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COMPARISON OF EFFECTIVENESS INVENTORY CONTROL OF EOQ METHOD WITH COMPANY METHOD IN STEEL MATERIAL FABRICATION KRAKATAU POSCO

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Abstract: PT. Krakatau Posco, is the largest steel manufacturing company in Southeast Asia that produces slabs and plates. This study aims to compare the effectiveness of controlling inventory of steel material fabrication workshop with the EOQ method and compared with the current method of the company in an effort to prevent the unavailability of such steel material fabrication. Inventory control using the EOQ method is expected to provide solutions for inventory control, and optimal ordering in order to obtain savings for inventory costs (Total Inventory Cost) at PT. Krakatau Posco. The method used is an interview and take the necessary data, then conduct an initial analysis using the ABC method to clarify the data that has been carried out at PT. Krakatau Posco, controls inventory using EOQ, determines safety stock, ROP and maximum inventory. By controlling the ordering and inventory also expected to provide significant savings for the company, by reducing inventory costs (Total Inventory Cost). The conclusion of this research is the EOQ method is the right method for controlling steel raw material fabrication to meet the production and repair processes at PT. Krakatau Posco and with this method the results of total inventory costs are also more efficient.

Keywords: Inventory control, EOQ, ROP, safety stock, total inventory cost

INTRODUCTION

Krakatau Posco is a company engaged in manufacturing that produces steel Slabs and Plates. As an integrated steel plant that has the first Blast Furnace technology in Indonesia, this Posco krakatau has 5 plants and has an integrated steel material system which means that all are integrated with one another. As well as having a centralized steel material fabrication

workshop, where any damage to machine components or facility components is repaired here. This steel material fabrication stock consists of various types of materials such as angles, channels, expanded metal, flat bars, H-beams, I-beams, pipes and round bars.

All this time, material fabrication inventory control only estimates the availability of raw materials available to meet production needs such as, how many have to order, when to order, how much maximum inventory should be stored in the warehouse, how much inventory must be in the warehouse (safety stock) so that there is no shortage or excess, as listed in table 1.1 excerpt of Steel Material stock 2018.

Tabel 1. ***Steel Material Stock List Krakatau Posco 2018***

Category	No.	Q-Code	Description	UOM	Optimum stock quantity	January		February		March		April		May		June		July		Aug		Sept		Oct	
						Stock Actual 1/1/2018	Jumlah Terpakai	Stock Actual 1/2/2018	Jumlah Terpakai	Stock Actual 1/3/2018	Jumlah Terpakai	Stock Actual 1/4/2018	Jumlah Terpakai	Stock Actual 1/5/2018	Jumlah Terpakai	Stock Actual 1/6/2018	Jumlah Terpakai	Stock Actual 1/7/2018	Jumlah Terpakai	Stock Actual 1/8/2018	Jumlah Terpakai	Stock Actual 1/9/2018	Jumlah Terpakai	Stock Actual 1/9/2018	Jumlah Terpakai
Angle	1	Q4202567	Angle EQUAL SIDE-TYPE,25Wx25Wx3T,6000L	EA	300	282	268	14	14	31	31	0	0	200	49	151	129	22	22	0	0	247	25	222	14
	2	Q4202566	Angle EQUAL SIDE-TYPE,30Wx30Wx3T,6000L,	EA	300	0	0	100	100	0	0	58	58	0	0	137	105	32	32	0	0	149	68	81	81
	3	Q4221831	Angle EQUAL, 50Wx50Wx5T,SS400,6M	EA	1000	0	0	650	509	141	141	0	0	198	193	5	5	625	342	283	283	457	457	470	470
	4	Q2175583	Angle EQUAL SIDE-TYPE,65Wx65Wx6T,6000L	EA	300	206	44	162	93	69	3	66	66	0	0	288	123	165	165	166	58	108	40	68	68
	5	Q2175584	Angle EQUAL SIDE-TYPE, 75Wx75Wx6T,6000L,	EA	200	0	0	76	76	106	68	38	38	47	12	35	35	218	121	97	43	54	54	190	26
	6	Q2175585	Angle EQUAL SIDE-TYPE, 75Wx75Wx9T,6000L,	EA	300	0	0	34	34	94	19	75	75	0	0	0	0	250	250	385	21	364	49	315	30
	7	Q4202558	Angle EQUAL SIDE-TYPE,90Wx90Wx7T,6000L,	EA	100	138	113	25	25	127	15	112	112	124	0	124	11	113	0	113	0	113	1	112	11
	8	Q2175587	Angle EQUAL SIDE-TYPE, 100Wx100Wx7T,6000L,	EA	100	210	2	7	7	107	34	73	7	66	0	66	66	67	7	60	0	60	3	57	57
	9	Q2175588	Angle EQUAL SIDE-TYPE, 100Wx100Wx10T,6000L,	EA	100	208	32	176	6	170	16	154	2	152	0	152	0	152	0	152	0	152	14	138	138
Channel	11	Q4280319	Channel 80Hx45Wx3T,SS400,6M/EA	EA	500	23	23	160	56	104	104	200	58	142	142	304	157	147	147	214	71	143	143	280	72
	12	Q2175598	Channel 100Hx50Wx5Tx5T,	EA	500	0	0	77	77	250	250	0	0	285	111	174	17	157	157	280	199	81	81	235	218
	13	Q2175599	Channel 125Hx65Wx6Tx6T	EA	300	46	46	67	67	147	107	40	40	138	2	136	61	75	75	85	15	70	16	54	19
	14	Q2175600	Channel 150Hx75Wx6.5Tx6.5T,	EA	300	135	135	140	4	136	136	139	19	120	0	120	8	112	27	85	9	76	8	68	68
	15	Q2175602	Channel 200Hx80Wx7.5Tx7.5T,	EA	100	45	0	45	13	32	13	19	19	69	20	49	0	49	0	49	49	65	0	65	65
	16	Q2175604	Channel 250Hx90Wx9Tx9T,	EA	50	30	30	32	4	28	0	28	0	28	0	28	28	58	58	69	10	59	0	59	1
Expanded Metal	17	Q4228906	Expanded Metal 30080,30 SWx75 LW	EA	500	113	73	40	40	175	118	57	57	0	0	130	130	228	81	147	147	244	117	127	65
	18	Q4228907	Expanded Metal 50075,33SWx75LW	EA	500	86	28	58	58	184	32	152	43	109	109	196	112	84	84	239	90	149	2	147	26
Flat Bar	19	Q2115560	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	EA	500	400	232	168	168	419	300	119	119	349	89	260	175	85	85	455	57	398	97	301	206
H-Beam	25	Q4202051	H-Beam 100Hx100Wx6Tx8T,	EA	300	47	39	8	8	91	75	16	16	55	3	52	24	28	28	71	41	30	30	166	38
	26	Q4202052	H-Beam 125Hx125Wx6.5Tx9T,	EA	200	31	1	30	7	23	7	16	16	47	3	44	0	44	12	32	32	37	0	37	17
	27	Q4202053	H-Beam 150Hx150Wx7Tx10T,	EA	200	74	27	47	47	112	84	28	7	21	21	68	8	60	60	123	58	65	26	39	9
	28	Q4202054	H-Beam 200Hx200Wx8Tx12T,	EA	100	54	16	38	31	7	7	46	46	57	18	39	39	46	46	90	45	45	45	79	12
	29	Q4202055	H-Beam 250Hx250Wx9Tx14T,	EA	50	48	0	48	3	45	9	36	11	25	0	25	2	23	3	20	20	22	9	13	13
	30	Q4202056	H-Beam 300Hx300Wx10Tx15T,	EA	30	42	0	42	2	40	14	26	26	32	0	32	3	29	0	29	17	12	12	22	22
	31	Q4202058	H-Beam 350Hx350Wx12Tx19T,	EA	30	13	0	13	0	13	0	13	0	13	0	13	0	13	13	14	0	14	0	14	0
	32	Q4202057	H-Beam 400Hx400Wx13Tx21T,	EA	30	19	0	19	0	19	1	18	1	17	0	17	17	18	1	17	0	17	0	17	0
I-Beam	33	Q4225345	I-Beam 400Hx200Wx8Tx13T,	EA	30	8	8	21	9	12	12	17	5	12	0	12	12	16	0	16	0	16	0	16	16
	34	Q4264854	I-Beam 300Hx150Wx7Tx9T,	EA	30	20	18	2	0	2	1	1	1	11	0	11	2	9	0	9	2	7	0	7	0
Pipe	43	Q4045989	PIPE BLACK STEEL,15Ax6000L,	EA	1000	470	64	406	17	389	75	314	314	0	0	0	0	140	140	259	161	98	98	320	104
	44	Q4045990	PIPE BLACK STEEL,20Ax6000L,	EA	500	205	205	213	213	236	163	73	73	199	6	193	193	0	0	87	87	211	211	317	25
	45	Q4045991	PIPE BLACK STEEL,25Ax6000L,	EA	500	65	65	200	200	0	0	0	0	466	192	274	274	0	0	401	274	127	127	208	208
	46	Q4045992	PIPE BLACK STEEL,32Ax6000L,	EA	300	800	118	682	551	131	131	300	300	0	0	0	0	116	116	400	236	164	164	306	145
	47	Q4045993	PIPE BLACK STEEL,40Ax6000L,	EA	300	262	34	228	21	207	14	193	35	158	27	131	106	25	25	307	129	178	17	161	35
	48	Q4045994	PIPE BLACK STEEL,50Ax6000L,	EA	300	165	88	77	77	0	0	0	0	0	0	200	112	88	62	26	26	145	38	107	107
	49	Q4045995	PIPE BLACK STEEL,65Ax6000L,	EA	100	34	34	225	225	309	196	113	44	69	10	59	6	53	1	52	52	156	0	156	103
	50	Q4045996	PIPE BLACK STEEL,80Ax6000L,	EA	100	123	32	91	26	65	16	49	49	126	6	120	120	129	8	121	6	115	5	110	10
	51	Q4045997	PIPE BLACK STEEL,100Ax6000L,	EA	100	60	60	67	15	52	52	0	0	30	5	25	22	3	3	82	41	41	2	39	9
	52	Q4045998	PIPE BLACK STEEL,125Ax6000L,	EA	50	64	64	67	0	67	2	65	1	64	0	64	0	64	64	77	1	76	0	76	4
	53	Q4045999	PIPE BLACK STEEL,150Ax6000L,	EA	50	42	2	40	0	40	14	26	0	26	0	26	0	26	26	36	1	35	35	55	20
Round Bar KSD3503	54	Q2115645	Round Bar 16Dx6000L,	EA	500	258	63	195	149	46	45	1	1	235	235	454	146	308	113	195	195	329	168	161	161
SS400	55	Q2115644	Round Bar 19Dx6000L,	EA	500	480	30	450	450	0	0	0	0	85	85	0	0	0	0	0	0	0	0	300	15
	56	Q2115642	Round Bar 25Dx6000L,	EA	600	300	249	51	51	148	13	135	135	0	0	400	3	397	127	270	1	269	0	269	1

