Streamlining Raw Material Inventory for Integrated Circuits: An Analysis of Leadframe and Diewafer Supply Using EOQ and JIT

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Abstract. This study was conducted to analyze the inventory of integrated circuit raw materials, especially leadframes and diewafers using the Economic Order Quantity (EOQ) and Just in Time (JIT) method approaches. This research was conducted to determine the optimal order quantity, avoid excess and shortage of stock, and reduce inventory costs more efficiently. In addition, this research also involves safety stock analysis, reorder point (ROP), and total inventory cost (TIC) to get a more comprehensive picture of optimal inventory management. The data used in this study is inventory data for 2023. The results of the calculation of EOQ, safety stock, ROP, TIC, and JIT are compared with the company's current inventory management. From the analysis, it was found that the EOQ method provides higher efficiency in raw material inventory management compared to the method currently used by the company. This can be seen with the number of leadframe purchases of 10,014 boxes with a leadframe purchase frequency of 2 times a year, savings of 6.015.589, Safety stock (SS) 409, Reorder Point (ROP) 2.078, and JIT made savings of 9.773.469. The number of diewafer purchases is 20,028 boxes with a diewafer purchase frequency of 2,5 times a year, savings of 10.433.486, Safety stock (SS) 1.022.5, Reorder point (ROP) 5.195, and JIT makes savings of 24.140.300.

Keywords: Economic Order Quantity, Just in Time, Safety Stock, Reorder Point, Integrated Circuit Components

1 Introduction

Inventory is an asset that the company uses as goods for sale in its daily operations or as an integrated asset, either directly or indirectly, into the products to be produced for sale [1]. Raw material inventory control is important to minimize inventory costs and increase efficiency. Effective strategies include just-in-time purchasing based on sales plans to prevent stock shortages or surpluses. This control also aims to avoid frequent small quantity purchases, which can result in high ordering costs. With proper planning, companies can fulfill customer orders quickly and accurately, and avoid excessive stockpiling that can lead to inefficient use of funds.

The Economic Order Quantity (EOQ) and Just in Time (JIT) methods are used to identify the best approach in managing inventory. Inventory costs can be minimized by having an optimal order quantity, known as the EOQ. In inventory management, the Economic Order Quantity (EOQ) and Just in Time (JIT) methods play a crucial role in

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determining the most effective strategy. EOQ assists organizations in finding the optimal order quantity required to minimize inventory costs, including storage and ordering expenses. By establishing an economical order quantity, companies can reduce the total cost of inventory while maintaining an adequate stock level to meet demand. On the other hand, JIT is an approach that focuses on waste reduction by synchronizing raw material orders directly with the production schedule, thereby allowing inventory to be cut as efficiently as possible. When applied correctly, both methods can provide a framework for efficient inventory management, reducing waste, and supporting smooth operations. Implementing EOQ and JIT requires careful analysis of demand patterns, supplier lead times, and production dynamics to achieve a balance between the availability of raw materials and cost efficiency.

PT. ABC is a company engaged in the semiconductor industry, with its main activity being the production of Integrated Circuits (IC) using leadframe and diewafer raw materials, which require effective cost control. PT. ABC has not yet achieved maximum efficiency in managing its raw material inventory. Therefore, implementing structured strategies such as the Economic Order Quantity (EOQ) and Just in Time (JIT) methods is recommended to achieve the ideal order point while reducing inventory or purchasing-related costs. With the implementation of EOQ and JIT, PT. ABC is expected to further improve its inventory management.

When it comes to raw material inventory, there are several issues present, such as long lead times that can increase inventory costs and reduce customer satisfaction due to delayed delivery times. Immediate changes in demand (either reduction or increase) with short notice refer to the sudden and swift demands to scale up or down the quantity of products or services requested by the market, where the company has limited time to prepare or adjust to these changes. Then there are storage constraints or limitations. These issues arise from internal problems such as errors in order processing or ineffective planning that cause delivery delays. Therefore, it is necessary to implement more effective raw material planning and control with the EOQ and JIT methods in the analysis to compare various implemented policies. Thus, EOQ and JIT methods are used to analyse and compare the existing policies, as these methods can minimize inventory costs and determine optimal inventory timing.

