UNIVERSITAS
MUHAMMADIYAH
SIDOARJO

UMSIDA
DARI SINI PENCERAHAN BERSEMI

Optimalisasi Biaya Pengendalian Persediaan Menggunakan Program Dinamis

Oleh:

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Progam Studi

Universitas Muhammadiyah Sidoarjo

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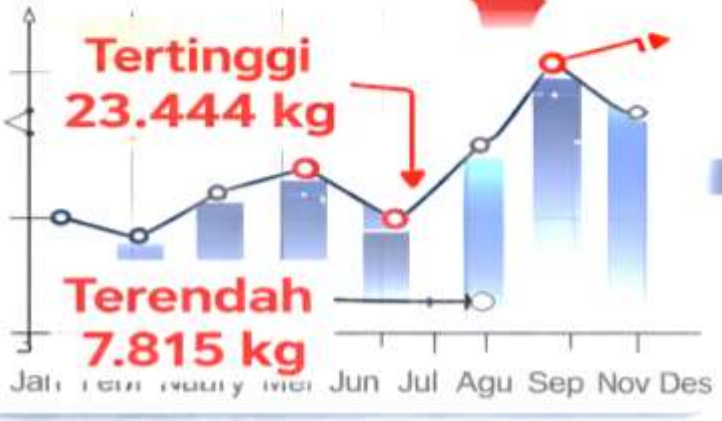
Pendahuluan

PT. MJM menggunakan bahan baku round bar AISI 4135

Permintaan berfluktuasi
(7.815 - 23.444 kg/bulan)