Source: KP company data 2018

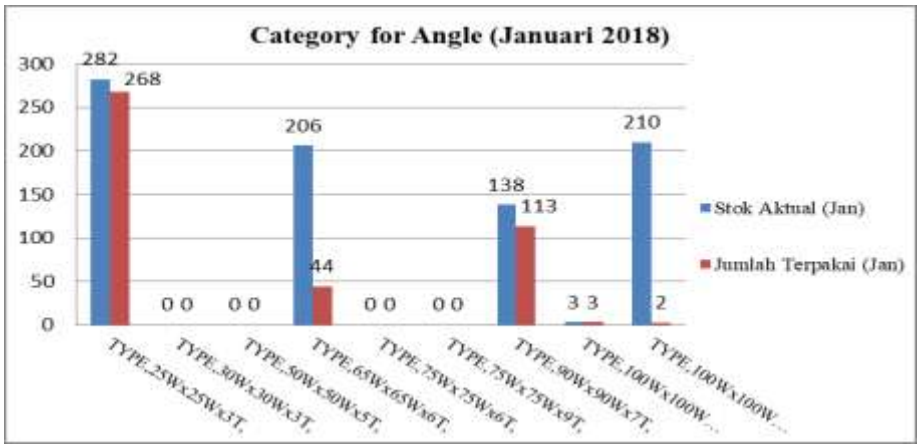


Chart 1. Example of the Angle category stock for January 2018

Table 1. shows an imbalance between the actual stock and the amount of usage as well as the optimum estimate of stock quantity which is only based on previous usage experience. In addition, in certain months and certain types of materials are often out of stock so that the process of repairing facilities or components of the factory is often constrained so that it can hamper the smooth production process. Therefore this study wants to assist companies in planning optimal inventory control of steel material in the hope of ensuring the needs and smoothness of company activities in the right quantity and quality as well as at optimal costs.

PT. Krakatau Posco has not used the correct method of controlling steel raw material fabrication, therefore this research will use the economic order quantity (EOQ) method of inventory control one of the most appropriate and can be more effective and efficient so that the steel material needs can be met all. The purpose of controlling raw materials is to find out (1) optimal quantity every time in purchasing raw materials, (2) points that indicate the time to reorder (ROP), (3) maximum inventory, and (4) total cost raw material inventory (total inventory cost) to avoid the risk of running out and also excess raw materials so as to minimize the cost of steel material fabrication.

LITERATURE REVIEW

Inventory

Inventories are defined as goods, materials, or assets owned by the company for future use. Inventories are available for sale in normal business activities, in the production process and or in travel and in the form of materials or supplies to be used in the production process or in providing services (Indonesian Institute of Accountants 2014: SFAS No. 14)

Inventory Control

Inventory control is a model commonly used to solve problems associated with controlling raw materials and finished goods in a company's activities. The distinctive feature of the inventory model is that the optimal solution is focused on guaranteeing supplies at the lowest possible cost.

Meanwhile, to make savings in the supply of supplies and also the smooth production process must be controlled inventory as mentioned by Agus Ristono (2013: 4) "An inventory control carried out by a company certainly has certain objectives. Inventory control carried out is to maintain inventory levels at optimal levels so that savings are obtained for these inventories.

Purpose of Inventory Control

The purpose of inventory control is to obtain the right quality and quantity of materials or items available at the time needed with minimum costs for the benefit or benefit of the company. Ristono (2013), detailed inventory control objectives are an effort to:

1. Keeping the company from running out of inventory so that it can result in the cessation of production activities
2. Keeping the formation of inventory by the company is not too large or excess
3. Keeping small purchases can be avoided because this will resulting in order costs too large.

ABC Analysis

ABC analysis divides inventory into three classes based on the value (value) generated by the inventory (Schroeder, 2010). This principle teaches to focus inventory

control on the types of inventory that are of high or critical value rather than those of low value or trivial. According to Schroeder (2010), ABC classification is as follows:

1. Class A is goods that provide high value. Even though group A is only represented by 20% of the total inventory available, the value given is 80%.
2. Class B is goods that give a medium value. This class B inventory group is represented by 30% of the total inventory and the resulting value is 15%.
3. Class C is goods which give low value. The C class inventory group is represented by 50% of the total available inventory and the value generated is 5%.

Economic Order Quantity (EOQ) Method

Economic Order Quantity (EOQ) is the quantity of material purchased at each purchase with the most minimal cost. The EOQ method can be used for both purchased and self-produced items (Handoko 2011: 340). Meanwhile, according to Heizer and Render (2010: 92), EOQ is one of the oldest and most widely known inventory control techniques, this inventory management method answers 2 (two) important questions, when to order and how much to order.

In applying the EOQ method there are several costs that must be considered in determining the purchase amount or profit, including:

1. Order Cost

Order costs represent costs that will be directly related to the order activities of the company. Order costs also consist of opportunity costs (Opportunity Cost). For example, time wasted processing orders, running administrative orders and so on.

According to (Heizer and Render 2010: 94) the formula for ordering costs is as following:

$$\text{Order Cost} = \frac{D}{Q} \; x \; S \qquad (2.1)$$

explanation:

D = Number of needs, units per year
Q = The number of messages each time
S = Order fee every time you order

2. Storage costs

Storage costs are costs that must be borne by the company in connection with the existence of raw materials stored in the company. According to (Heizer and Render 2010: 95) storage costs are formulated as follows:

$$\text{Storage cost} = \frac{Q}{2} \; x \; H \qquad (2.2)$$

Explanation :

Q = Number of items each time ordered
H = Storage costs, units per year

Next determine the total cost of supplies (TIC) by adding up the cost of the message and the cost of saving. The formula is as follows (Heizer and Render 2010: 97):

$$TIC = \frac{D}{Q} \; S + \frac{Q}{2} \; H \qquad (2.3)$$

explanation:

TIC = Total inventory cost
D = Number of needs, units per year
Q = Number of items each time ordered
S = Cost of the message each time a message

H = Storage costs, units per year

$$Q^* = \sqrt{\frac{2DS}{H}}$$

explanation :
Q * = Optimal Q value
S = Order fee (rupiah / order)
H = Storage fee (rupiah / unit / year)
Q * indicates that the Q value is optimal, known as the EOQ method

Safety Stock

A safety stock is an additional inventory held to protect or protect the possibility of a material shortage (stock out). According to (Sofjan Assauri, 2011) the possibility of a stock out can be caused by the use of raw materials that are greater than originally estimated or the delay in the arrival of raw materials ordered.

To determine the cost of safety stock, statistical analysis is used, which is to consider the deviations that have occurred between the estimated use of raw materials and actual use so that the standard deviation is known.
Adapun rumus standar deviasi adalah sebagai berikut :

$$SD = \sqrt{\frac{\sum(x-\bar{x})^2}{n}} \quad (2.4)$$

$$SS = SD \; x \; Z \quad (2.5)$$

Reorder Point

Reorder Point (ROP) is when another order has to be held so that the receipt of the ordered material right at the time of inventory above the safety stock is zero. (According to Martono and Harjito.2011).

