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Analysis of Raw Material Inventory Control Using the Min-Max Stock Method to Control Inventory Costs at PT. Artha King Indonesia

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A B S T R A C T

In the current era of globalization, a company must always try to have the ability to compete with other companies. The issue of inventory planning and control is one of the most important things every business has to face. This study aims to determine the picture of inventory management using Min-Max Stock at PT Artha King Indonesia and find out the amount of inventory costs incurred using the Min Max Stock method. The type of research used is quantitative descriptive research conducted at PT Artha King Indonesia. We recommend that data collection uses primary data from interviews and company observations. While secondary data is obtained from historical company data. The results of this study show that theoretically the minimum and maximum limit values of stock, safety stock, and reorder level (Q) are different for each raw material. Furthermore, by using a policy proposal with the minimum inventory method, the cost calculation results show that the annual costs incurred by the company are lower because there is no excess or out-of-stock material during the warehouse period. Knowing the results of theoretical calculations of the above values, it is possible to evaluate the policies used today so that in the future the company can minimize the costs incurred and maximize profits.

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1. INTRODUCTION

Along with the progress of manufacturing companies in Indonesia and increasingly fierce business competition, it certainly requires business people to find ways to improve efficiency in all fields. One way is to control the stock. (Yanuarsyah et al, 2021) States that stock is a collection of goods stored for sale in a company's business operations and can be used in the production process or for certain purposes. Without stock, companies risk not being able to meet customer demand on time. Overstock is a waste because it can cause high storage and maintenance costs during storage in the warehouse (Meileni, et al, 2020). Raw materials are one of the important elements of production. Lack of available raw materials can result in a halt in the production process due to running out of materials for processing. However, if the stock of raw materials is too large, it can lead to high costs of storing and maintaining raw materials during storage in the

warehouse. The state of overstock is seen in terms of finances or ineffective expenses because there are too many goods that are not used and do not rotate. Stock control is one of the activities that is integrated with all production operations of the company, in accordance with a predetermined plan, both in terms of time, quantity, quantity, and cost (Assauri, 2005 in Vikaliana 2020). Every company is required to always maintain the inventory of raw materials to support production activities to run smoothly. Therefore, it is important for every company to control raw material inventory. Some methods that can be used in this regard are Min-Max Stock and Just-in-Time (JIT). However, the JIT method is no longer effective if the raw material has no value or cannot be resold. This causes the price of raw materials imposed on products to be higher. If this continues to happen, it can cause losses to the company because the smooth production process is disrupted due to problems in the supply of raw materials. As a result, inventory control at PT. Artha King Indonesia is also not running well, which affects inconsistent inventory costs every month.

Therefore, after considering both methods and problems that exist in the research subject, researchers use the Min-Max Stock method as a tool in controlling inventory at PT. Artha King Indonesia. In this study, researchers chose the Min-Max Stock method because it was considered more optimal than using the JIT method in inventory control at PT. Artha King Indonesia. Another reason is that by using the Min-Max Stock method, companies can find solutions related to raw material control. It is also a solution to the uncertainty of repurchasing raw materials, even if there are constraints with suppliers. The research needs to be done by using the Min-max stock method to reduce the the possibility of stockouts or excess stock in the warehouse so as not to interfere with the production process. Companies can also save inventory costs by determining the optimal order quantity.

2. LITERATURE REVIEW

Research by (Herjanto 2008, in Vikaliana, 2020) also states that inventory is material or products that are stored and will be used to achieve a specific purpose, such as for use in production or assembly processes, for resale, or as spare parts of equipment or machinery. According to (Handoko, 1999 in Vikaliana 2020), the types of supplies can be divided into: (a) Inventory of raw materials, namely the inventory of physical goods such as steel, wood, and other components used in the production process, (b) Inventory of Assembled Components (purchased parts/components), which is the inventory of goods consisting of components obtained from other companies, which can be assembled directly into products, (c) Inventory of Auxiliary or Auxiliary Materials (supplies), namely the inventory of goods needed in the production process, but not part or component of finished goods, (d) Work in process, which is the inventory of goods produced by each part in the production process or which have been processed into a form, but still need further processing into finished goods, (e) Finished goods inventory, which is the inventory of goods that have been processed or processed in the factory and are ready to be sold or shipped to customers.

According to (Divianto 2011 in Sari, 2021), the inventory function has an important meaning in an effort to improve company operations, both internal and external operations, so that the company looks in a free position. The inventory and purchasing function is responsible for maintaining inventory and handling the purchase of raw materials from suppliers (Mulyati and Kisa, 2019). Research by (Hertanto, 2020) coined the min-max method is a method used in raw material control based on the fact that inventory consists of two levels, namely the maximum level and the minimum level. After the two levels are determined, when the inventory reaches the minimum level, an order for raw materials must be placed to return the inventory to the maximum level in raw material inventory control (especially in inventory control). Determination of the frequency of orders in one year (Lentari and Rachmawati, 2022). The ordering frequency formula is as follows:

Frequency: D/Q
Description:
F = order frequency (times/year).
D = quantity of goods needed (tons/year).

Q = order quantity (tons/year).

Research by Kurniawan (2022), suggests that minimum inventory (Minimum stock) is the amount of usage during the purchase order time and is calculated from the multiplication of the order time per period and the average usage in one month / week / day plus safety stock. The minimum inventory formula is as follows:

Minimum Inventory = (T x C) + R

Description:
T = average usage of goods per period (tons / meters / liters)
C = order time (month)
R = safety stock (tons)

According to Kurniawan (2022), maximum inventory is the maximum amount allowed to be kept in stock. The maximum inventory formula is as follows:

Maximum Inventory
Maximum Inventory = 2 (T x C) + R
Description:
T = average usage of goods per period (tons / meters / liters)
C = order time (month)
R = safety stock (tons)

According to (Hansen and Mowen, 2005: 474 in Ahmad and Sholeh, 2019) explains that the lead time period is the duration required to receive a number of economic orders after the order is placed or preparation begins. Basically, ordering inventory requires waiting time (lead time), which starts from ordering, production period, delivery period, until the goods are received and enter the warehouse. The duration of waiting (lead time) is fixed. Each order is received in one shipment and can be used immediately. Plywood is an artificial board made of several layers of wood veneers that are joined together to form a board. It is one of the most commonly used wood products for various purposes. Research by (Setiarini et al, 2020) state that forecasting is the art and science of estimating future events. This can be done by collecting past data either the last few months or the last few years and projecting it into the future using a mathematical model. Past data is collected, studied, analyzed, and analyzed with respect to the time factor. Thus, from the results of the data analysis, we can try to predict what will happen in the future.

