph of EOQ and Reorder Point for SPHC project VL01 in 2018

Indicate that the company can purchase material at the Maximum Inventory point of 358,104 kg and start making requests for SPHC material when the inventory touches the Re-Order Point point, 77,079 kg, with the terms of the Safety Stock safety limit as agreed in this study, that is 95% service level = 1.65. Thus the amount of ordering material when it touches the Re-Order Point is the value of EOQ which is 344,579 kg. for more details can be seen in Figure 3

From the two data above, the value of the factors that determine the inventory is influenced by the amount of deviation per month needs. This can be predicted using the trend projection lines that have been found previously analyzed by finding the values of x and y in the following equation Y = 49,589 + 1004,752 X.

3. Total Inventory Cost Analysis (TIC)

And the results of the Total Inventory Cost with a centralized system, the researchers compare with the previous system contained in the company with the following calculations:

$$TIC = \sqrt{2\,D\,S\,H}$$

Where the company's TIC in the previous method is$TIC = TIC\ PT.AWC + TIC\ PT.CNK + TIC\ PT.SUP$

Then the value of Total Inventory Cost in the company method if it does not use the EOQ method in 2017 is shown in table 3

Table 3: Calculation of TIC in the previous method in 2017

Year	Supplier	Purchase Amount	Booking Fees	Storage costs per kg	TIC
2017	PT.AWC	13,752	613,698	264	2,110,240
	PT.CNK	105,451	1,926,891	260	10,277,335
	PT.SUP	358,722	5,848,878	260	33,001,033
		Total			**45,388,609**

And the total value of Total Inventory Cost in the company method if not using the EOQ method in 2018 is shown in table 4

Table 4: TIC calculations for the previous method in 2018

Year	Supplier	Purchase Amount	Booking Fees	Storage costs per kg	TIC
2018	PT.AWC	19,132	989,119	260	3,136,559
	PT.CNK	167,240	2,707,039	256	15,232,193
	PT.SUP	576,271	7,250,057	256	46,244,889
		Total			**64,613,640**

From the calculation results above when compared to the calculation of Total Inventory Cost using the MOQ method can be seen in Figure 5.

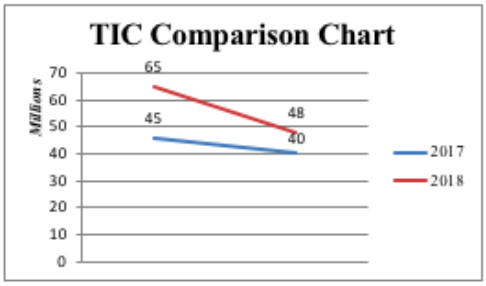

Figure 5: Comparative Graph of SPHC Project VL01 Material TIC for 2017 and 2018

It can be seen in graph 5. The EOQ method has a lower value than the total inventory cost (TIC) with the previous method, which is only a centralized system. The total cost according to the company based on existing data in the VL01 project in 2017 and 2018 is IDR 45,388,609 and IDR 64,613,640, While the total value of total inventory costs in 2017 and 2018 with the EOQ method is IDR 39,996,125 and IDR 47,506,191. For the comparison table as follows:

Table 5: Comparison of the Total Inventory Costs by the EOQ Method and the Previous Method

	Company Method	**EOQ Method**	***Diff***	**%**
TIC 2017	45.388.609	39.996.125	-5.392.484	-12%
TIC 2018	64.613.640	47.506.191	-17.107.449	-26%

From the table above there are differences of Rp 5,392,484 in 2017 and Rp 17,107,449 in 2018.

Conclusion

Based on the research conducted, the following conclusions can be obtained:

1. Number of frequencies in one period of purchasing SPHC material for project VL01, if PT. IAMI uses the centralized Economic Order Quantity method as much as 2.6 times in 2017 and 2.2 times in 2018, with a higher material quantity value in 2018, this shows that the high quantity of purchase quantities affects the value of inventory. EOQ results will be more optimal if the frequency value approaches a number with rounding 0.5 <X <1.
2. Optimal total inventory costs for SPHC materials with a thickness of 1.6 mm in the VL01 project at PT. Isuzu Astra Motor Indonesia is IDR 39,996,125 in 2017 and IDR 47,506,191 in 2018.
3. The Re-Order Point and SPHC material stock safety requirements required by PT. IAMI in the VL01 project when establishing the EOQ method were 46,331 kg and 6,504 kg in 2017 and 77,039 kg and 13,525 kg in 2018 with a lead time of ordering for 30 days
4. The total cost of SPHC material inventory (TIC) in project VL01 if the company determines the Economic Order Quantity method in 2017 and 2018 is IDR 39,996,125 and IDR 47,506,191 whereas, if the company uses the previous conditions is IDR 45,388,609 and IDR 64,613,640 of these results will have a positive impact with savings in 2017 and 2018 of IDR 5,392,484 and IDR 17,107,449.