According to Heizer and Render (2010: 99) ROP is the level of inventory where when inventory has reached that level, orders must be made immediately and ROP can be calculated with the following formula:

$$ROP = (D \times L) + SS \quad (2.6)$$

Total Company Inventory Costs

The calculation of total company costs can be calculated using the following formula:

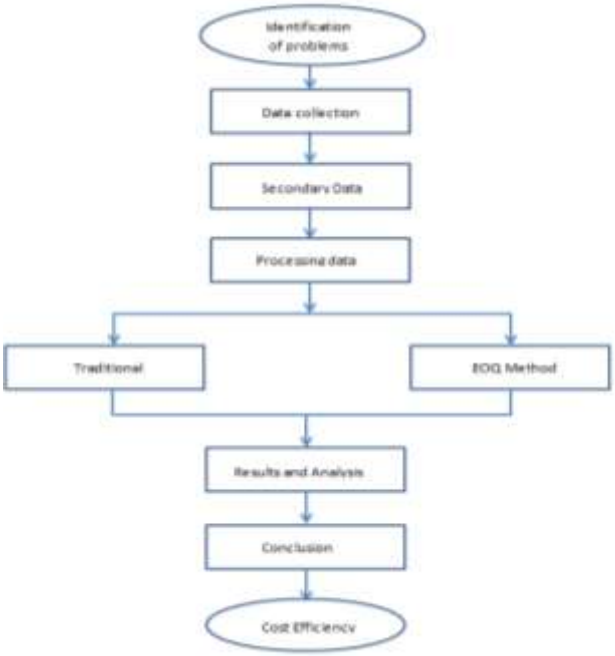
$$TIC_{per} = (\bar{D} \times H) + (n \times S) \quad (2.7)$$

RESEARCH METODE

In this study after the researchers obtained secondary data, the researchers conducted the ABC method to obtain a category of steel material fabrication category A. After that the researchers used an analysis tool to be able to find out the number of orders that the company

should have made so as not to be inadequate and not excessive. The analysis tool is inventory control with the economic order quantity (EOQ) method.

The Economic Order Quantity method is used to determine the quantity of inventory orders that minimize direct costs, inventory storage and inventory ordering costs. After doing an economic calculation with EOQ, then calculate the reorder point (ROP), safety stock (SS) and the calculation of the company's total inventory cost (TIC). The final step is to compare the results of economic order quantities between orders placed by the company with the economic order quantity (EOQ)



RESEARCH RESULT AND DISCUSSION

ABC analysis of Steel Material Fabrication

ABC analysis for steel material fabrication includes eight raw materials used, consisting of angles, channels, expanded metal, flat bars, H-beams, I-beams, pipes and round bars. By using ABC Analysis, we can find out the classification of raw materials of each type that has critical properties. The critical nature here means which raw materials represent the highest use of money. ABC analysis using manual calculations in Microsoft Excel can be seen in the table below.

Table 2. Analysis ABC of Steel Material Fabrication Type Angle

Kategori	Tahun	No	Deskripsi	Total Pemakaian bahan (Unit)	Harga/ Unit ($)	Total Harga Pemakaian bahan ($)	Persentase dari $ - Vol	Komulatif $ - Vol $	Kategori
Angle	2016	1	Angle EQUAL SIDE-TYPE,90Wx90Wx7T,6000L,KSD3503,SS400,9.59KG/M,	1163	38,55	44830,11	31,25	31,25	A
		2	Angle EQUAL SIDE-TYPE,75Wx75Wx9T,6000L,KSD3503,SS400,9.96KG/M	750	34,02	25515,26	17,79	49,04	A
		3	Angle EQUAL SIDE-TYPE,100Wx100Wx10T,6000L,KSD3503,SS400,14.9KG/M	351	60,36	21185,83	14,77	63,81	A
		4	Angle EQUAL SIDE-TYPE,75Wx75Wx6T,6000L,KSD3503,SS400,6.85KG/M	654	24,66	16125,89	11,24	75,05	A
		5	Angle EQUAL,50Wx50Wx5T,SS400,6M	1942	7,11	13803,19	9,62	84,68	B
		6	Angle EQUAL SIDE-TYPE,65Wx65Wx6T,6000L,KSD3503,SS400,5.91KG/M	802	12,76	10230,76	7,13	91,81	B
		7	Angle EQUAL SIDE-TYPE,100Wx100Wx7T,6000L,KSD3503,SS400,10.7KG/M	183	44,02	8055,60	5,62	97,42	C
		8	Angle EQUAL SIDE-TYPE,25Wx25Wx3T,6000L,KSD3503,SS400,1.12KG/M,	700	3,45	2415,13	1,68	99,11	C
		9	Angle EQUAL SIDE-TYPE,30Wx30Wx3T,6000L,KSD3503,SS400,1.36KG/M,	379	3,38	1280,19	0,89	100,00	C
			Total			**143441,97**			
	2017	1	Angle EQUAL SIDE-TYPE,90Wx90Wx7T,6000L,KSD3503,SS400,9.59KG/M,	1329	38,55	51228,90	25,28	25,28	A
		2	Angle EQUAL SIDE-TYPE,75Wx75Wx9T,6000L,KSD3503,SS400,9.96KG/M	1002	34,02	34088,39	16,82	42,10	A
		3	Angle EQUAL SIDE-TYPE,100Wx100Wx10T,6000L,KSD3503,SS400,14.9KG/M	460	60,36	27764,91	13,70	55,80	A
		4	Angle EQUAL SIDE-TYPE,65Wx65Wx6T,6000L,KSD3503,SS400,5.91KG/M	1858	12,76	23701,69	11,70	67,49	A
		5	Angle EQUAL SIDE-TYPE,75Wx75Wx6T,6000L,KSD3503,SS400,6.85KG/M	898	24,66	22142,28	10,93	78,42	A
		6	Angle EQUAL,50Wx50Wx5T,SS400,6M	3039	7,11	21600,35	10,66	89,08	B
		7	Angle EQUAL SIDE-TYPE,100Wx100Wx7T,6000L,KSD3503,SS400,10.7KG/M	390	44,02	17167,67	8,47	97,55	C
		8	Angle EQUAL SIDE-TYPE,25Wx25Wx3T,6000L,KSD3503,SS400,1.12KG/M,	931	3,45	3212,13	1,58	99,13	C
		9	Angle EQUAL SIDE-TYPE,30Wx30Wx3T,6000L,KSD3503,SS400,1.36KG/M,	520	3,38	1756,47	0,87	100,00	C
			Total			**202662,79**			
	2018	1	Angle EQUAL SIDE-TYPE,100Wx100Wx10T,6000L,KSD3503,SS400,14.9KG/M	355	60,36	21427,27	20,29	20,29	A
		2	Angle EQUAL,50Wx50Wx5T,SS400,6M	2523	7,11	17932,77	16,98	37,27	A
		3	Angle EQUAL SIDE-TYPE,75Wx75Wx9T,6000L,KSD3503,SS400,9.96KG/M	482	34,02	16397,81	15,53	52,79	A
		4	Angle EQUAL SIDE-TYPE,75Wx75Wx6T,6000L,KSD3503,SS400,6.85KG/M	637	24,66	15706,72	14,87	67,66	A
		5	Angle EQUAL SIDE-TYPE,90Wx90Wx7T,6000L,KSD3503,SS400,9.59KG/M,	288	38,55	11101,52	10,51	78,18	A
		6	Angle EQUAL SIDE-TYPE,65Wx65Wx6T,6000L,KSD3503,SS400,5.91KG/M	760	12,76	9694,99	9,18	87,36	B
		7	Angle EQUAL SIDE-TYPE,100Wx100Wx7T,6000L,KSD3503,SS400,10.7KG/M	196	44,02	8627,86	8,17	95,52	C
		8	Angle EQUAL SIDE-TYPE,25Wx25Wx3T,6000L,KSD3503,SS400,1.12KG/M,	767	3,45	2646,30	2,51	98,03	C
		9	Angle EQUAL SIDE-TYPE,30Wx30Wx3T,6000L,KSD3503,SS400,1.36KG/M,	616	3,38	2080,74	1,97	100,00	C
			Total			**105615,96**			