3. RESEARCH METHOD

The type of research used is quantitative descriptive research conducted at PT Artha King Indonesia which is located at KM 30, Jl. Bypass Krian No.15, Sidotemo, Sidomulyo, Krian, Sidoarjo Regency, East Java 61262. Data collection starts from February 2023 until the data needed from this research is fulfilled. The implementation of the research was carried out during working hours, namely from 08.00-16.00, with a break from 12.00-13.00 WIB. In measuring and viewing variables are needed so that the results can be known. Identification of variables is obtained by identifying the production process using work sampling, namely, independent variables and dependent variables. The dependent variables and independent variables in this study:

a. Bound Variables

The dependent variable is the variable that is affected or becomes the result of the independent variable. In this study, the dependent variables are: (1) Raw Material Usage Data. Raw material usage data is data obtained from the amount of raw material used in one period, (2) Raw Material Inventory Data Raw material inventory data is data on the amount of raw materials that have not been used for the production process contained in the warehouse, (3) Ordering Cost. The cost of ordering raw materials is the cost incurred for purchasing raw materials to suppliers, (4) Storage Costs. Storage costs are costs incurred for things related to the cost of storing goods in a warehouse. This cost includes the cost of maintaining sengon wood and kruing wood veener and warehouse electricity costs, (5) Lead Time. Lead time is the time required from the time the raw materials are ordered by the company from the supplier until the raw materials arrive at the company, (6) Safety Stock. Safety stock is inventory that serves to maintain the possibility of a shortage of goods.

b. Independent Variable

Independent variables are variables that have an influence on other variables that you want to know or is the cause of changes in the

dependent variable dependent variable. In this study, the independent variable is to reduce the total cost in the supply of raw materials for sengon wood and kruing veneer wood. Based on this, data collection is more focused on using primary data from interviews and observations with the company. While secondary data is obtained from the company's historical data. Data that can be used and available for production planning include product type data, actual production data, actual product demand data, raw material usage data, production cost data, storage cost data for each product at PT Artha King Indonesia. Data analysis uses the Min-Max Stock method as a comparison with the company's actual method. The stages carried out in analyzing existing data are as described in the following flowchart :

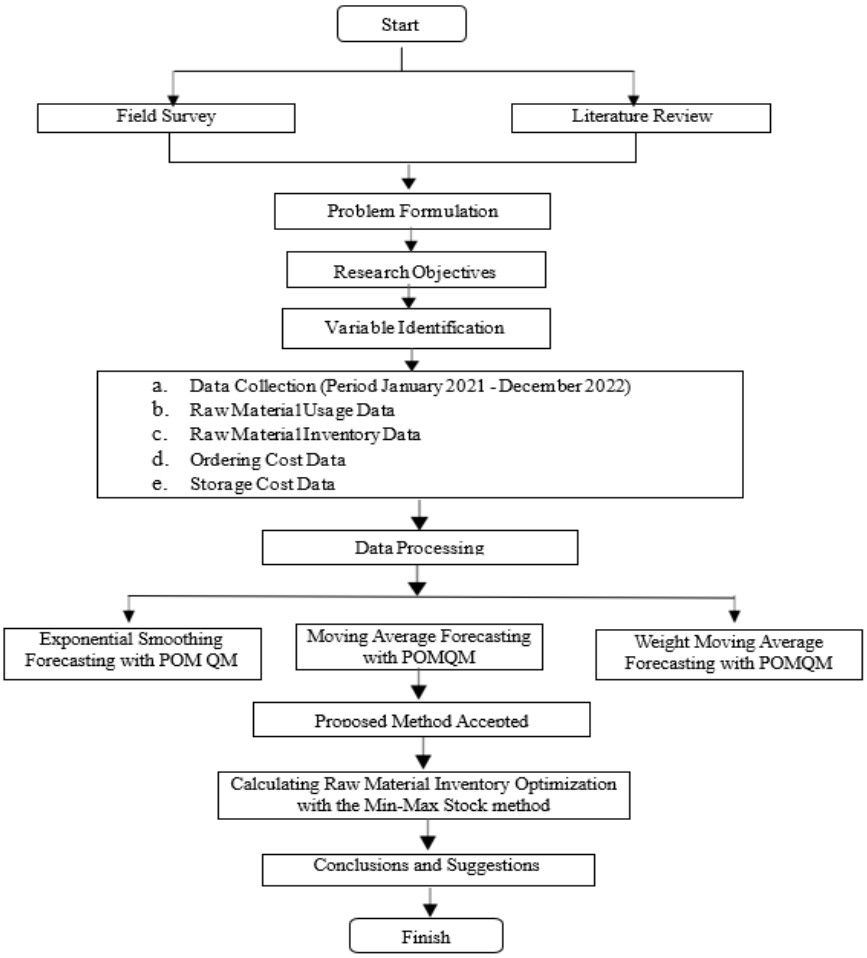

Figure 1. Study framework

4. RESULT AND DISCUSSION

After collecting information at PT Artha King Indonesia, information processing is then carried out using the Min-Max Stock method. Information that can be used and available for making production planning is product type information, actual production information, actual product demand information, raw material usage information, production cost information, storage cost information for each product at PT Artha King Indonesia. The information processing process is:

a. Forecasting

In calculating demand forecasting with the help of the PomQm program, product demand information for the period January 2021 - December 2022 from 2 products is entered into

the POM-QM program and forecasting is carried out using Time Series by first plotting information to determine the information model so that it can be seen which type of method is used in demand for the period January 2020 - December 2021. From the demand for the period January 2021 - December 2022, it is obtained that the forecasting methods used are the Exponential Smoothing and Moving Average methods for each type of product raw material. The Mean Square Error (MSE) values of the three forecasting methods can be seen in the calculations below. The following is a forecasting calculation for sengon wood raw materials.

a. Exponential Smoothing POMQM

	Demand(y)	Forecast	Error	|Error|	Error^2	|Pct Error|
Past Period 1	57					
Past Period 2	144	57	87	87	7569	60,417%
Past Period 3	240	77,01	162,99	162,99	26565,74	67,913%
Past Period 4	73	114,498	-41,498	41,498	1722,059	56,846%
Past Period 5	192	104,953	87,047	87,047	7577,14	45,337%
Past Period 6	439	124,974	314,026	314,026	98612,33	71,532%
Past Period 7	323	197,2	125,8	125,8	15825,64	38,947%
Past Period 8	228	226,134	1,866	1,866	3,482	,818%
Past Period 9	225	226,563	-1,563	1,563	2,444	,695%
Past Period 10	547	226,204	320,796	320,796	102910,3	58,647%
Past Period 11	547	299,987	247,013	247,013	61015,51	45,158%
Past Period 12	348	356,8	-8,8	8,8	77,438	2,529%
Past Period 13	73	354,776	-281,776	281,776	79397,66	385,994%
Past Period 14	192	289,967	-97,967	97,967	9597,619	51,025%
Past Period 15	348	267,435	80,565	80,565	6490,729	23,151%
Past Period 16	94	285,965	-191,965	191,965	36850,52	204,218%
Past Period 17	225	241,813	-16,813	16,813	282,676	7,472%
Past Period 18	547	237,946	309,054	309,054	95514,38	56,5%