Based on the background outlined above, the research problem is twofold: first, how does PT. ABC control its inventory of leadframes and die wafers in 2023? And second, how to calculate the inventory of leadframe and die wafer raw materials at PT. ABC using the EOQ and JIT methods in 2023. The objectives of this study are, firstly, to determine how PT. ABC controls its inventory of leadframes and die wafers in 2023. The second objective is to analyze the calculation of leadframe and die wafer raw material inventory at PT. ABC using the EOQ and JIT methods in the year 2023. This research has both practical and theoretical benefits. The practical benefit is to achieve optimal results through proper planning that can serve as a basis for decision-making, especially regarding the control of leadframe and die wafer inventory in the company. The theoretical benefit is to contribute to the development of knowledge and expand insights related to the subject of raw material inventory planning and control using the EOQ and JIT methods. The scope of this research includes an analysis of the inventory of leadframe and die wafer raw materials at PT. ABC using the EOQ and JIT methods. This study is conducted using qualitative methods and will analyze the collected data, including actual costs, raw material needs, ordering costs, storing costs, and lead time during the Integrated Circuit (IC) production process.

2 Theoretical Studies and Literature Studies

2.1 Theoretical Studies

Inventory and Raw Material Management.

Inventory is a general term that refers to all items or organizational resources stored in anticipation of meeting demand [2]. States that raw materials are crucial components in manufacturing finished products [3]. Raw materials and auxiliary materials are essential in production and cost management. Raw materials are the fundamental materials for production, acquired through purchasing and utilized in the production process [4]. Inventory classification is based on company type. Businesses engaged in the sale of goods will consider merchandise as their main inventory component. Companies that sell goods consider merchandise inventory, while factories classify inventory into raw materials, work in process, and finished goods [5]. Finished goods are complete products ready to be sold to consumers. This classification aids companies in efficiently monitoring and managing their inventory, ensuring that each inventory component is accessible and processed according to production needs and market demand.

Inventory Costs.
In general, for decision-making regarding the determination of inventory quantity, the following variable costs should be considered, including [6]:

1. Storage costs (holding costs or carrying costs), consisting of costs that vary directly with the quantity of inventory.
2. Ordering or purchasing costs (ordering costs or procurement costs). Typically, the cost per order (excluding material costs and quantity discounts) does not increase as the order quantity becomes larger.

Types and Categories of Inventory.

1. Raw Material Inventory
   Inventory consists of tangible goods used in the production process, which can be procured from suppliers or companies that produce raw materials for the manufacturing firms that utilize them. Leadframes and die wafers are types of raw material inventory because they are obtained from raw material producers and are tangible.
2. Component Parts Inventory

Inventory of items, which consists of parts or components received from other companies, can be directly assembled with other parts without undergoing a previous production process.

3. Maintenance, Repair, and Operating (MRO) Supplies Inventory
   The inventory of goods or materials is a necessary element in the production process. However, these materials or goods are not part or component of the final product being sold.

Raw Materials.
Raw materials are a number of items purchased from suppliers and will be used or processed into products to be produced by the company. there are two main groups of raw materials, namely[7] :

1. Direct raw materials, which are materials that form and constitute a significant part of the finished goods, with their costs easily traceable from the value of the finished goods. The amount of direct raw materials is variable, meaning it is highly dependent on and influenced by the scale of production volume or changes in output.
2. Indirect raw materials are materials that are used in the production process, but it is difficult to determine their exact cost contribution to each finished product.

Economic Order Quantity Method.