Table 3. Analysis ABC of Steel Material Fabrication Type Pipe

Kategori	Tahun	No	Deskripsi	Total Pemakaian bahan (Unit)	Harga/ Unit ($)	Total Harga Pemakaian bahan ($)	Persentase dari $ - Vol	Komulatif $ - Vol $	Kategori
Pipe	2016	1	PIPE BLACK STEEL,32Ax6000L,KSD3507,SPP,3.16KG/M	1618	10,69	17296,18	15,58	15,58	A
		2	PIPE BLACK STEEL,50Ax6000L,KSD3507,SPP,5.12KG/M	1075	15,30	16444,01	14,81	30,40	A
		3	PIPE BLACK STEEL,80Ax6000L,KSD3507,SPP,8.49KG/M	489	29,03	14195,59	12,79	43,19	A
		4	PIPE BLACK STEEL,25Ax6000L,KSD3507,SPP,2.45KG/M	1554	8,34	12957,38	11,67	54,86	A
		5	PIPE BLACK STEEL,150Ax6000L,KSD3507,SPP,19.2KG/M	184	67,00	12328,00	11,11	65,96	A
		6	PIPE BLACK STEEL,40Ax6000L,KSD3507,SPP,3.63KG/M	890	12,07	10743,52	9,68	75,64	A
		7	PIPE BLACK STEEL,20Ax6000L,KSD3507,SPP,1.60KG/M	1780	4,83	8600,04	7,75	83,39	B
		8	PIPE BLACK STEEL,65Ax6000L,KSD3507,SPP,6.34KG/M	301	20,78	6254,72	5,63	89,03	B
		9	PIPE BLACK STEEL,15Ax6000L,KSD3507,SPP,1.25KG/M	1349	3,72	5021,98	4,52	93,55	B
		10	PIPE BLACK STEEL,100Ax6000L,KSD3507,SPP,12.2KG/M	103	42,08	4334,56	3,90	97,46	C
		11	PIPE BLACK STEEL,125Ax6000L,KSD3507,SPP,16.1KG/M	50	56,50	2824,80	2,54	100,00	C
			Total			**111000,79**			
	2017	1	PIPE BLACK STEEL,125Ax6000L,KSD3507,SPP,16.1KG/M	317	56,50	17909,24	14,72	14,72	A
		2	PIPE BLACK STEEL,25Ax6000L,KSD3507,SPP,2.45KG/M	1924	8,34	16042,47	13,18	27,90	A
		3	PIPE BLACK STEEL,150Ax6000L,KSD3507,SPP,19.2KG/M	212	67,00	14204,00	11,67	39,57	A
		4	PIPE BLACK STEEL,65Ax6000L,KSD3507,SPP,6.34KG/M	673	20,78	13984,80	11,49	51,06	A
		5	PIPE BLACK STEEL,100Ax6000L,KSD3507,SPP,12.2KG/M	270	42,08	11362,43	9,34	60,40	A
		6	PIPE BLACK STEEL,80Ax6000L,KSD3507,SPP,8.49KG/M	340	29,03	9870,15	8,11	68,51	A
		7	PIPE BLACK STEEL,32Ax6000L,KSD3507,SPP,3.16KG/M	917	10,69	9802,59	8,06	76,57	A
		8	PIPE BLACK STEEL,50Ax6000L,KSD3507,SPP,5.12KG/M	621	15,30	9499,29	7,81	84,37	B
		9	PIPE BLACK STEEL,40Ax6000L,KSD3507,SPP,3.63KG/M	724	12,07	8739,67	7,18	91,55	B
		10	PIPE BLACK STEEL,20Ax6000L,KSD3507,SPP,1.60KG/M	1218	4,83	5884,75	4,84	96,39	C
		11	PIPE BLACK STEEL,15Ax6000L,KSD3507,SPP,1.25KG/M	1180	3,72	4392,83	3,61	100,00	C
			Total			**121692,23**			
	2018	1	PIPE BLACK STEEL,32Ax6000L,KSD3507,SPP,3.16KG/M	1922	10,69	20545,90	18,78	18,78	A
		2	PIPE BLACK STEEL,65Ax6000L,KSD3507,SPP,6.34KG/M	724	20,78	15044,57	13,75	32,54	A
		3	PIPE BLACK STEEL,25Ax6000L,KSD3507,SPP,2.45KG/M	1738	8,34	14491,59	13,25	45,79	A
		4	PIPE BLACK STEEL,100Ax6000L,KSD3507,SPP,12.2KG/M	228	42,08	9594,94	8,77	54,56	A
		5	PIPE BLACK STEEL,50Ax6000L,KSD3507,SPP,5.12KG/M	566	15,30	8657,96	7,92	62,47	A
		6	PIPE BLACK STEEL,80Ax6000L,KSD3507,SPP,8.49KG/M	292	29,03	8476,71	7,75	70,22	A
		7	PIPE BLACK STEEL,125Ax6000L,KSD3507,SPP,16.1KG/M	136	56,50	7683,46	7,02	77,25	A
		8	PIPE BLACK STEEL,150Ax6000L,KSD3507,SPP,19.2KG/M	105	67,00	7035,00	6,43	83,68	B
		9	PIPE BLACK STEEL,40Ax6000L,KSD3507,SPP,3.63KG/M	569	12,07	6868,61	6,28	89,96	B
		10	PIPE BLACK STEEL,20Ax6000L,KSD3507,SPP,1.60KG/M	1357	4,83	6556,33	5,99	95,95	C
		11	PIPE BLACK STEEL,15Ax6000L,KSD3507,SPP,1.25KG/M	1189	3,72	4426,34	4,05	100,00	C
			Total			**109381,41**			

Table 4. Analysis ABC of Steel Material Fabrication Type *H- Beam*

Kategori	Tahun	No	Deskripsi	Total Pemakaian bahan (Unit)	Harga/ Unit ($)	Total Harga Pemakaian bahan ($)	Persentase dari $ - Vol	Komulatif $ - Vol $	Kategori
H - Beam	2016	1	H-Beam 150Hx150Wx7Tx10T,KSD3503,SS400,31.5KG/M,12M	483	213,05	102905,52	20,42	20,42	A
		2	H-Beam 125Hx125Wx6.5Tx9T,KSD3502,SS400,23.8KG/M,12M	520	197,11	102494,83	20,34	40,77	A
		3	H-Beam 200Hx200Wx8Tx12T,KSD3503,SS400,49.9KG/M,12M	245	410,44	100559,00	19,96	60,72	A
		4	H-Beam 100Hx100Wx6Tx8T,KSD3502,SS400,17.2KG/M,12M	500	133,98	66988,63	13,30	74,02	A
		5	H-Beam 400Hx400Wx13Tx21T,KSD3503,SS400,233KG/M,12M	42	1100,00	46200,00	9,17	83,19	B
		6	H-Beam 250Hx250Wx9Tx14T,KSD3503,SS400,72.4KG/M,12M	77	493,01	37961,40	7,53	90,72	B
		7	H-Beam 300Hx300Wx10Tx15T,KSD3503,SS400,94KG/M,12M	40	618,40	24735,88	4,91	95,63	C
		8	H-Beam 350Hx350Wx12Tx19T,KSD3503,SS400,137KG/M,12M	16	1376,00	22016,02	4,37	100,00	C
			Total			**503861,28**			
	2017	1	H-Beam 200Hx200Wx8Tx12T,KSD3503,SS400,49.9KG/M,12M	361	410,44	148170,61	26,19	26,19	A
		2	H-Beam 125Hx125Wx6.5Tx9T,KSD3502,SS400,23.8KG/M,12M	371	197,11	73126,12	12,93	39,12	A
		3	H-Beam 400Hx400Wx13Tx21T,KSD3503,SS400,233KG/M,12M	59	1100,00	64900,00	11,47	50,59	A
		4	H-Beam 250Hx250Wx9Tx14T,KSD3503,SS400,72.4KG/M,12M	127	493,01	62611,66	11,07	61,66	A
		5	H-Beam 100Hx100Wx6Tx8T,KSD3502,SS400,17.2KG/M,12M	446	133,98	59753,86	10,56	72,22	A
		6	H-Beam 300Hx300Wx10Tx15T,KSD3503,SS400,94KG/M,12M	92	618,40	56892,51	10,06	82,28	B
		7	H-Beam 350Hx350Wx12Tx19T,KSD3503,SS400,137KG/M,12M	38	1376,00	52288,05	9,24	91,53	B
		8	H-Beam 150Hx150Wx7Tx10T,KSD3503,SS400,31.5KG/M,12M	225	213,05	47937,35	8,47	100,00	C
			Total			**565680,16**			
	2018	1	H-Beam 200Hx200Wx8Tx12T,KSD3503,SS400,49.9KG/M,12M	372	410,44	152685,50	28,22	28,22	A
		2	H-Beam 150Hx150Wx7Tx10T,KSD3503,SS400,31.5KG/M,12M	377	213,05	80321,70	14,84	43,06	A
		3	H-Beam 300Hx300Wx10Tx15T,KSD3503,SS400,94KG/M,12M	126	618,40	77918,01	14,40	57,46	A
		4	H-Beam 400Hx400Wx13Tx21T,KSD3503,SS400,233KG/M,12M	55	1100,00	60500,00	11,18	68,64	A
		5	H-Beam 100Hx100Wx6Tx8T,KSD3502,SS400,17.2KG/M,12M	430	133,98	57610,22	10,65	79,29	A
		6	H-Beam 250Hx250Wx9Tx14T,KSD3503,SS400,72.4KG/M,12M	106	493,01	52258,55	9,66	88,95	B
		7	H-Beam 350Hx350Wx12Tx19T,KSD3503,SS400,137KG/M,12M	27	1376,00	37152,04	6,87	95,81	C
		8	H-Beam 125Hx125Wx6.5Tx9T,KSD3502,SS400,23.8KG/M,12M	115	197,11	22667,13	4,19	100,00	C
			Total			**541113,14**			