Figure 2. Forecasting details output and MA error value for sengon wood

b. Moving Average POMQM

	Demand(y)	Forecast	Error	|Error|	Error^2	|Pct Error|
Past Period 1	57					
Past Period 2	144					
Past Period 3	240					
Past Period 4	73	147	-74	74	5476	101,37%
Past Period 5	192	152,333	39,667	39,667	1573,444	20,66%
Past Period 6	439	168,333	270,667	270,667	73260,44	61,655%
Past Period 7	323	234,667	88,333	88,333	7802,78	27,348%
Past Period 8	228	318	-90	90	8100	39,474%
Past Period 9	225	330	-105	105	11025	46,667%
Past Period 10	547	258,667	288,333	288,333	83136,12	52,712%
Past Period 11	547	333,333	213,667	213,667	45653,45	39,062%
Past Period 12	348	439,667	-91,667	91,667	8402,776	26,341%

Past Period 13	73	480,667	-407,667	407,667	166192,1	558,448%
Past Period 14	192	322,667	-130,667	130,667	17073,78	68,056%
Past Period 15	348	204,333	143,667	143,667	20640,11	41,284%
Past Period 16	94	204,333	-110,333	110,333	12173,44	117,376%
Past Period 17	225	211,333	13,667	13,667	186,778	6,074%
Past Period 18	547	222,333	324,667	324,667	105408,4	59,354%
Past Period 19	411	288,667	122,333	122,333	14965,45	29,765%
Past Period 20	240	394,333	-154,333	154,333	23818,78	64,306%
Past Period 21	240	399,333	-159,333	159,333	25387,12	66,389%
Past Period 22	725	297	428	428	183184	59,034%
Past Period 23	725	401,667	323,333	323,333	104544,4	44,598%
Past Period 24	370	563,333	-193,333	193,333	37377,79	52,252%
TOTALS	7553		740	3772,667	955382,3	1582,222%

Figure 3. Forecasting details output and MA error value for sengon wood

c. Weight Moving Average

	Demand(y)	Forecast	Error	|Error|	Error^2	|Pct Error|
Past Period 1	57					
Past Period 2	144					
Past Period 3	240					
Past Period 4	73	185	-112	112	12544,0	153,425%
Past Period 5	192	136,708	55,293	55,293	3057,262	28,798%
Past Period 6	439	159,347	279,653	279,653	78205,84	63,702%
Past Period 7	323	311,041	11,959	11,959	143,022	3,703%
Past Period 8	228	343,946	-115,946	115,946	13443,37	50,853%
Past Period 9	225	286,293	-61,293	61,293	3756,772	27,241%
Past Period 10	547	238,646	308,354	308,354	95082,02	56,372%
Past Period 11	547	400,626	146,374	146,374	21425,39	26,759%
Past Period 12	348	505,381	-157,381	157,381	24768,76	45,224%
Past Period 13	73	438,701	-365,701	365,701	133737,0	500,96%
Past Period 14	192	224,061	-32,061	32,061	1027,923	16,699%
Past Period 15	348	173,306	174,694	174,694	30517,95	50,199%
Past Period 16	94	261,517	-167,517	167,517	28061,95	178,21%
Past Period 17	225	189,606	35,395	35,395	1252,774	15,731%
Past Period 18	547	198,123	348,878	348,878	121715,6	63,78%
Past Period 19	411	383,306	27,694	27,694	766,951	6,738%
Past Period 20	240	431,367	-191,367	191,367	36621,46	79,736%
Past Period 21	240	335,517	-95,517	95,517	9123,497	39,799%
Past Period 22	725	262,102	462,898	462,898	214274,5	63,848%
Past Period 23	725	503,946	221,054	221,054	48865,05	30,49%
Past Period 24	370	662,313	-292,313	292,313	85446,84	79,003%
TOTALS	7553		481,15	3663,34	963837,9	1581,271%
AVERAGE	314,708		22,912	174,445	45897,04	75,299%
Next period forecast		531,803	(Bias)	(MAD)	(MSE)	(MAPE)
				Std err	225,23	

Figure 4. Forecasting details output and MA error value for sengon wood

Next, a forecasting calculation is carried out for the raw material of kruing wood veener:

a. Exponential Smoothing POMQM

	Demand(y)	Forecast	Error	|Error|	Error^2	|Pct Error|
Past Period 1	5300					
Past Period 2	9800	5300	4500	4500	20250000	45,918%
Past Period 3	5600	6560	-960	960	921600	17,143%
Past Period 4	7000	6291,2	708,8	708,8	502397,2	10,126%
Past Period 5	5600	6489,664	-889,664	889,664	791502,1	15,887%
Past Period 6	8400	6240,558	2159,442	2159,442	4663190,0	25,708%
Past Period 7	14000	6845,202	7154,798	7154,798	51191140	51,106%
Past Period 8	8400	8848,545	-448,545	448,545	201192,5	5,34%
Past Period 9	13850	8722,952	5127,048	5127,048	26286620	37,018%
Past Period 10	11200	10158,53	1041,475	1041,475	1084669,0	9,299%
Past Period 11	11200	10450,14	749,861	749,861	562292	6,695%
Past Period 12	7000	10660,1	-3660,1	3660,1	13396330	52,287%
Past Period 13	7000	9635,271	-2635,271	2635,271	6944656	37,647%
Past Period 14	13850	8897,396	4952,604	4952,604	24528290	35,759%
Past Period 15	7000	10284,13	-3284,125	3284,125	10785480	46,916%
Past Period 16	9800	9364,57	435,43	435,43	189599,0	4,443%
Past Period 17	7000	9486,49	-2486,49	2486,49	6182634,0	35,521%
Past Period 18	9800	8790,273	1009,727	1009,727	1019548,0	10,303%
Past Period 19	14000	9072,997	4927,003	4927,003	24275360	35,193%
Past Period 20	9800	10452,56	-652,558	652,558	425831,4	6,659%
Past Period 21	14000	10269,84	3730,158	3730,158	13914080	26,644%
Past Period 22	13850	11314,29	2535,714	2535,714	6429845	18,308%
Past Period 23	13850	12024,29	1825,714	1825,714	3333231	13,182%
Past Period 24	8400	12535,49	-4135,486	4135,486	17102250	49,232%
TOTALS	235700		21705,53	60010,02	234981700	596,334%
AVERAGE	9820,833		943,719	2609,131	10216600	25,928%
Next period forecast		11377,55	(Bias)	(MAD)	(MSE)	(MAPE)
				Std err	3345,087	