This method is used to calculate the optimal amount of inventory that should be ordered at each restock to maintain a certain level and minimize the total cost of inventory. The EOQ method aims to maintain the lowest possible level of inventory, with low costs and better quality. Inventory planning using the EOQ method in an enterprise is capable of minimizing the occurrence of stockouts, thus not disrupting the production process within the company and saving on the cost of raw material inventory. In the EOQ method, there are several variables that influence the quantity of orders, namely carrying costs and ordering costs. The EOQ formula is [8]:

$$EOQ = \sqrt{\frac{2DS}{H}} \quad (1)$$

Note:
D represents the annual demand for the item
S is the ordering cost per order
H is the holding cost per unit per year (cost to store one unit in inventory for a year)

When calculating the total cost of inventory, the goal is to demonstrate that the optimal commodity purchase quantity calculated using the EOQ method can minimize the total cost of inventory for the commodity. According to Buffa[9], the total inventory cost (TIC) can be formulated as follows:

$$TIC = \sqrt{2.D.S.h} \quad (2)$$

Note:
D : Total demand for goods in units
S : Ordering cost per order
h : Holding cost

Meanwhile, the calculation of EOQ according to the company is as follows:

$$TIC = (Average\ Inventory)(Storage\ Cost) + (Ordering\ Cost)(Purchase\ Fredquency$$

To ensure the continuity of the production process and minimize the costs incurred by the company for the available raw materials, actions must be taken by implementing Economic Order Quantity (EOQ), Safety Stock, and Reorder Point (ROP). The purchasing requirements based on EOQ are:

1. The price per unit of the product is constant.
2. Each period, the company requires a stable of amount of raw materials.
3. The amount of production with raw materials and maintenance in the warehouse.

Safety Stock.

Safety stock is the inventory used with the purpose of avoiding stockouts or running out of stock." According to Hansen and Mowen [10], the safety stock can be calculated using the following formula:

$$SS = (Max\ Usage - Avg\ Usage)\ x\ Lead\ Time \tag{3}$$

Note:
SS is Safety stock quantity (units)
Maximum Usage is Maximum unit usage
Average Usage is Average unit consumption per month (units)
Lead Time is the time required to receive an order (months)

Reorder Point (ROP).

Reorder Point (ROP) According to Heizer and Render[8], "The Reorder Point (ROP) is the inventory level at which, once reached, an order should be placed immediately." To calculate the reorder point:

$$ROP = (LT\ x\ AU) + SS \tag{4}$$

Note:
ROP : Reorder point
LT : Lead time
AU : Average usage during a certain period
SS : Safety stock

Just In Time Method.
Just In Time (JIT) is a system used to minimize occurrences of wastage by basing it on the actual demand for the required goods, eliminating all unnecessary elements. Just In Time strives to remove anything superfluous related to inventory and overproduction as well as making full use of workers' potential, especially in terms of improving quality, productivity, and work morale.

To determine the optimal shipment quantity, we use following formula:

$$Q_n = \sqrt{n\ x\ Q^*} \quad (5)$$

Note:
Qn is the JIT Ordering Quantity
n is the frequency of shipments
Q* is the lead time demand over the year

JIT determines the optimal number of units as following formula:

$$q = \frac{Q^*}{n} \quad (6)$$

Note:
q is the optimal number of units
n is the frequency of shipments
Q* is the lead time demand over the year

Calculating JIT costs using following formula:

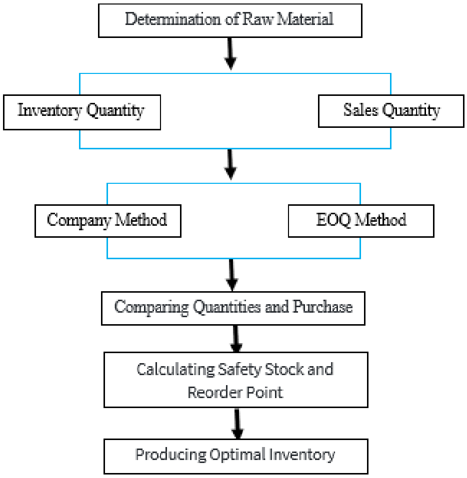
$$Tjit = \frac{1}{\sqrt{n}}\,(T^*) \quad (7)$$