Table 5. Analysis ABC of Steel Material Fabrication Type *channel*

Kategori	Tahun	No	Deskripsi	Total Pemakaian bahan (Unit)	Harga/ Unit ($)	Total Harga Pemakaian bahan ($)	Persentase dari $ - Vol	Komulatif $ - Vol $	Kategori
Channel	2016	1	Channel 100Hx50Wx5Tx5T,KSD3503,SS400,9.36KG/M,6M	2046	23,06	47172,63	33,52	33,52	A
		2	Channel 125Hx65Wx6Tx6T,KSD3503,SS400,13.4KG/M,6M	989	37,19	36779,05	26,13	59,65	A
		3	Channel 200Hx80Wx7.5Tx7.5T,KSD3503,SS400,24.6KG/M,6M	216	96,42	20826,37	14,80	74,45	A
		4	Channel 80Hx45Wx3T,SS400,6M/EA	905	20,00	18100,00	12,86	87,31	B
		5	Channel 150Hx75Wx6.5Tx6.5T,KSD3503,SS400,18.6KG/M,6M	335	53,30	17855,58	12,69	100,00	C
		6	Channel 250Hx90Wx9Tx9T,KSD3503,SS400,34.6KG/M,6M	0	174,49	0,00	0,00	100,00	C
			Total			**140733,62**			
	2017	1	Channel 80Hx45Wx3T,SS400,6M/EA	1385	20,00	27700,00	23,57	23,57	A
		2	Channel 150Hx75Wx6.5Tx6.5T,KSD3503,SS400,18.6KG/M,6M	439	53,30	23398,80	19,91	43,48	A
		3	Channel 100Hx50Wx5Tx5T,KSD3503,SS400,9.36KG/M,6M	1000	23,06	23056,02	19,62	63,09	A
		4	Channel 125Hx65Wx6Tx6T,KSD3503,SS400,13.4KG/M,6M	542	37,19	20155,96	17,15	80,24	B
		5	Channel 250Hx90Wx9Tx9T,KSD3503,SS400,34.6KG/M,6M	69	174,49	12039,97	10,24	90,48	B
		6	Channel 200Hx80Wx7.5Tx7.5T,KSD3503,SS400,24.6KG/M,6M	116	96,42	11184,53	9,52	100,00	C
			Total			**117535,29**			
	2018	1	Channel 100Hx50Wx5Tx5T,KSD3503,SS400,9.36KG/M,6M	1248	23,06	28773,92	20,12	20,12	A
		2	Channel 200Hx80Wx7.5Tx7.5T,KSD3503,SS400,24.6KG/M,6M	266	96,42	25647,28	17,93	38,05	A
		3	Channel 250Hx90Wx9Tx9T,KSD3503,SS400,34.6KG/M,6M	143	174,49	24952,41	17,45	55,50	A
		4	Channel 80Hx45Wx3T,SS400,6M/EA	1181	20,00	23620,00	16,51	72,01	A
		5	Channel 150Hx75Wx6.5Tx6.5T,KSD3503,SS400,18.6KG/M,6M	414	53,30	22066,30	15,43	87,44	B
		6	Channel 125Hx65Wx6Tx6T,KSD3503,SS400,13.4KG/M,6M	483	37,19	17961,86	12,56	100,00	C
			Total			**143021,77**			

Table 6. Analysis ABC of Steel Material Fabrication Type *round bar*

Kategori	Tahun	No	Deskripsi	Total Pemakaian bahan (Unit)	Harga/ Unit ($)	Total Harga Pemakaian bahan ($)	Persentase dari $ - Vol	Komulatif $ - Vol $	Kategori
Round Bar	2016	1	Round Bar 25Dx6000L,KSD3503,SS400,3.85KG/M	1132	96,42	109145,58	65,71	65,71	A
		2	Round Bar 19Dx6000L,KSD3503,SS400,2.23KG/M	1378	37,19	51245,22	30,85	96,56	B
		3	Round Bar 16Dx6000L,KSD3503,SS400,1.58KG/M	248	23,06	5717,89	3,44	100,00	C
			Total			**166108,70**			
	2017								
		1	Round Bar 19Dx6000L,KSD3503,SS400,2.23KG/M	746	53,30	39761,97	49,23	49,23	A
		2	Round Bar 25Dx6000L,KSD3503,SS400,3.85KG/M	1274	23,06	29373,38	36,36	85,59	B
		3	Round Bar 16Dx6000L,KSD3503,SS400,1.58KG/M	582	20,00	11640,00	14,41	100,00	C
			Total			**80775,35**			
	2018	1	Round Bar 25Dx6000L,KSD3503,SS400,3.85KG/M	650	21,64	14066,65	38,61	38,61	A
		2	Round Bar 16Dx6000L,KSD3503,SS400,1.58KG/M	1647	7,16	11792,52	32,37	70,97	A
		3	Round Bar 19Dx6000L,KSD3503,SS400,2.23KG/M	761	13,90	10576,70	29,03	100,00	B
			Total			**36435,87**			

Table 7. Analysis ABC of Steel Material Fabrication Type *expanded metal*

Kategori	Tahun	No	Deskripsi	Total Pemakaian bahan (Unit)	Harga/ Unit ($)	Total Harga Pemakaian bahan ($)	Persentase dari $ - Vol	Komulatif $ - Vol $	Kategori
Expanded Metal	2016	1	Expanded Metal 50075,33SWx75LW,5x7.5,1.2X2.4,LCA,SS400,50,	1393	49,56	69041,41	75,10	75,10	A
		2	Expanded Metal 30080,30 SWx75 LW,3x8,1.2X2.4,LCA,SS400,28,	730	31,35	22887,88	24,90	100,00	B
			Total			**91929,29**			
	2017	1	Expanded Metal 50075,33SWx75LW,5x7.5,1.2X2.4,LCA,SS400,50,	1497	49,56	74195,98	61,43	61,43	A
		2	Expanded Metal 30080,30 SWx75 LW,3x8,1.2X2.4,LCA,SS400,28,	1486	31,35	46590,94	38,57	100,00	B
			Total			**120786,92**			
	2018	1	Expanded Metal 50075,33SWx75LW,5x7.5,1.2X2.4,LCA,SS400,50,	705	49,56	34941,99	53,26	53,26	A
		2	Expanded Metal 30080,30 SWx75 LW,3x8,1.2X2.4,LCA,SS400,28,	978	31,35	30663,48	46,74	100,00	B
			Total			**65605,48**			

Table 8. Analysis ABC of Steel Material Fabrication Type *I – beam*

Kategori	Tahun	No	Deskripsi	Total Pemakaian bahan (Unit)	Harga/ Unit ($	Total Harga Pemakaian bahan ($)	Persentase dari $ - Vol	Komulatif $ - Vol $	Kategori
I Beam	2016	1	I-Beam 400Hx200Wx8Tx13T,SS400,12M/EA, WIDE FLANGE	22	589,10	12960,22	87,55	87,55	A
		2	I-Beam 300Hx150Wx7Tx9T,SS400,12M, WIDE FLANGE	10	184,26	1842,62	12,45	100,00	B
			Total			**14802,84**			
	2017	1	I-Beam 300Hx150Wx7Tx9T,SS400,12M, WIDE FLANGE	232	283,52	65776,95	73,00	73,00	B
		2	I-Beam 400Hx200Wx8Tx13T,SS400,12M/EA, WIDE FLANGE	50	486,58	24328,80	27,00	27,00	A
			Total			**90105,74**			
	2018	1	I-Beam 400Hx200Wx8Tx13T,SS400,12M/EA, WIDE FLANGE	63	486,58	30654,28	76,43	76,43	A
		2	I-Beam 300Hx150Wx7Tx9T,SS400,12M, WIDE FLANGE	24	393,96	9455,02	23,57	100,00	B
			Total			**40109,31**			

Table 9. Analysis ABC of Steel Material Fabrication Type *flat bar*

Kategori	Tahun	No	Deskripsi	Total Pemakaian bahan (Unit)	Harga/ Unit ($)	Total Harga Pemakaian bahan ($)	Persentase dari $ - Vol	Komulatif $ - Vol $	Kategori
Flat Bar	2016	1	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	1102	14,62	16107,83	100,00	100,00	A
			Total			**16107,83**			
	2017	1	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	937	14,62	13696,04	100,00	100,00	A
			Total			**13696,04**			
	2018	1	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	1735	14,62	25360,32	100,00	100,00	A
			Total			**25360,32**			

Inventory Cost

According to Puspita and Suryani (2012), inventory is one aspect that needs to be considered by companies, especially for manufacturing companies. Inventory costs are costs arising from the availability of raw materials. Inventory costs consist of, order costs (Ordering Cost or Setup Cost), and storage costs (Holding Cost).

Table 10. Storage cost of *steel material fabrication*

The Cost of Ordering Component	Ordering Cost (Rp.)
Unloading Costs (Using a Forklift)	500,000
Total cost	500,000

Order costs incurred by PT Krakatau Posco only consist of the costs of unloading costs while shipping costs are included in the price of raw materials and are free. So the total booking fee is IDR 500,000. As for the storage costs incurred consisting of the salary of one steel material fabrication operator, loading costs (using a forklift).