Figure 5. Output details of forecasting and ES error value for crafting wood veener

b. Moving Average

	Demand(y)	Forecast	Error	|Error|	Error^2	|Pct Error|
Past Period 1	5300					
Past Period 2	9800					
Past Period 3	5600					
Past Period 4	7000	6900	100	100	10000	1,429%
Past Period 5	5600	7466,667	-1866,667	1866,667	3484444,0	33,333%
Past Period 6	8400	6066,667	2333,333	2333,333	5444445	27,778%
Past Period 7	14000	7000	7000	7000	49000000	50%
Past Period 8	8400	9333,333	-933,333	933,333	871110,5	11,111%
Past Period 9	13850	10266,67	3583,334	3583,334	12840280	25,872%
Past Period 10	11200	12083,33	-883,333	883,333	780277,2	7,887%
Past Period 11	11200	11150	50	50	2500	,446%
Past Period 12	7000	12083,33	-5083,333	5083,333	25840270	72,619%
Past Period 13	7000	9800	-2800	2800	7840000	40%
Past Period 14	13850	8400	5450	5450	29702500	39,35%
Past Period 15	7000	9283,333	-2283,333	2283,333	5213610,0	32,619%
Past Period 16	9800	9283,333	516,667	516,667	266944,8	5,272%
Past Period 17	7000	10216,67	-3216,667	3216,667	10346950	45,952%
Past Period 18	9800	7933,333	1866,667	1866,667	3484444,0	19,048%
Past Period 19	14000	8866,667	5133,333	5133,333	26351110	36,667%
Past Period 20	9800	10266,67	-466,666	466,666	217777,2	4,762%
Past Period 21	14000	11200	2800	2800	7840000	20%
Past Period 22	13850	12600	1250	1250	1562500	9,025%
Past Period 23	13850	12550	1300	1300	1690000	9,386%
Past Period 24	8400	13900	-5500	5500	30250000	65,476%
TOTALS	235700		8350,002	54416,66	223039200	558,033%
AVERAGE	9820,833		397,619	2591,27	10620910	26,573%
Next period forecast		12033,33	(Bias)	(MAD)	(MSE)	(MAPE)
				Std err	3426,208	

Figure 6. Output details of forecasting and ES error value for crafting wood veener

c. Weight Moving Average

	Demand(y)	Forecast	Error	|Error|	Error^2	|Pct Error|
Past Period 1	5300					
Past Period 2	9800					
Past Period 3	5600					
Past Period 4	7000	6659,42	340,58	340,58	115994,5	4,865%
Past Period 5	5600	7338,165	-1738,165	1738,165	3021216	31,039%
Past Period 6	8400	5978,744	2421,256	2421,256	5862480	28,824%
Past Period 7	14000	7284,058	6715,942	6715,942	45103880	47,971%
Past Period 8	8400	10334,3	-1934,3	1934,3	3741516,0	23,027%
Past Period 9	13850	9914,976	3935,024	3935,024	15484420	28,412%
Past Period 10	11200	12414,01	-1214,01	1214,01	1473820,0	10,839%
Past Period 11	11200	11200	0	0	0	0%
Past Period 12	7000	11878,5	-4878,503	4878,503	23799790	69,693%
Past Period 13	7000	9211,595	-2211,595	2211,595	4891151	31,594%
Past Period 14	13850	8075,362	5774,638	5774,638	33346440	41,694%
Past Period 15	7000	10243,0	-3242,995	3242,995	10517020	46,329%
Past Period 16	9800	8853,141	946,859	946,859	896542,7	9,662%
Past Period 17	7000	10079,47	-3079,469	3079,469	9483128	43,992%
Past Period 18	9800	7757,488	2042,512	2042,512	4171856	20,842%
Past Period 19	14000	8866,667	5133,333	5133,333	26351110	36,667%
Past Period 20	9800	10266,67	-466,666	466,666	217777,2	4,762%
Past Period 21	14000	11200	2800	2800	7840000	20%
Past Period 22	13850	12600	1250	1250	1562500	9,025%
Past Period 23	13850	12550	1300	1300	1690000	9,386%
Past Period 24	8400	13900	-5500	5500	30250000	65,476%
TOTALS	235700		8350,002	54416,66	223039200	558,033%
AVERAGE	9820,833		397,619	2591,27	10620910	26,573%
Next period forecast		12033,33	(Bias)	(MAD)	(MSE)	(MAPE)
				Std err	3426,208	

Figure 6. Output details of forecasting and ES error value for crafting wood veener

Table 1. Error size of each method for sengon wood forecasting

Method	MAD	MSE	MAPE
Exponential Smoothing	152,328	38208,01	60,967
Moving Average	179,651	45494,39	75,344
Weight Moving Average	174,445	45897,04	75,299

Table 2. Error size of each method for forecasting kruing wood veener

Method	MAD	MSE	MAPE
Exponential Smoothing	2609,131	10216600	25,928
Moving Average	2591,27	10620910	26,573
Weight Moving Average	2725,696	10932260	28,034

Table 3. MSE value of 3 forecasting methods

Product	Exponential Smoothing	Moving Average	Weight Moving Average
Exponential Smoothing	38208,01	45494,39	45897,04
Moving Average	10216600	10620910	10932260

From the calculation of the MSE value, the lowest MSE value is selected based on the forecasting method used. Based on the lowest MSE value obtained, the method used to forecast demand for the January 2021-December 2022 period is the Exponential

Smoothing method and the Kruing Wood Veener product uses the Exponential Smoothing method. for Sengon Wood products, namely using the Exponential

b. Raw Material Inventory Calculation

Smoothing method and Kruing Wood Veener products using the Exponential Smoothing method.

Table 4. Sengon wood inventory

Month	Year 2021	Year 2022
January	57 M^3	73 M^3
February	144 M^3	192 M^3
March	240 M^3	348 M^3
April	73 M^3	94 M^3
May	192 M^3	225 M^3
June	439 M^3	547 M^3
July	323 M^3	411 M^3
August	228 M^3	240 M^3
September	225 M^3	240 M^3
October	547 M^3	675 M^3
November	547 M^3	675 M^3
December	348 M^3	370 M^3
Total	**3363 M^3**	**4172 M^3**
Average	**280 M^3**	**348 M^3**

Table 5. Kruing wood veener inventory

Month	Year 2021	Year 2022
January	5300 Pcs	7000 Pcs
February	9800 Pcs	13850 Pcs
March	5600 Pcs	7000 Pcs
April	7000 Pcs	9800 Pcs
May	5600 Pcs	7000 Pcs
June	8400 Pcs	9800 Pcs
July	14000 Pcs	14000 Pcs
August	8400 Pcs	9800 Pcs
September	13850 Pcs	14000 Pcs
October	11200 Pcs	13850 Pcs
November	11200 Pcs	13850 Pcs
December	7000 Pcs	8400 Pcs
Total	**107350 Pcs**	**128350 Pcs**
Average	**8946 Pcs**	**10696 Pcs**

The data collected shows that the peak use of sengon wood in 2021 was in October, amounting to 547 M^3. While the peak use of sengon wood in 2022 was in October, amounting to 675 M^3. The average use of sengon wood in 2021 was 280 M^3 and the average use of sengon wood in 2022 was 348 M^3. Then the peak use of kruing wood veener in 2021 was in July, which amounted to 14000 pcs. While the peak use of kruing wood veener in 2021 was in July, which amounted to 14000 pcs. The average use of kruing wood veener in 2021 was 8946 pcs and the average use of kruing wood veener in 2022 was 10696 pcs. After the calculation is done, it can be seen that the raw material inventory in 2021 is 3363 pcs of sengon wood and 107350 pcs of kruing wood veener. While in 2022 there are 4172 pcs of sengon wood and 128350 pcs of kruing wood veener.

c. Calculation of Final Inventory of Raw Materials and Inventory using the Min-Max Method.