Note:
Tjit is the total JIT cost
n is the frequency of shipments
T* is the ordering cost

2.2 Conceptual Framework

This scheme illustrates the conceptual framework for research on analyzing the raw materials of PT. ABC using EOQ and JIT approaches. In this scheme, at the top, we start with the determination of raw material inventory, specifically leadframes and die wafers. From there, we calculate the inventory quantity and sales volume of leadframes and die wafers. Then, we proceed to calculate inventory and storage costs according to the company and according to EOQ and JIT. Afterwards, we compare the purchase frequency between the company’s method, EOQ, and JIT. Next, we calculate the safety stock and reorder points for leadframes and die wafers. Finally, we conclude whether the EOQ and JIT methods will result in a more optimal inventory compared to the company's method. Based on previous research findings, a distinction can be made with the current study in that the research object now focuses on the raw materials for integrated circuit (IC), specifically the Leadframe and Die Wafer, at PT. ABC.

Fig. 1. Conceptual Framework



3 Research Methods

3.1 Research Methods

This study employs a qualitative research approach. This method was selected as it enables researchers to gain an in-depth understanding of the phenomena under investigation, which in this case is the inventory control of integrated circuit (IC) raw materials such as Leadframes and Die Wafers. The qualitative approach of this research involves the collection of descriptive data in the form of words, images, or objects. This approach is highly beneficial for exploring various aspects related to organizational behavior, decision-making processes, and the operational dynamics occurring at PT. ABC. Qualitative research supports more contextual and subjective analysis, allowing researchers to interpret phenomena based on the actual contexts in which they occur and providing a more nuanced understanding of the impact of EOQ and JIT methods on inventory control within the company.

This study, carried out between August 2023 and June 2024 in Batam City, specifically examines the management of leadframes and diewafers inventory at PT. ABC. The study's informants consist of the logistics department, material planners (MP), and process line planners (PLP), as they have direct involvement and responsibility for the leadframe and diewafer inventory processes. These parties have a wealth of knowledge and expertise on the research subject, making them highly important sources of information.

The study is using interview and observation to collect data from these specific informants. The study intends to obtain complete insights into the inventory management processes for leadframes and diewafers by actively involving the MP, Logistics, and PLP departments. This technique facilitates a comprehensive analysis of the procedures, difficulties, and tactics utilised in overseeing these vital elements in the manufacturing operations of PT. ABC.

In order to gather the essential data for this study, the author utilised a wide range of methods such as firsthand observation, in-depth interviews with specialists, surveys, questionnaires, and examination of pre-existing records. The primary objective of this comprehensive method was to improve the precision and dependability of the study's results, with a specific emphasis on the expenses and management of raw material inventories for the production of Integrated Circuits (IC), specifically for materials like leadframes and diewafers.

The study process encompassed conducting interviews to acquire an in-depth comprehension of cost management tactics and raw material inventories, with a structured observation phase at PT. ABC. This observation encompassed the necessary preparations to identify the scope of the observation, the identification of stakeholders engaged in the inventory and logistics processes, and meticulous note-taking of all observed occurrences, including any unforeseen events. These methodologies facilitated a comprehensive analysis of the inventory management procedures for leadframes and diewafers in IC manufacture.

Data Analysis Technique

The data analysis technique is "Describing which analysis technique is used by the researcher to analyze the data that has been collected".

Data Collection.

Data collection in involves collecting data in the research area through observation methods, interviews, and documentation by choosing the best approach in accumulating data which aims to focus and deepen the information study in the next data collection phase. There are two types of data used in data collection, namely subject data and documentary data.