Table 11. Total cost of storing steel material fabrication / year

Storage Cost Component	Cost (Rp.) / Year	Total Cost (Rp.)
Salary 1 Operator	6.000.000 x 12 (Month)	72,000,000
Load Costs (Using a Forklift)	500.000 x 720 (Hour)	360,000,000
Total Cost (Rp)		432,000,000

Table 12. Storage Cost Per unit

Tahun	Round Bar (Unit)	Channel (Unit)	H- Beam (Unit)	Flat Bar (Unit)	I- Beam (Unit)	Expanded Metal (Unit)	Pipe (Unit)	Angle (Unit)	Total (Unit)	Rata rata	Total Biaya Penyimpanan steel material fabrication / Tahun (Rp.)	Biaya Penyimpanan / Unit (Rp.)
2016	1132	3251	1923	1102	32	2123	9393	6924	25880	3235	432.000.000	16692,43
2017	746	2824	1719	937	282	2983	8396	10427	28314	3539,25	432.000.000	15257,47
2018	2297	2838	1608	1735	87	1683	8826	6624	25698	3212,25	432.000.000	16810,65

The total storage cost for each unit is IDR 16,692 for raw materials in 2016, IDR 15,257 for raw materials in 2017 and IDR 16,810 for raw materials in 2018.

Calculation of EOQ and Order Frequency

The following will be attached to the calculation for the calculation of each material category, previously the order fee and storage fee will be submitted for each of the material categories.

Table 13. Calculation of EOQ and order frequency in 2016-2018

Kategori	Tahun	No	Deskripsi	EOQ	Frekuensi Pemesanan
Angle	2016	1	Angle EQUAL SIDE-TYPE,90Wx90Wx7T,6000L,KSD3503,SS400,9.59KG/M,	263,96	4,41
		2	Angle EQUAL SIDE-TYPE,75Wx75Wx9T,6000L,KSD3503,SS400,9.96KG/M	211,97	3,54
		3	Angle EQUAL SIDE-TYPE,100Wx100Wx10T,6000L,KSD3503,SS400,14.9KG/M	145,01	2,42
		4	Angle EQUAL SIDE-TYPE,75Wx75Wx6T,6000L,KSD3503,SS400,6.85KG/M	197,94	3,30
	2017	1	Angle EQUAL SIDE-TYPE,90Wx90Wx7T,6000L,KSD3503,SS400,9.59KG/M,	295,14	4,50
		2	Angle EQUAL SIDE-TYPE,75Wx75Wx9T,6000L,KSD3503,SS400,9.96KG/M	256,27	3,91
		3	Angle EQUAL SIDE-TYPE,100Wx100Wx10T,6000L,KSD3503,SS400,14.9KG/M	173,64	2,65
		4	Angle EQUAL SIDE-TYPE,65Wx65Wx6T,6000L,KSD3503,SS400,5.91KG/M	348,96	5,32
		5	Angle EQUAL SIDE-TYPE,75Wx75Wx6T,6000L,KSD3503,SS400,6.85KG/M	242,60	3,70
	2018	1	Angle EQUAL SIDE-TYPE,100Wx100Wx10T,6000L,KSD3503,SS400,14.9KG/M	145,32	2,44
		2	Angle EQUAL,50Wx50Wx5T,SS400,6M	387,41	6,51
		3	Angle EQUAL SIDE-TYPE,75Wx75Wx9T,6000L,KSD3503,SS400,9.96KG/M	169,33	2,85
		4	Angle EQUAL SIDE-TYPE,75Wx75Wx6T,6000L,KSD3503,SS400,6.85KG/M	194,66	3,27
		5	Angle EQUAL SIDE-TYPE,90Wx90Wx7T,6000L,KSD3503,SS400,9.59KG/M,	130,89	2,20
Pipe	2016	1	PIPE BLACK STEEL,32Ax6000L,KSD3507,SPP,3.16KG/M	311,34	5,20
		2	PIPE BLACK STEEL,50Ax6000L,KSD3507,SPP,5.12KG/M	253,77	4,24
		3	PIPE BLACK STEEL,80Ax6000L,KSD3507,SPP,8.49KG/M	171,16	2,86
		4	PIPE BLACK STEEL,25Ax6000L,KSD3507,SPP,2.45KG/M	305,12	5,09
		5	PIPE BLACK STEEL,150Ax6000L,KSD3507,SPP,19.2KG/M	104,99	1,75
	2017	1	PIPE BLACK STEEL,125Ax6000L,KSD3507,SPP,16.1KG/M	144,14	2,20
		2	PIPE BLACK STEEL,25Ax6000L,KSD3507,SPP,2.45KG/M	355,11	5,42
		3	PIPE BLACK STEEL,150Ax6000L,KSD3507,SPP,19.2KG/M	117,88	1,80
		4	PIPE BLACK STEEL,65Ax6000L,KSD3507,SPP,6.34KG/M	210,02	3,20
		5	PIPE BLACK STEEL,100Ax6000L,KSD3507,SPP,12.2KG/M	133,03	2,03
	2018	1	PIPE BLACK STEEL,32Ax6000L,KSD3507,SPP,3.16KG/M	338,13	5,68
		2	PIPE BLACK STEEL,65Ax6000L,KSD3507,SPP,6.34KG/M	207,53	3,49
		3	PIPE BLACK STEEL,25Ax6000L,KSD3507,SPP,2.45KG/M	321,54	5,41
		4	PIPE BLACK STEEL,100Ax6000L,KSD3507,SPP,12.2KG/M	116,46	1,96
		5	PIPE BLACK STEEL,50Ax6000L,KSD3507,SPP,5.12KG/M	183,49	3,08
H - Beam	2016	1	H-Beam 150Hx150Wx7Tx10T,KSD3503,SS400,31.5KG/M,12M	170,10	2,84
		2	H-Beam 125Hx125Wx6.5Tx9T,KSD3502,SS400,23.8KG/M,12M	176,50	2,95
		3	H-Beam 200Hx200Wx8Tx12T,KSD3503,SS400,49.9KG/M,12M	121,15	2,02
		4	H-Beam 100Hx100Wx6Tx8T,KSD3502,SS400,17.2KG/M,12M	173,07	2,89
	2017	1	H-Beam 200Hx200Wx8Tx12T,KSD3503,SS400,49.9KG/M,12M	153,82	2,35
		2	H-Beam 125Hx125Wx6.5Tx9T,KSD3502,SS400,23.8KG/M,12M	155,94	2,38
		3	H-Beam 400Hx400Wx13Tx21T,KSD3503,SS400,233KG/M,12M	62,18	0,95
		4	H-Beam 250Hx250Wx9Tx14T,KSD3503,SS400,72.4KG/M,12M	91,23	1,39
		5	H-Beam 100Hx100Wx6Tx8T,KSD3502,SS400,17.2KG/M,12M	170,97	2,61
	2018	1	H-Beam 200Hx200Wx8Tx12T,KSD3503,SS400,49.9KG/M,12M	148,76	2,50
		2	H-Beam 150Hx150Wx7Tx10T,KSD3503,SS400,31.5KG/M,12M	149,75	2,52
		3	H-Beam 300Hx300Wx10Tx15T,KSD3503,SS400,94KG/M,12M	86,58	1,46
		4	H-Beam 400Hx400Wx13Tx21T,KSD3503,SS400,233KG/M,12M	57,20	0,96
		5	H-Beam 100Hx100Wx6Tx8T,KSD3502,SS400,17.2KG/M,12M	159,93	2,69
Channel	2016	1	Channel 100Hx50Wx5Tx5T,KSD3503,SS400,9.36KG/M,6M	350,10	5,84
		2	Channel 125Hx65Wx6Tx6T,KSD3503,SS400,13.4KG/M,6M	243,41	4,06
		3	Channel 200Hx80Wx7.5Tx7.5T,KSD3503,SS400,24.6KG/M,6M	113,75	1,90
	2017	1	Channel 80Hx45Wx3T,SS400,6M/EA	301,29	4,60
		2	Channel 150Hx75Wx6.5Tx6.5T,KSD3503,SS400,18.6KG/M,6M	169,63	2,59
		3	Channel 100Hx50Wx5Tx5T,KSD3503,SS400,9.36KG/M,6M	256,01	3,91
	2018	1	Channel 100Hx50Wx5Tx5T,KSD3503,SS400,9.36KG/M,6M	272,47	4,58
		2	Channel 200Hx80Wx7.5Tx7.5T,KSD3503,SS400,24.6KG/M,6M	125,79	2,11
		3	Channel 250Hx90Wx9Tx9T,KSD3503,SS400,34.6KG/M,6M	92,23	1,55
		4	Channel 80Hx45Wx3T,SS400,6M/EA	265,05	4,46
Round Bar	2016	1	Round Bar 25Dx6000L,KSD3503,SS400,3.85KG/M	260,41	4,35
	2017	1	Round Bar 19Dx6000L,KSD3503,SS400,2.23KG/M	221,12	3,37
	2018	1	Round Bar 25Dx6000L,KSD3503,SS400,3.85KG/M	196,64	3,31
		2	Round Bar 16Dx6000L,KSD3503,SS400,1.58KG/M	313,01	5,26
Flat Bar	2016	1	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	256,94	4,29
	2017	1	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	247,82	3,78
	2018	1	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	321,26	5,40
Expanded Metal	2016	1	Expanded Metal 50075,33SWx75LW,5x7.5,1.2X2.4,LCA,SS400,50,	288,88	4,82
	2017	1	Expanded Metal 50075,33SWx75LW,5x7.5,1.2X2.4,LCA,SS400,50,	313,23	4,78
	2018	1	Expanded Metal 50075,33SWx75LW,5x7.5,1.2X2.4,LCA,SS400,50,	204,79	3,44
I Beam	2016	1	I-Beam 400Hx200Wx8Tx13T,SS400,12M/EA, WIDE FLANGE	36,30	0,61
	2017	1	I-Beam 300Hx150Wx7Tx9T,SS400,12M, WIDE FLANGE	123,31	1,88
	2018	1	I-Beam 400Hx200Wx8Tx13T,SS400,12M/EA, WIDE FLANGE	61,22	1,03

Table 4.12 is elaborated to get the optimum ordering point from the calculation results, the order is carried out with qty as listed in table 4.12 and also the frequency of orders made in one year varies from 1 time order in a year to 7 times order in one year.