Next, the calculation of zincon wood and kruing wood veener inventory using the Min-Max Stock method is carried out. Based on data on the purchase of Sengon wood raw materials in 2021 and data on the use of Sengon wood raw materials in 2022, the total

final inventory can be calculated as follows:
Stock Akhir 2021 = (Total Pembelian - Total Pemakaian) + Stock Awal = (3384 M^3– 3363 M^3) + 87 M^3= 108 M^3

The ending inventory in 2021 of 108 M^3 will be the starting inventory in 2022.

Early 2022 stock= 108 M^3.
Based on the data on the purchase of Sengon Wood raw materials in 2022 and the data on the use of Sengon Wood raw materials in 2022, the total final inventory can be calculated as follows:

Year End Stock 2022 = (Total Purchase - Total Usage) + Initial Stock = (4190 M^3– 4190 M^3) + 108 M^3= 108 M^3
a. Year 2021

1) Safety Stock
Safety Stock = (Maximum Usage – T) x C
= (547 M^3 – 280 M^3) x 0,7 month
= 267 M^3 x 0,7 month
= 187 M^3
2). Minimum Inventory
Minimum Inventory = (T x C) + R
= (280 M^3x 0,7 month) + 187 M^3
= 383 M^3

3) Maximum Inventory
Maximum Inventory = 2 (T x C)
= 2 (280 M^3 x 0,7 month)
= 392 M^3
4) Reservation Rate (Q)
Q = Max – Min
= 392 M^3– 383 M^3
= 9 M^3
5) Orders placed during 1 year (m)
$m = \frac{D}{Q} = \frac{(547\ M^3)}{(9\ M^3)}$
= 60,778 ≈ 61 times

b. Year 2022

1) Safety Stock
Safety Stock = (Maximum Usage – T) x C
= (675 M^3 – 349 M^3) x 0,7 month
= 376 M^3x 0,7 month
= 228 M^3

2) Minimum Inventory
Minimum Inventory = (T x C) + R
= (349 M^3x 0,7 month) + 228 M^3
= 472 M^3
3) Maximum Inventory
Maximum Inventory = 2 (T x C)
= 2 (349 M^3 x 0,7 month)
= 489 M^3

4) Reservation Rate (Q)
Q = Max – Min
= 489 M^3– 472 M^3
= 17 M^3
5) Orders placed during 1 year (m)

$m = \frac{D}{Q} = \frac{(675\ M^3)}{(17\ M^3)}$ = 39,705 ≈ 40 times

Description :
T = Average item usage per period (pcs)
C = Lead Time (bulan)
R = Safety Stock (pcs)
Q = Inventory reorder rate (pcs)
Max = Maximum Inventory (pcs)
Min = Minimum Inventory (pcs)

Based on the information on the purchase of kruing wood raw materials in 2021 and the use of kruing wood raw materials in 2022, we can calculate the total ending inventory as follows: 2021 Ending Inventory = (Total Purchase – Total Usage) + Beginning Inventory = (107350 pcs - 107350 pcs) + 346 pcs = 346 pcs.

The total ending inventory in 2021 is 346 pcs, this will be the starting inventory in 2022.
Beginning Inventory for 2022 = 346 pcs.

Based on the information on the purchase of kruing wood raw materials in 2022 and the use of kruing wood raw materials in 2022, we can calculate the total ending inventory as follows:

Year 2022 Ending Stock = (Total Purchase - Total Usage) + Beginning Stock = (128350 pcs – 128350 pcs) + 346 pcs
= 346 pcs

a. Year 2021

1) Safety Stock
Safety Stock = (Maximum Usage – T) x C
= (14.000 pcs – 8946 pcs) x 0,7 month
= 5054 pcs x 0,7 month

= 3538 pcs
2) Minimum Inventory
Minimum Inventory = (T x C) + R
= (8946 pcs x 0,7 month) + 3538 pcs
= 9800 pcs
3) Maximum Inventory
Maximum Inventory = 2 (T x C)
= 2 (8946 pcs x 0,7 month)
= 12.524 pcs
4) Reservation Rate (Q)
Q = Max – Min
= 12.524 pcs – 9800 pcs
= 2.724 pcs
5) Orders placed during 1 year (m)
$m = = \frac{D}{Q} = \frac{(14.000\ pcs)}{(2.724\ pcs)}$
= 5,139 ≈ 5 times

b. Year 2022

1) Safety Stock

= (Maximum Usage – T) x C
= (14.000 pcs – 10696 pcs) x 0,7 month
= 3.304 pcs x 0,7 month
= 2.313 pcs

2) Minimum Inventory
Minimum Inventory = (T x C) + R
= (10696 pcs x 0,7 month) + 2.313 pcs
= 9800 pcs

3) Maximum Inventory
Maximum Inventory = 2 (T x C)
= 2 (10696 pcs x 0,7 month)
= 14.974 pcs

4) Reservation Rate (Q)
Q = Max – Min
= 14.974 pcs – 9800 pcs
= 5.174 pcs

5) Orders placed during 1 year (m)
$M = \frac{D}{Q} = \frac{(14.000\ pcs)}{(2.724\ pcs)}$
= 5,139 ≈ 5 times

Description :
T = Average item usage per period (pcs)
C = Lead Time (bulan)
R = Safety Stock (pcs)
Q = Inventory reorder rate (pcs)
Max = Maximum Inventory (pcs)
Min = Minimum Inventory (pcs)

Table 6. Raw material ending inventory year 2021-2022

Product	Year 2021	Year 2022
Sengon Wood	108 M^3	108 M^3
Veener Kruing Wood	346 Pcs	346 Pcs

Based on the data above, it can be concluded that the largest final stock in the last two years is in the raw material for kruing wood veener. In 2021 there were 346 pcs and in 2022 there were 346 pcs. While the smallest final stock in the last two years is in sengon wood raw materials.