1. Subject data is data obtained directly from competent parties in the Company.
2. Documentary data is data obtained from documents or historical records within the Company.

Data Reduction.

The researcher sorts the data by selecting which data are interesting, important, useful, and new. These data are grouped into various categories that are established as the focus of the research. The steps to reduce data undertaken by the author are:

1. Determining order cost: Identify all costs involved in making an order, shipping fees, administrative fees, and total them to find the total order cost.
2. Estimating storage costs: Calculate the costs associated with storing leadframes and diewafers for a year, including warehouse rent, and deterioration costs.

Drawing Conclusions.

Based on the analysis of findings and comparison with the research objectives, the researcher will draw conclusions about how PT. ABC manages the inventory of leadframes and diewafers. These conclusions may include an evaluation of the effectiveness of the inventory management process.

Comparison Method.

The author will perform a comparative analysis between the Target stock setting method and the Economic Order Quantity (EOQ) and Just in Time (JIT) methods in the context of Integrated Circuit (IC) raw material inventory management. This analysis aims to evaluate the advantages, disadvantages, and applicability of each method in optimizing the management of IC raw material inventory. By considering aspects such as cost, operational efficiency, flexibility, and response to demand fluctuations, a deep understanding of the potential application of each method in a relevant context can be obtained.

4 Results and Discussion

ABC is a leading semiconductor company specializing in the production and management of Integrated Circuit (IC) components. The raw materials used are leadframes and diewafers. PT. ABC stands as a frontrunner in the semiconductor industry, with its core expertise rooted in the manufacturing and management of Integrated Circuit (IC) components. As a company that prides itself on innovation and quality, PT. ABC has carved out a niche for itself by offering a range of IC solutions that cater to various technological sectors. Its state-of-the-art production facilities are equipped with advanced technology, enabling the creation of highly sophisticated components. The company’s focus on stringent management protocols ensures that each IC component adheres to the highest standards of performance and reliability, thus solidifying PT. ABC's reputation as a trusted leader in the semiconductor space.

The data obtained from the company regarding raw material purchases for the period January 2023 – December 2023. The leadframe purchase data can be seen in Table 1 and the diewafer purchase data can be viewed in Table 2.

Table 1. Leadframe Purchase Period January 2023 – December 2023

Month	Number of Orders (box)	Sent (box)	Late (box)	Percentage (%)
Jan-23	1039	986	53	5,1%
Feb-23	992	930	62	6,25%
Mar-23	988	940	48	4,85%
Apr-23	930	930	0	0%
Mei-23	947	879	68	7,18%
Jun-23	988	933	55	5,56%
Jul-23	895	895	0	0%
Agu-23	934	890	44	4,7%
Sep-23	636	597	39	6,1%
Okt-23	559	528	31	5,54%
Nov-23	546	546	0	0%
Des-23	560	519	41	7,32%
Total	**10.014**	**9.573**	**441**	
Average	**834,5**	**797,75**	**36,75**	

Table 2. Diewafer Purchase Period January 2023 – December 2023

Month	Number of Orders (box)	Sent (box)	Late (box)	Percentage (%)
Jan-23	2078	2011	67	3,2%
Feb-23	1984	1913	71	3,57%
Mar-23	1976	1977	0	0%
Apr-23	1860	1801	59	3,1%
Mei-23	1894	1894	0	0%
Jun-23	1976	1900	76	3,8%
Jul-23	1790	1723	67	3,7%
Agu-23	1868	1868	0	0%
Sep-23	1272	1213	59	4,6%
Okt-23	1118	1064	54	4,8%
Nov-23	1092	1092	0	0%
Des-23	1120	1067	53	4,7%
Total	**20.028**	**19.522**	**506**	
Average	**1669**	**1.626**	**42**	