Calculation of Safety Stock Steel Material Fabrication

Safety Stock is an additional inventory held to maintain the continuity of production from possible shortages of raw materials. Calculation of standard deviation and safety stock samples for 2016 - 2018 is as follows.

Example Year 2016 angle equal side type (90W x 90W x 7T).

Table 14. Calculation of Angle deviation of SIDE-TYPE EQUAL, 90Wx90Wx7T

Bulan	Permintaan X_i	$\bar{x}$	$(X_i - \bar{X})$	$(X_i - \bar{X})^2$
Januari	37	96,92	-59,92	3590,01
Februari	46	96,92	-50,92	2592,51
Maret		96,92	-96,92	9392,84
April	65	96,92	-31,92	1018,67
Mei	277	96,92	180,08	32430,01
Juni	11	96,92	-85,92	7381,67
Juli	313	96,92	216,08	46692,01
Agustus	17	96,92	-79,92	6386,67
September		96,92	-96,92	9392,84
Oktober	340	96,92	243,08	59089,51
November	47	96,92	-49,92	2491,67
Desember	10	96,92	-86,92	7554,51
Total	1163			188012,92

From table 14, the deviation for 2016 type material angle equal side type (90W x 90W x 7T) is 188,012.92 and the calculation for safety stock is as follows:

$$SD = \sqrt{\frac{\sum(Xi - \bar{X})^2}{n}}$$

$$SD = \sqrt{\frac{188012,92}{12}}$$

$$SD = \sqrt{15667,74} = 125,17$$

$$SS = SD \; x \; Z$$

$$SS = 125,17 \; x \; 2,33 = 291,64 \; unit$$

Calculation of Reorder Point Steel Material Fabrication

Reorder Point (ROP) or re-order point is the point of reorder number of raw materials. In this study ROP can be used to find out when companies must place an order, by looking at the inventory of raw materials in the warehouse. By using ROP, companies can find out at what amount of raw materials the company must repurchase so that there is no shortage of raw materials in the warehouse. The components used for the calculation of ROP are annual demand (D), number of working days 264 days, lead time or waiting time from order to goods arriving at the warehouse is 15 days and safety stock.**Example calculation for 2016 angle equal side type (90W x 90W x 7T).**

$$ROP = (D \; x \; L) + SS$$

$$ROP = \left(1163 \; x \frac{15}{264}\right) + 291,65$$

$$ROP = 66,07 + 291,65 = 357,73 \text{ unit}$$

From the above calculation, the reorder point for 2016 type material angle equal side type (90W x 90W x 7T) is 357.73 units

Calculation of Total Inventory Costs Company

The calculation of total inventory costs by company will be calculated using the average inventory available in the company using the following formula:

$$TIC\ per = (\bar{D}\ x\ H) + (n\ x\ S)$$

Example calculation for 2016 angle equal side type (90Wx90Wx7T).

$$TIC\ per = (\bar{D}\ x\ H) + (n\ x\ S)$$
$$TIC\ per = (97\ x\ 16692{,}43) + (6\ x\ 500000)$$
$$TIC\ per = 1617774{,}4 + 3000000$$
$$TIC\ per = Rp\ 4.617.774{,}34$$

From the above calculation, the company's total inventory costs for 2016 type material angle equal side type (90W x 90W x 7T) are. $Rp\ 4.617.774{,}34$.

Calculation of Total Inventory Costs According to the EOQ Method

Calculation of total inventory costs according to the EOQ method will be calculated using the EOQ values that have been obtained using the following formula

$$TIC* = \left(\frac{D}{Q}x\ S\right) + \left(\frac{Q}{2}x\ H\right)$$

Example calculation for 2016 angle equal side type (90Wx90Wx 7T).

$$TIC* = \left(\frac{D}{Q}x\ S\right) + \left(\frac{Q}{2}x\ H\right)$$
$$TIC* = \left(\frac{1163}{263{,}96}x\ 500000\right) + \left(\frac{263{,}96}{2}x\ 16692{,}43\right)$$
$$TIC* = 2203025{,}9 + 2203026$$
$$TIC* = Rp\ 4.406.051{,}76$$

From the above calculation, the total inventory cost of the EOQ method for 2016 type of material angle equal side type (90W x 90W x 7T) is $Rp\ 4.406.051{,}76$.

Comparison of Research Results with Company Policy

Comparison of the total cost of raw material inventory according to EOQ with the total raw material inventory run by the company in 2016-2018 can be seen in the table below:

Table 15. TIC According to EOQ and TIC Run by the Company and Savings During the 2016-2018 Period

Tahun	TIC Metode Perusahaan		TIC Metode EOQ		Penghematan	
					Rupiah	Persentase
2016	Rp	77.932.612,06	Rp	69.371.506,24	Rp 8.561.105,82	10,98%
2017	Rp	81.533.693,58	Rp	69.319.824,16	Rp 12.213.869,42	14,98%
2018	Rp	88.861.779,13	Rp	78.159.819,71	Rp 10.701.959,41	12,04%

Based on Table 15 generated total inventory cost savings of Rp. 8,561,105.82 in 2016, Rp. 12,213,869.42 in 2017 and Rp. 10,701,959.41 in 2018. If the savings made are in percent, the savings in 2016 will be 10.98%, 2017 will be 14.98% and 2018 will be 12.04%. Comparison of the results obtained from this study with the policies adopted by the company can be seen in the table below.

Table 16. Comparison of Q Value of EOQ method with Company Q Value, Research Reorder Point and Company Reorder Point, Safety Research Stock and Company Safety Stock in 2016 - 2018.