Table 7. Sengon wood inventory calculation results with the min-max stock method for 2021-2022

Calculation result	Year 2021	Year 2022
Safety Stock	187 M^3	228 M^3
Minimum Inventory	383 M^3	472 M^3
Maximum Inventory	392 M^3	489 M^3
Reorder Point	9 M^3	17 M^3
1 Year Ordering	61 M^3	40 M^3

The data above shows the reorder level in 2021 of 9 M^3 and in 2022 of 17 M^3. This shows that the condition of the zincon wood raw material inventory in 2021 and 2022 is normal or there is no shortage of inventory.

Table 8. Calculation results of kruing wood veener inventory with the min-max stock method for 2021-2022

Calculation Result	Year 2021	Year 2022
Safety Stock	3538 Pcs	2313 Pcs
Minimum Inventory	9800 Pcs	9800 Pcs
Maximum Inventory	12.524 Pcs	14.974 Pcs
Reorder Point	2724 Pcs	5174 Pcs
1 Year Ordering	5 Pcs	5 Pcs

According to the above data, the supply deadline for the raw material of crewing wood veneer in 2021 is 2724 pcs, and there will be no shortage of supply under normal circumstances. Based on the raw material usage data for crewing veneer, the maximum consumption in July was 14,000 pcs. This consumption is very high compared to the average consumption of 8,946 pcs. In such an inventory shortage, safety stock is required to cover the inventory shortage. The backordered inventory for 2022 is 5174 pcs, and there is no shortage, and the inventory is under normal conditions.

d. Inventory Cost

Storage costs are the total costs incurred by a company for the procurement of raw materials. Storage costs include ordering costs and storage costs. The more inventory stored in the warehouse, the higher the storage costs. The same goes for ordering costs. The more often a company orders, the higher the ordering costs. Cost Calculation - The costs used include material costs and inventory shortage costs. This calculation is intended to enable comparison of the current and proposed policies using the minimum-maximum inventory method. The calculations performed are shown in the following table.

Table 9. Components of total inventory cost of sengon wood and kruing wood veener for 2021-2022

Raw Materials	Costs associated with raw material inventory	Cost Type	Number/Year
Sengon and Veener Wood Kruing Wood	Ordering Cost	Telephone Costs	IDR9.600.000
		Administrative Costs	IDR118.000
		(stationery)	IDR9.718.000,-
		Total Cost	
	Storage Cost	Electricity Cost	IDR13.200.000
	Total Inventory Cost		IDR22.918.000,-
Total Cost of Raw Material Expenditure for Sengon Wood 2021: IDR3.357.316.587,50			
Total Cost of Raw Material Expenditure for Sengon Wood 2022: IDR4.023.224.280,00			
Total Raw Material Expenditure Cost of Kruing Wood Veener 2021:IDR707.005.974,00			
Total Cost of Kruing Wood Veener Raw Material Expenditure 2022: IDR748.997.280,00			

Calculation of costs - the costs used include material costs and inventory shortage costs. The calculation is intended to be able to determine the comparison between the current policy and the proposed policy using the min - max stock method.

a. Ordering Costs

- Telephone = Subscription fee + wifi subscription = IDR800,000/month
= IDR9,600,000/year
- Order Administration
1. Notes (12) = IDR60,000
2. Desk pens (6) = IDR27,000
3. Stapler (2) = IDR31,000
Total = IDR118,000

So, the total ordering cost required in 1 year is = IDR9,718,000.

b. Storage Costs

- Warehouse Electricity Cost = IDR 1,100,000/month = IDR 13,200,000/year

The total inventory cost required in 1 year is = IDR 22,918,000.

c. Total Inventory Cost with Raw Material Expenditure Cost in 2021

- Sengon wood

IDR 3,357,316,587.50 + IDR 4,023,224,280.00 = IDR 7,380,540,867.50
- Kruing Wood Veener IDR 707,005,974.00 + IDR 748,997,280.00 = IDR 1,456,003,254.00

d. Forecasting Results
In addition, the prediction results are calculated from the MSE value. The data obtained from a valid forecast using the Moving Range Chart (MRC) card is determined from the forecast results using the selected method. This is done to see if the demand is controlled based on the forecasting method used. The MRC figures are at the end of the manuscript. We also obtained monthly demand forecast data for aluminum and acrylic products for 2021 and 2022.

Tabel 10. Recapitulation calculation

Calculation Result	Raw Materials	
	Sengon wood	Kruing Wood Veener
Year End Stock 2021	108 M^3	346 Pcs
Year End Stock 2022	108 M^3	346 Pcs
Safety Stock 2021	187 M^3	3538 Pcs
Safety Stock 2022	228 M^3	2313 Pcs
Minimum Stock 2021	383 M^3	9800 Pcs
Minimum Stock 2022	472 M^3	9800 Pcs
Maximum Stock 2021	392 M^3	12.524 Pcs
Maximum Stock 2022	489 M^3	14.974 Pcs
Q 2021	9 M^3	2724 Pcs
Q 2022	17 M^3	5174 Pcs

From the table above, it can be concluded that the company's inventory at the end of 2021 is very large compared to the safety stock calculated using the minimax inventory method. For this reason, the company should consider this method to prevent overstocking of raw materials. Based on the data above, the order backlog for 2021 sengon wood raw materials is 9M^3, kruing wood veneer raw materials are 2724 pcs, 2022 sengon wood raw materials are 17 M^3, and kruing wood veneer raw materials are 5174 pcs. This means that the availability of raw materials is normal or out of stock. Of course, by using this method, the company can reduce the costs incurred by not taking into account the cost of out of stock. As we can see from the table above, there is no out of stock. Businesses also need to anticipate consumer needs, for that to happen, the company can meet the demand for raw materials. not too much or too little. Repair costs will be incurred as follows:

a. Ordering Cost
Telephone = Subscription fee + wifi subscription = IDR800,000/month
= IDR9,600,000/year

- Order Administration
1. Notes (12) = IDR60,000
2. Desk pens (6) = IDR27,000
3. Stapler (2) = IDR31,000 Total = IDR118,000
So, the total ordering cost required in 1 year is = IDR9,718,000.

b. Storage Cost
- Warehouse Electricity Cost = IDR 1,100,000/month = IDR 13,200,000/year
The total inventory cost required in 1 year is = IDR 22,918,000.