Suggestion

The following are suggestions related to research conducted at PT. IAMI:

1. Improvement of centralized material control by the EOQ method must be made by agreement of 2 related parties, namely the steel center as a material supplier and press part supplier in the VL01 project.
2. SPHC material control in the VL01 project must be carried out continuously and carried out in coordination with the three parties to avoid shortage or over-stocking of material.

References

[1]. Arman Hakim, N. and Prastyawan, Y., (2003). Perencanaan dan pengendalian produksi. *Edisi Pertama, Surabaya: Guna Widya*.

[2]. Assauri, S., (2004). Manajemen Produksi dan Operasi edisi revisi. *Jakarta: Lembaga Penerbit FEUI*.

[3]. Ahyari, A. and Produksi II, M.P.P., (1994). Edisi IV. *BPFE UGM, Yogyakarta*.
[4]. Husnan, S., (1993). Pembelanjaan Perusahaan (Dasar-Dasar Manajemen Keuangan). *Liberty, Yogyakarta*.
[5]. Handoko, T.H., (1984). edisi ke 1. *Dasar-dasar Manajemen Produksi dan Operasi, Yogyakarta: BPFE*.
[6]. Herjanto, E., (1999). Manajemen produksi dan operasi. *Edisi kedua, PT Gramedia Widiasarana Indonesia, Jakarta*.
[7]. Nasution, A.H., (2003). Perencanaan dan Pengendalian Produksi Edisi 1.
[8]. Prawirosentono, S., (2001). Manajemen Produksi dan Operasi Edisi 1**.** *BPFE, Yogyakarta.*
[9]. Rangkuti, F. and Persediaan, M., (2000). Aplikasi di Bidang Bisnis, PT. *Raja Grafindo Persada, Jakarta*.
[10]. Render, H.J.B., (2005). Prinsip-prinsip Manajemen Operasi, Salemba Empat.
[11]. Yamit, Z., (2003). Manajemen Produksi dan Operasi edisi kedua. *Ekonisia: Yogyakarta*.
[12]. Indrayati, R., (2007). *Analisis Pengendalian Persediaan Bahan Baku Dengan Metode EOQ (Economic Order Quantity) Pada PT. Tipota Furnishings Jepara* (Doctoral dissertation, Universitas Negeri Semarang).
[13]. Amrillah, A.F. and Zahroh, Z.A., (2016). Analisis Metode Economic Order Quantity (EOQ) Sebagai Dasar Pengendalian Persediaan Bahan Baku Pembantu (Studi Pada PG. Ngadirejo Kediri-PT. Perkebunan Nusantara X). *Jurnal Administrasi Bisnis*, *33*(1), pp.35-42.
[14]. Surnedi, Y., (2010). *Analisis Manajemen Persediaan Dengan Metode EOQ Pada Optimalisasi Persediaan Bahan Baku Kain Di PT. New Suburtex* (Doctoral dissertation, Universitas Sebelas Maret).
[15]. Mekel, C., Anantadjaya, S.P. and Lahindah, L., (2014). Stock Out Analysis: An Empirical Study on Forecasting, Re-Order Point and Safety Stock Level at PT Combiphar, Indonesia. *RIBER: Review of Integrative Business and Economics Research*, *3*(1), pp.52-64.
[16]. Sanny, L. and Felicia, M., (2014). Construction Field Company in Indonesia. *Journal of Applied Sciences*, *14*(24), pp.3538-3546.
[17]. Kurniasari, N.S. and Hidayat, Y.A., (2017). Imported Raw Material Inventory Control System as an Effort to Minimize Inventory Cost (A Case Study in PT. Apparel One Indonesia). *Admisi dan Bisnis*, *17*(3), pp.175-183.
[18]. Rachmawati, S.N. and Siregar, K.R., (2013). An Analysis of Transformer Raw Materials Planning by Using Lot Sizing Technique (A Study Case of PT. XYZ Indonesia). *International Journal of Science and Research (IJSR)*, *4*(3), pp.1100-1104.
[19]. Pujawan, I.N. and Mahendrawathi, E., (2005). Supply Chain Management, Surabaya.
[20]. Haekal, J., & Setio, H. (2017). Selection of Raw Material Suppliers Using Analytical Hierarchy Process in Food and Beverage Company, South Jakarta. *ComTech: Computer, Mathematics and Engineering Applications*, *8*(2), 63-68.
[21]. Yosan, R. B., Kholil, M., & Hanum, B. (2018, March). Implementation of Inventory Management System (IMS) case study on XYZ online store business unit. In *IOP Conference Series: Materials Science and Engineering* (Vol. 343, No. 1, p. 012022). IOP Publishing.
[22]. Hanum, B., & Billy, A. (2018). Usulan Persediaan Bahan Baku Dengan Menggunakan Metode Economic Order Quantity (EoQ). *SAINSTECH*, *28*(1).