Kategori	Tahun	No	Deskripsi	Perbandingan Metode EOQ Dengan Metode Perusahaan				Reorder Point (Unit)		Safety Stock (Unit)	
				Metode EOQ (Unit)	Frekuensi Pemesanan (EOQ)	Metode Q Perusahaan (Unit)	Frekuensi Pemesanan (Perusahaaan)	Penelitian	Perusahaan	Penelitian	Perusahaan
Angle	2016	1	Angle EQUAL SIDE-TYPE,90Wx90Wx7T	263.96	4	193.83	6	358	194	292	-
		2	Angle EQUAL SIDE-TYPE,75Wx75Wx9T	211.97	4	125.00	6	193	125	150	-
		3	Angle EQUAL SIDE-TYPE,100Wx100Wx10T	145.01	2	58.50	6	97	59	77	-
		4	Angle EQUAL SIDE-TYPE,75Wx75Wx6T	197.94	3	109.00	6	171	109	134	-
	2017	1	Angle EQUAL SIDE-TYPE,90Wx90Wx7T	295.14	5	221.50	6	337	222	261	-
		2	Angle EQUAL SIDE-TYPE,75Wx75Wx9T	256.27	4	167.00	6	251	167	194	-
		3	Angle EQUAL SIDE-TYPE,100Wx100Wx10T	173.64	3	76.67	6	139	77	112	-
		4	Angle EQUAL SIDE-TYPE,65Wx65Wx6T	348.96	5	309.67	6	497	310	391	-
		5	Angle EQUAL SIDE-TYPE,75Wx75Wx6T	242.60	4	149.67	6	263	150	212	-
	2018	1	Angle EQUAL SIDE-TYPE,100Wx100Wx10T	145.32	2	59.17	6	139	59	119	-
		2	Angle EQUAL,50Wx50Wx5T	387.41	7	420.50	6	583	421	440	-
		3	Angle EQUAL SIDE-TYPE,75Wx75Wx9T	169.33	3	80.33	6	184	80	156	-
		4	Angle EQUAL SIDE-TYPE,75Wx75Wx6T	194.66	3	106.17	6	131	106	95	-
		5	Angle EQUAL SIDE-TYPE,90Wx90Wx7T	130.89	2	72.00	4	110	72	94	-
Pipe	2016	1	PIPE BLACK STEEL,32Ax6000L,KSD3507,SPP,3.16KG/M	311.34	5	269.67	6	438	270	346	-
		2	PIPE BLACK STEEL,50Ax6000L,KSD3507,SPP,5.12KG/M	253.77	4	179.17	6	239	179	177	-
		3	PIPE BLACK STEEL,80Ax6000L,KSD3507,SPP,8.49KG/M	171.16	3	81.50	6	125	82	97	-
		4	PIPE BLACK STEEL,25Ax6000L,KSD3507,SPP,2.45KG/M	305.12	5	259.00	6	389	259	301	-
		5	PIPE BLACK STEEL,150Ax6000L,KSD3507,SPP,19.2KG/M	104.99	2	46.00	4	58	46	48	-
	2017	1	PIPE BLACK STEEL,125Ax6000L,KSD3507,SPP,16.1KG/M	144.14	2	79.25	4	88	79	70	-
		2	PIPE BLACK STEEL,25Ax6000L,KSD3507,SPP,2.45KG/M	355.11	5	320.67	6	414	321	305	-
		3	PIPE BLACK STEEL,150Ax6000L,KSD3507,SPP,19.2KG/M	117.88	2	53.00	4	62	53	50	-
		4	PIPE BLACK STEEL,65Ax6000L,KSD3507,SPP,6.34KG/M	210.02	3	112.17	6	193	112	155	-
		5	PIPE BLACK STEEL,100Ax6000L,KSD3507,SPP,12.2KG/M	133.03	2	67.50	4	94	68	78	-
	2018	1	PIPE BLACK STEEL,32Ax6000L,KSD3507,SPP,3.16KG/M	338.13	6	320.33	6	452	320	343	-
		2	PIPE BLACK STEEL,65Ax6000L,KSD3507,SPP,6.34KG/M	207.53	3	120.67	6	211	121	169	-
		3	PIPE BLACK STEEL,25Ax6000L,KSD3507,SPP,2.45KG/M	321.54	5	289.67	6	331	290	233	-
		4	PIPE BLACK STEEL,100Ax6000L,KSD3507,SPP,12.2KG/M	116.46	2	57.00	4	60	57	47	-
		5	PIPE BLACK STEEL,50Ax6000L,KSD3507,SPP,5.12KG/M	183.49	3	94.33	6	124	94	92	-
H - Beam	2016	1	H-Beam 150Hx150Wx7Tx10T,KSD3503,SS400,31.5KG/M,12M	170.10	3	80.50	6	125	81	98	-
		2	H-Beam 125Hx125Wx6.5Tx9T,KSD3502,SS400,23.8KG/M,12M	176.50	3	86.67	6	165	87	135	-
		3	H-Beam 200Hx200Wx8Tx12T,KSD3503,SS400,49.9KG/M,12M	121.15	2	61.25	4	69	61	55	-
		4	H-Beam 100Hx100Wx6Tx8T,KSD3502,SS400,17.2KG/M,12M	173.07	3	83.33	6	187	83	159	-
	2017	1	H-Beam 200Hx200Wx8Tx12T,KSD3503,SS400,49.9KG/M,12M	153.82	2	60.17	6	99	60	79	-
		2	H-Beam 125Hx125Wx6.5Tx9T,KSD3502,SS400,23.8KG/M,12M	155.94	2	61.83	6	118	62	97	-
		3	H-Beam 400Hx400Wx13Tx21T,KSD3503,SS400,233KG/M,12M	62.18	1	19.67	3	18	20	15	-
		4	H-Beam 250Hx250Wx9Tx14T,KSD3503,SS400,72.4KG/M,12M	91.23	1	31.75	4	39	32	32	-
		5	H-Beam 100Hx100Wx6Tx8T,KSD3502,SS400,17.2KG/M,12M	170.97	3	74.33	6	95	74	69	-
	2018	1	H-Beam 200Hx200Wx8Tx12T,KSD3503,SS400,49.9KG/M,12M	148.76	3	62.00	6	54	62	32	-
		2	H-Beam 150Hx150Wx7Tx10T,KSD3503,SS400,31.5KG/M,12M	149.75	3	62.83	6	77	63	56	-
		3	H-Beam 300Hx300Wx10Tx15T,KSD3503,SS400,94KG/M,12M	86.58	1	31.50	4	28	32	21	-
		4	H-Beam 400Hx400Wx13Tx21T,KSD3503,SS400,233KG/M,12M	57.20	1	27.50	2	20	28	17	-
		5	H-Beam 100Hx100Wx6Tx8T,KSD3502,SS400,17.2KG/M,12M	159.93	3	71.67	6	75	72	51	-
Channel	2016	1	Channel 100Hx50Wx5Tx5T,KSD3503,SS400,9.36KG/M,6M	350.10	6	341.00	6	543	341	426	-
		2	Channel 125Hx65Wx6Tx6T,KSD3503,SS400,13.4KG/M,6M	243.41	4	164.83	6	217	165	160	-
		3	Channel 200Hx80Wx7.5Tx7.5T,KSD3503,SS400,24.6KG/M,6M	113.75	2	54.00	4	69	54	56	-
	2017	1	Channel 80Hx45Wx3T,SS400,6M/EA	301.29	5	230.83	6	311	231	232	-
		2	Channel 150Hx75Wx6.5Tx6.5T,KSD3503,SS400,18.6KG/M,6M	169.63	3	73.17	6	121	73	96	-
		3	Channel 100Hx50Wx5Tx5T,KSD3503,SS400,9.36KG/M,6M	256.01	4	166.67	6	269	167	213	-
	2018	1	Channel 100Hx50Wx5Tx5T,KSD3503,SS400,9.36KG/M,6M	272.47	5	208.00	6	266	208	196	-
		2	Channel 200Hx80Wx7.5Tx7.5T,KSD3503,SS400,24.6KG/M,6M	125.79	2	66.50	4	80	67	65	-
		3	Channel 250Hx90Wx9Tx9T,KSD3503,SS400,34.6KG/M,6M	92.23	2	47.67	3	49	48	40	-
		4	Channel 80Hx45Wx3T,SS400,6M/EA	265.05	4	196.83	6	171	197	104	-
Round Bar	2016	1	Round Bar 25Dx6000L,KSD3503,SS400,3.85KG/M	260.41	4	188.67	6	333	189	268	-
	2017	1	Round Bar 19Dx6000L,KSD3503,SS400,2.23KG/M	221.12	3	124.33	6	214	124	171	-
	2018	1	Round Bar 25Dx6000L,KSD3503,SS400,3.85KG/M	196.64	3	108.33	6	213	108	176	-
		2	Round Bar 16Dx6000L,KSD3503,SS400,1.58KG/M	313.01	5	274.50	6	260	275	167	-
Flat Bar	2016	1	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	256.94	4	183.67	6	262	184	199	-
	2017	1	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	247.82	4	156.17	6	165	156	111	-
	2018	1	Flat Bar 6000Lx100Wx6T,SS400,4.71KG/M	321.26	5	289.17	6	281	289	183	-
Expanded Metal	2016	1	Expanded Metal 50075,33SWx75LW,5x7.5,1.2X2.4,LCA,SS400,50,	288.88	5	232.17	6	309	232	230	-
	2017	1	Expanded Metal 50075,33SWx75LW,5x7.5,1.2X2.4,LCA,SS400,50,	313.23	5	249.50	6	310	250	225	-
	2018	1	Expanded Metal 50075,33SWx75LW,5x7.5,1.2X2.4,LCA,SS400,50,	204.79	3	117.50	6	117	118	77	-
I Beam	2016	1	I-Beam 400Hx200Wx8Tx13T,SS400,12M/EA, WIDE FLANGE	36.30	1	11.00	2	8	11	7	-
	2017	1	I-Beam 300Hx150Wx7Tx9T,SS400,12M, WIDE FLANGE	123.31	2	38.67	6	70	39	57	-
	2018	1	I-Beam 400Hx200Wx8Tx13T,SS400,12M/EA, WIDE FLANGE	61.22	1	21.00	3	17	21	13	-

Based on Table 16 the results obtained Q value (the number of messages each time) based on the results of research and methods that have been applied in the company. The frequency of orders made by the company when seen from the Q value of the company ranges from 6 orders per year for each type of material means that on average every 2-3 months the company orders it. While the results of ordering frequency based on the EOQ method vary according to the level of need and usage, the order frequency varies greatly from 1 time to 6 times a year. This EOQ method is one of the ways to control inventory which is

part of the fields included in the SCOR (Supply Chain Operation Reference) model because it includes interactions in the company's supply chain that explains the mapping done to get a clear model picture of the material flow of information flow , financial flow, from a company's supply chain. This is in line with the results of Ahmad Hidayat Sutawijaya's research (MIX: Journal of Management Scientific, Volume VI, No. 1, February 2016).

Based on Table 16, the results of the company's ROP value tend to be smaller than the ROP results of the EOQ method and the average ROP value of the company is smaller than the EOQ method because the company still conducts ROP only based on estimates and applies an average order every two months meaning ordering only done when the stock in the field is running low.

Based on Table 16 we can see that the company has not yet owned and implemented a safety stock system, so a state of stock out occurs when the plant needs certain material. Then based on the EOQ method a safety stock is calculated and the results vary according to the annual needs of each material.

CONCLUSION

Based on the analysis and calculation results that have been obtained, it can be concluded that a comparative analysis of the effectiveness of inventory control using the EOQ (economic order quantity) method with the company method on steel material fabrication Krakatau Posco that the steel material fabrication inventory control method with the EOQ method is proven to be more effective, efficient and better than the company's manual method. Starting from the results of the EOQ value, ROP, safety stock and from the calculation results of Krakatau Posco's total inventory cost can save inventory costs by Rp 8,561,105 (10.98%), - in 2016, Rp 12,213,869 (14.98%) , - in 2017 and IDR 10,701,959 (12.04%)

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