5. CONCLUSION

Based on the results of research that has been carried out on the inventory of two raw materials for making electrical panels at PT Artha King Indonesia for 2021-2022, it can be concluded as follows: (1) The final inventory of sengon wood raw materials at PT Artha King Indonesia in 2021 is 108 M^3 while the safety stock according to the min-max stock method is 187 M^3. In 2022 the final inventory of sengon wood raw materials was 108 M^3 while the safety stock according to the min-max stock method was 228 M^3. In these two years, it shows that the amount of final inventory of sengon wood raw materials is very large when compared to inventory according to the min-

max stock method. The final inventory of kruing wood veener raw materials at PT Artha King Indonesia in 2021 was 346 pcs. Meanwhile, the safety stock according to the min-max stock method is 3538 pcs. In 2022 the final inventory of kruing wood veener raw materials amounted to 346 pcs. Meanwhile, the safety stock according to the min-max stock method is 2313 pcs. (2) The results of theoretical calculations show that the minimum and maximum stock limit values, safety stock, and reorder level (Q) are different for each raw material. By knowing the results of the calculation, the results of inventory costs in 2022 for sengon wood raw materials are IDR 7,380,540,867.50 and kruing wood veener raw materials IDR 1,456,003,254.00. So that an evaluation of the policies that are being used now can be carried out so that in the future the company can minimize costs incurred and maximize profits. (3) The suggestion for another researcher that may be wanting to analazie the same method at PT. Artha King Indonesia is using another raw material that is used to make plywood. It can be glue, gum tape, or putty. Another suggestion is researcher can use another method to analize and help companies to reduce the costs, such as economic order quantity, periodic review, material requirement planning, and just in time method.

REFERENCES

Ahmad, A., Sholeh, B. (2019). Analisis Pengendalian Persediaan Bahan Baku Dengan Menggunakan Metode Economic Order Quantity Pada Usaha Kecil Dan Menengah (UKM) Dodik Bakery. *Jurnal Riset Akuntansi Terpadu*, 12(1), 96-103. http://dx.doi.org/10.35448/jrat.v12i1.5245

Agustina, E., Nasir, W. S., Rahmi, Y., Ihwan, H, Rio, P. K., Fanani, A. A. (2021). Perencanaan Produksi dan Pengendalian Persediaan. Penerbit UB Press: Malang.

Ajeng, A. M., Oman, S., Septi, D. R., Tanti, F., Isnaini, M. (2021). Analisis Peramalan Jumlah Penerimaan Mahasiswa Baru Dengan Menggunakan Metode Regresi Linear Sederhana. *Jurnal Bayesian, 1(1),* 17-23. https://doi.org/10.46306/bay.v1i1.2

Akmal, N. (2019). Metode Weighted Moving Average Dalam M-Forecasting. *Jurnal Teknologi dan Sistem Informasi, 5(2),* 119 -124. https://doi.org/10.33330/jurteksi.v5i2.355

Anna, l., Yuliarty, P. (2020). Penerapan Metode Peramalan (Forecasting) Pada Permintaan Atap di PT X. *Jurnal Teknik Industri, 10(1),* 11-20. https://doi.org/10.36040/industri.v10i1.2530

Arfan, B., Salsabila, A. (2021). Analisis Pengendalian Persediaan Aux Raw Material Menggunakan Metode Min-Max Stock Di PT. Mitsubishi Chemical Indonesia. Jurnal Teknik Industri, 16(3), 161-168. https://doi.org/10.14710/jati.16.3.161-168

Chendrasari, W. O., Christine, N. (2021). Analisis Pengaruh Pendekatan Economic Order Quantity Terhadap Penghematan Biaya Persediaan. *Jurnal Penelitian dan Aplikasi Sistem & Teknik Industri, 15(1),* 103-117. https://doi.org/10.22441/pasti.2021.v15i.010

Delpiero, R., Wilda, S. (2019). Penerapan Metode Economic Order Quantity (EOQ) untuk menentukan Safety Stock dan Reorder Point. *Jurnal Mahasiswa Aplikasi Teknologi Komputer dan Informasi, 1(1),* 76-84. https://ejournal.pelitaindonesia.ac.id/ojs32/index.php/jmapteksi/article/view/3006

Desi, M., Supriyanto, S. (2022). Analisis Pengendalian Persediaan Bahan Baku Menggunakan Metode EOQ Pada PT Suryamas Lestari Prima. *Jurnal Bisnis Administrasi, 10(2),* 44-50. https://doi.org/10.55445/bisa.v10i02.10

Devit, A. P., Novi, S. D. (2021). Pengaruh Jumlah Laminasi Core Komposit Sandwich Serat Kenaf Dengan Core Kayu Sengon Terhadap Kekuatan Bending. *JTM-Jurnal Teknik Mesin, 9(1), 1-10.* https://ejournal.unesa.ac.id/index.php/jtm-unesa/article/view/37509

Diyan, K. (2020). Analisis Penerapan Persediaan Bahan Baku dengan Metode Economic Order Quantity pada Abdi Jaya Trikora Banjarbaru. *JURNAL KINDAI : Kumpulan Informasi dan*

Artikel Ilmiah Manajemen dan Akuntansi, 14(3), 226-235. https://doi.org/10.35972/kindai.v14i3.225

Eko, M., Ester, A. (2021). Sistem Pendukung Keputusan Prediksi Jumlah Stok Barang Menggunakan Metode Weighted Moving Average. Jurnal Informatika SIMANTIK, 6(2), 46-51. https://simantik-panca-sakti.ac.id/index.php/simantik/article/view/76

Farhan, F., Sutandi, S., Yusup, R. H. (2021). Pengaruh Logistic Management Improvement Terhadap Kinerja Wwarehouse Pada PT. Fastindo Piranti Kabel. *Jurnal Manajemen Logistik, 1(1), 67-71*. https://ojs.stiami.ac.id/index.php/JUMATIK/article/viewFile/1246/643

Fauziah, F., Yulia, I. N., Eva, S. (2019). Analisis Peramalan (Forecasting) Penjualan Jasa Pada Warnet Bulian City di Muara Bulian. *Jurnal Ilmiah Ekonomi dan Bisnis, 10(1),* 61-67. http://dx.doi.org/10.33087/eksis.v10i1.160

Gustin, M., Sukarno, S. (2019). Analisis Sistem Pembelian dan Persediaan Pada PT Semangat Duta Pratama. *PROSIDING SEMINAR NASIONAL AKUNTANSI, 2(1): 2019*. https://openjournal.unpam.ac.id/index.php/SNU/article/view/2612

Harly, I. U, Arrazi, H. J., Ferdinand, T. (2019). Analisis Economic Order Quantity (EOQ) Pengendalian Persediaan Bahan Baku Kopi Pada PT. Fortuna Inti Alam. *Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi, 7(1),* 51-60. https://doi.org/10.35794/emba.v7i1.22263

Havid, S., Febriyaningsih, S., Pristiyanilicia, P., Masitah, H. (2021). Forecasting Jumlah Pengangguran di Kabupaten Asahan Menggunakan Metode Weighted Moving Average. *Jurnal Teknik Informatika Kaputama (JTIK), 5(2),* 699-706. https://doi.org/10.33330/jurteksi.v9i4.2624