Table 3. Integrated Circuit Sales for the Period of January 2023 – December 2023

No	Month	Sales Quantity	Total Usage	Total Usage
		Integrated Circuit	Leadframe	Diewafer
1	Jan-23	51890	103.780	207.560
2	Feb-23	49300	98.600	197.200
3	Mar-23	49240	98.480	196.960
4	Apr-23	46500	93.000	186.000

No	Month	Sales Quantity Integrated Circuit	Total Usage Leadframe	Total Usage Diewafer
5	Mei-23	47320	94.640	189.280
6	Jun-23	49310	98.620	197.240
7	Jul-23	44700	89.400	178.800
8	Agu-23	46690	93.380	186.760
9	Sep-23	31700	63.400	126.800
10	Okt-23	27950	55.900	111.800
11	Nov-23	27250	54.500	109.000
12	Des-23	27800	55.600	111.200
Quantity per pcs		**499.650**	**999.300**	**1.998.600**
Quantity per box		**4.997**	**9.993**	**19.986**

Table 4. Ordering Cost for January 2023 – December 2023

No	Cost Type	Leadframe	Diewafer
1	Shipping and unloading costs	12.000.000	18.000.000
	Total	**12.000.000**	**18.000.000**

Table 5. Total Supply Units, Storage Cost, Storage Cost Per Unit

Types of Goods	IC Selling price per unit	Selling price of raw materials per units	Storage Percentage	Storage Cost per Unit per Year
Leadframe	570.000	75.000	10%	7.500
Diewafer		105.000	10%	10.500

Table 6. Storage Cost Details

No	Cost Type	Leadframe	Diewafer
1	Electricity and warehouse administration costs	32.400.000	32.400.000
	Total	**32.400.000**	**32.400.000**

4.1 Economic Order Quantity (EOQ) Calculation

Table 7. Leadframe and Diewafer Sales, Order Fees, Storage Fees for the Period *2023*

Types of Goods	Sales			Ordering Cost	Storage
	Total	Price	Total Cost		

Leadframe	999.300	62.500	62.456.250.000	12.000.000	32.400.000
Diewafer	1.998.600	43.750	87.438.750.000	18.000.000	32.400.000

Leadframe

$EOQ = \sqrt{2DS/H}$
$EOQ = \sqrt{2\ x\ 9.993\ x\ 12.000.000/7.500}$ = 5.655

With the Frequency of Leadframe purchases required by the company
$Purchase\ Frequency = \frac{D}{\text{EOQ}}$
$Purchase\ Frequency = \frac{9.993}{5.655}$ = 1,76 or rounded to 2
Optimal booking is $\frac{360}{2}$ = 180 days

Diewafer

$EOQ = \sqrt{2DS/H}$
$EOQ = \sqrt{2\ x\ 19.986\ x\ 18.000.000/10.500}$ = 8.278

With the Frequency of Leadframe purchases required by the company
$Purchase\ Frequency = \frac{D}{\text{EOQ}}$
$Purchase\ Frequency = \frac{19.986}{8.278}$ 2,41 or rounded to 2,5
Optimal booking is $\frac{360}{2,5}$ = 144 days

4.2 Determination of Safety Stock

Leadframe
$SS = (\text{Maximum Usage} - \text{Average Usage})x\ Lead\ Time$
$SS = (1039\ -\ 834{,}5)\ x\ 2 = 409$

Diewafer
$SS = (\text{Maximum Usage} - \text{Average Usage})x\ Lead\ Time$
$SS = (2078 - 1669)\ x\ 2{,}5$ = 1.022,5

4.3 Determination of Reorder Point.

Leadframe
$ROP = (LT\ x\ AU) + SS$
$ROP = (2\ x\ 834{,}5) + 409 = 2.078$

Diewafer
$ROP = (LT\ x\ AU) + SS$
$ROP = (2{,}5\ x\ 1.669) + 1.022{,}5 = 5.195$

To see more clearly about the calculation of leadframe and diewafer inventory for the period January 2023 - December 2023, please see the table 8:

Table 8. EOQ, Safety Stock, Reorder Point

Raw material name	EOQ	*Safety stock*	*Reoder Point*
Leadframe	5.655	409	2.078
Diewafer	8.278	1.022,5	5.195

4.4 Calculation of TIC Value of Raw Material Inventory by Company

Leadframe
$TIC = (\text{Average Inventory})(H) + (S)(\text{Purchase frequency})$
$TIC = (834{,}5)(7.500) + (1.000.000)(12)$
$TIC = 18.258.750$

Diewafer`
$TIC = (\text{Average Inventory})(H) + (S)(\text{Purchase frequency})$
$TIC = (1669)(10.500) + (1.500.000)(12)$
$TIC = 35.524.500$

The Total Inventory Cost (TIC) of raw leadframe materials according to the company is 18.258.750 and the TIC of raw diewafer materials according to the company is 35.524.500

4.5 Calculation of TIC Value of Raw Material Inventory According to EOQ

Leadframe
$TIC = \sqrt{2.D.S.h}$
$TIC = \sqrt{2\ x\ 9.993\ x 1.000.000\ x\ 7.500}$
$TIC = 12.243.161$

Diewafer
$TIC = \sqrt{2.D.S.h}$
$TIC = \sqrt{2\ x\ 19.986\ x\ 1.500.000\ x\ 10.500}$
$TIC = 25.091.014$

The Total Inventory Cost (TIC) of leadframe raw materials according to EOQ is 12.243.161 and the TIC of diewafer raw materials according to EOQ is 25.091.014.

4.6 Just In Time Calculation

Leadframe

Optimal Shipment Quantity

$$. Qn = \sqrt{n \, x \, Q*}$$
$$Qn = \sqrt{2x10.014}$$
$$Qn = 142 \, unit$$

Optimal Number of Units.

$$q = \frac{Q*}{n}$$
$$q = \frac{10.014}{2}$$
$$q = 5.007 \, unit$$

Total Cost.

$$Tjit = \frac{1}{\sqrt{n}} (T*)$$
$$Tjit = \frac{1}{\sqrt{2}} (12.000.000)$$

$$Tjit = IDR \; 8.485.281$$

From the JIT calculations, the optimal number of leadframe shipments is 142 units, the optimal number of leadframe units is 5.007 units, and the total leadframe cost is IDR 8.485.281.

Diewafer

Optimal Shipment Quantity.

$$Qn = \sqrt{n \, x \, Q*}$$
$$Qn = \sqrt{2{,}5x20.028}$$
$$Qn = 224 \text{ unit}$$

Optimal Number of Units.

$$q = \frac{Q*}{n}$$
$$q = \frac{20.028}{2{,}5}$$
$$q = 8.011{,}2 \, unit$$

Total Cost.

$$Tjit = \frac{1}{\sqrt{n}} (T*)$$

$$Tjit = \frac{1}{\sqrt{2,5}}(18.000.000)$$
$$Tjit = IDR.11.384.200$$

From the JIT calculations, the optimal number of diewafer shipments is 224 units, the optimal number of diewafer units is 8.011,2 units, and the total diewafer cost is IDR. 11.384.200

4.7 Results of Economic Order Quantity Analysis

Table 9. Comparison of Leadframe Raw Material Inventory Calculation

Calculation	Purchase Quantity	F	SS	ROP
Company Policy	10.014	12	-	-
EOQ	5.655	2	409	2.078

Table 10. Comparison of Diewafer Raw Material Inventory Calculation

Calculation	Purchase Quantity	F	SS	ROP
Company Policy	20.028	12	-	-
EOQ	8.278	2,5	1.022,5	5.195

The table indicates the company's current raw material inventory control for leadframes and diewafers is not yet optimal. High ordering costs result from too frequent orders of small quantities, while large, infrequent orders increase storage costs. Through EOQ analysis, an optimal purchase strategy balancing order quantity and frequency to reduce inventory costs is identified. PT. ABC has not set a safety stock to prevent shortages, where EOQ could assist in establishing an appropriate level. Furthermore, the company lacks a defined reorder point, often purchasing when stock is nearly depleted, risking stockouts or excess. For a comparison of Total Inventory Cost (TIC) between the EOQ method and the company's method, refer to Table 11.