Hazimah, H., Yongki, A. S., Nurlinda, A. T. (2020). Analisis Persedian Bahan Baku, Reorder Point dan Safety Stock Bahan Baku ADC-12. *Jurnal Ilmiah Universitas Batanghari Jambi, 20(2),* 675-681. http://dx.doi.org/10.33087/jiubj.v20i2.989

Jehan, S. K., Fitria, R. (2021). Rancang Bangun Penerapan Model Prototype Dalam Perancangan Sistem Informasi Pencatatan Persediaan Barang Berbasis Web. *Jurnal Sistem Informasi, 8(2),* 223-230. https://doi.org/10.35968/jsi.v8i2.737

Karno, A. S. B. (2020). Prediksi Data Time Series Saham Bank BRI Dengan Mesin Belajar LSTM (Long ShortTerm Memory). *Journal of Information and Information Security (JIFORTY),* 1(1), 1-8. https://doi.org/10.31599/jiforty.v1i1.133

Kumila, A., Sholihah, B., Evizia, Safitri, N., Fitri, S. (2019). Perbandingan Metode Moving Average dan Metode Naïve Dalam Peramalan Data Kemiskinan. *Jurnal Teori dan Aplikasi Matematika (JTAM),* 3(1), 65-73. https://doi.org/10.31764/jtam.v3i1.764

Kurnadi, K., Muhammad, M., Yassyir, M. (2020). Analisis Pengendalian Produk Cacat Pada Kayu Lapis Menggunakan SQL (Statistical Quality Control) Pada Pabrik PT. Wijaya Tri Utama Plywood Industri. *Jurnal Jieom, 03(02),* 12-16. http://dx.doi.org/10.31602/jieom.v3i2.4998

Maissy, P. S., Ventje, I. , Sherly, P. (2019). Evaluasi Penerapan Akuntansi Persediaan Obat Untuk Penentuan Harga Pokok Penjualan Pada PT. Cempaka Iindah Murni Manado. *Jurnal Riset Akuntansi Going Concern, 14(1),* 142-147. https://doi.org/10.32400/gc.14.1.22323.2019

Matheus, S. R., Tirsa, N. L., Titin, P. S., Piton, M., Adrianus, A., Richard, S. (2021). Optimasi Jumlah Produksi Roti Menggunakan Program Linear Dan Software POM-QM. *Computer Based Information System Journal, 09(01),* 42-49. https://ejournal.upbatam.ac.id/index.php/cbis/issue/view/318

Michael, A. S., Agung, T. P. (2021). Analisis Dan Perancangan Sistem Informasi

Pengendalian Persediaan Barang. *Jurnal Informatika dan Rekayasa Perangkat Lunak, 2(1),* 134-143. https://doi.org/10.33365/jatika.v2i1.734

Ni, L. W. S. R. G., Ida, B. G. A. (2019). Penerapan Metode Single Exponential Smoothing Dalam Peramalan Penjualan Barang. *Jurnal Sains Komputer & Informatika, 3(2),* 433-441. http://dx.doi.org/10.30645/j-sakti.v3i2.162

Putri, A. Z. (2019). Aplikasi Metode Min-Max Stock Dalam Mengendalikan Persediaan Bahan Baku di PT Kurnia Persada Mitra Mandiri. *Skripsi: Universitas Sriwijaya, Indralaya.*

Rani, D. P., Deviya, A. (2021). Rancang Bangun Mesin Pencuci Kentang Kapasitas 5 Kg. *Jurnal Teknik Mesin, 7(1),* 40-55. http://ejournal.polraf.ac.id/index.php/JTM/article/view/66

Ratih, K. S., Fatmawati, I. (2021). Perancangan Sistem Monitoring Persediaan Stok Es Krim Campina Pada PT Yunikar Jaya Sakti. Jurnal Informatika dan Rekayasa Perangkat Lunak, 2(1), 151-159. http://ilmuteknik.org/index.php/ilmuteknik/article/view/14

Resista, V., Yayan, S., Novi, S., Dimas, B. A., Saskia, S. M. (2020). Manajemen Persediaan. *Penerbit Media Sains Indonesia: Bandung.*

Retno, W. P., Rosyida, R. I. (2022). Penerapan Metode Peramalan (Forecast) Penjualan pada Dzikrayaat Business Center Ponorogo. *Jurnal Akuntansi, Perpajakan, dan Portofolio, 02(01),* 29-45. DOI : 10.24269/japp.v2i1.4894

Rezagi, M., Febrinita, D., Tanto, T. (2019). Pengembangan Sistem Informasi Persediaan Barang dengan Metode Waterfall. *Jurnal Elektronika, Listrik dan Teknologi Informasi Terapan, 2(1),* 30-34.

Ronny, H. H. (2020). Metode Min-Max Dan Penerapannya Sebagai Pengendali Persediaan Bahan Baku Pada PT. Balatif Malang. *Jurnal Administrasi dan Bisnis, 14(2),* 161-167. https://doi.org/10.33795/adbis.v14i2.1874

Siti, Z. U., Adi, I., Retno, K. (2020). Analisis Pengendalian Persediaan Bahan Baku Dengan Menggunakan Metode Material Requirement Planning (MRP). *Jurnal Ekonomi, Bisnis dan Akuntansi (JEBA), 2(1),* 103-112. https://doi.org/10.32424/jeba.v22i1.1568

Syardiansah, S., Muhammad, F., Puspita, S. (2020). Analisis Pengendalian Persediaan Produksi Pada CV. Fanara Abadi. *Jurnal Ilmiah Manajemen, 8(2),* 80-91. https://doi.org/10.33884/jimupb.v8i2.1884

Taufiq, R., Ahmad, F., Cecep, N. N. (2022). Kekuatan Tarik Plywood Dari Bahan Sengon (Albizia Chinesis). *Jurnal Ilmu Teknik, 3(2),* 65-70.

Tri, E., Ali, S. N., Duwel, T. (2019). Analisa Pengendalian Persediaan Bahan Baku Pada PT. Incasi Raya Pesisir Selatan. *Jurnal Sains dan Teknologi, 19(1),* 39-45.

Vikaliana, R. (2020). Manajemen Persediaan. Bandung: Media Sains Indonesia.

Wiwin, H. (2019). Prediksi Jumlah Penerimaan Mahasiswa Baru Dengan Metode Single Exponential Smoothing (Studi Kasus: Amik Royal Kisaran). *JURTEKSI, V(2),* 125-132. https://doi.org/10.33330/jurteksi.v5i2.356

Yayu, N. R., Opan, A. (2020). Program Linier. Widina Bhakti Persada Bandung: Bandung.

Zihan, S., Ahmad, Z., Dedy, I. (2020). Penerapan Metode Weighted Moving Average Untuk Peramalan Persediaan Produk Farmasi. *JITEKH, 8(2),* 59-64. https://doi.org/10.35447/jitekh.v8i2.220