Table 11. Comparison of TIC By Company and by EOQ

Material	TIC by Company	TIC by EOQ	Savings	Percentage
Leadframe	18.258.750	12.243.161	6.015.589	33%
Diewafer	35.524.500	25.091.014	10.433.486	29%

The costs incurred using the EOQ method are lower than the costs the company has to bear, as seen in the table:

1. The total leadframe cost according to the company is IDR 18.258.750, while according to the EOQ, it is IDR 12.243.161, resulting in savings of IDR 6.015.589.

2. The total diewafer cost according to the company is IDR 35.524.500, while according to the EOQ, it is IDR 25.091.014, resulting in savings of IDR 10.433.486.

The analysis indicates that the control of leadframes and diewafers at PT.ABC is not yet effective. The EOQ method is more efficient in controlling inventory with a lower total cost. By establishing safety stock and reorder points, PT. ABC can anticipate excess or insufficient stock, ensuring smooth sales processes without high inventory costs.

4.8 Results of Just in Time Analysis

Table 11. Comparison of Leadframe Raw Material Inventory Calculation

Method Type	Leadframe	Diewafer
Company Cost	18.258.750	35.524.500
Just In Time Cost	8.485.281	11.384.200
Efficiency	9.773.469	24.140.300
Percentage	54%	68%

Based on data collection, the total result from the company's method of calculating leadframe costs is IDR 18.258.750. Furthermore, the company's method for calculating diewafer costs amounts to IDR 35.524.500. The efficiency of the company's method compared to JIT for leadframes is IDR 9.773.469, and for diewafers, it is IDR 24.140.300.

5 Conclusions And Suggestions

5.1 Conclusions

The data obtained from the company indicates that the total raw material inventory can be evaluated by comparing the Economic Order Quantity (EOQ), Just In Time (JIT), and the method currently used by the company. From this analysis, it is revealed that the company's purchasing process for leadframes and diewafers is not yet optimized. The policy of buying small amounts of raw materials frequently leads to increased ordering costs, while buying large amounts infrequently results in higher storage costs. For efficiency, the company should purchase 5.655 boxes of leadframes four times a year, or every 180 days, and 8.278 boxes of diewafers three times a year, or every 144 days. Additionally, the company should establish a safety stock of 409 boxes and a reorder point of 2.078 boxes for leadframes, as well as a safety stock of 1.022,5 boxes and a reorder point of 5.195 boxes for diewafers to maintain stock stability. The cost for storing leadframes which must be carried out using the JIT method is IDR 8.485.281 and the amount of diewafer storage that must be carried out is IDR 11.384.200.

5.2 Suggestions

Based on the above conclusions, the researcher offers several recommendations for the company to consider. First, the company should reevaluate its current inventory policies. Second, the company should adopt the EOQ method, which has been proven to reduce purchasing costs compared to the current method. Third, the company should determine the appropriate levels of safety stock and reorder points to avoid running out of or overstocking raw materials, thereby minimizing inventory costs. Lastly, the company should implement the JIT method, which has been shown to reduce storage costs compared to the method currently in use.

For further research, it is advisable to consider different types of raw materials with varying order quantities and frequencies. Secondly, select a different research subject from another field, for example, a contracting company that requires various raw materials for projects with fluctuating amounts and different types. Thirdly, consider comparing the performance of the EOQ and JIT methods with other approaches, such as Lean Manufacturing or Six Sigma, to determine which is most efficient under various operational conditions.

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