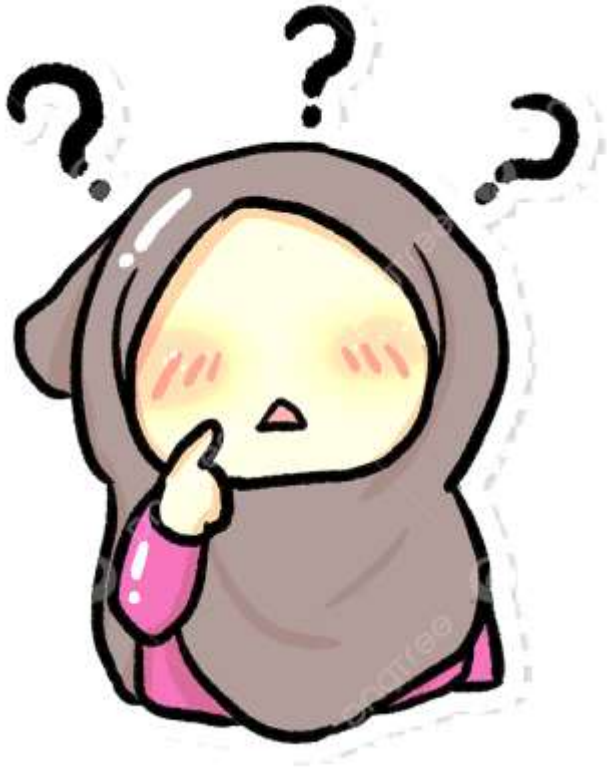


Kebijakan pembelian **belum optimal**

Terjadi **kelebihan** pembelian **7.815 kg**

Total **biaya persediaan tinggi**

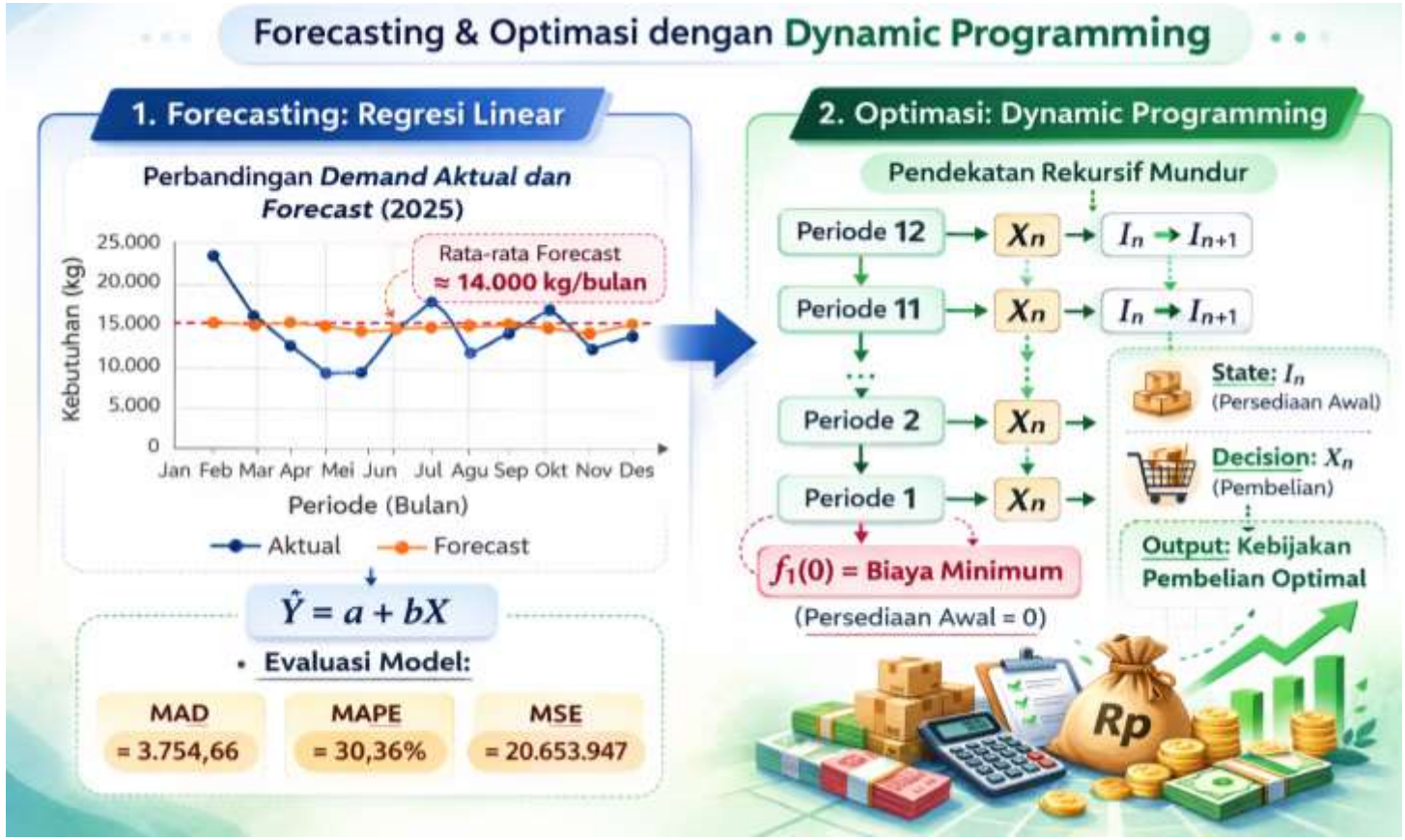
Pertanyaan Penelitian (Rumusan Masalah)



Bagaimana mengoptimalkan pengendalian persediaan bahan baku menggunakan metode program dinamis

Metode

Analisis pola kebutuhan berdasarkan data historis



Penentuan keputusan optimal multi-periode

Hasil

Hasil Peramalan Kebutuhan

Periode	X	RB AISI 4135 (Ø 325 mm)	Ŷ	|Error|	APE (%)
Jan	1	23444	14.878	8566,038	0,3654
Feb	2	15629	14.837	792,031	0,0507
Mar	3	11722	14.796	3073,976	0,2622
Apr	4	7815	14.755	6939,983	0,888
Mei	5	7815	14.714	6898,99	0,8828
Jun	6	15629	14.673	956,003	0,0612
Jul	7	19537	14.632	4904,997	0,2511
Agu	8	11722	14.591	2869,01	0,2448
Sep	9	15629	14.550	1078,983	0,069
Okt	10	19537	14.509	5027,976	0,2574
Nov	11	11722	14.468	2746,031	0,2343
Des	12	15629	14.427	1201,962	0,0769
Total		175830		45055,98	

Nilai Kesalahan Peramalan

Ukuran Error	Nilai
MAD	3.754,66
MAPE	30,36%
MSE	20.653.947

Hasil Proyeksi Kebutuhan Tahun 2026

Periode	X	Dn (Kg)
Jan	13	14.386
Feb	14	14.345
Mar	15	14.304
Apr	16	14.263
Mei	17	14.222
Jun	18	14.181
Jul	19	14.140
Agu	20	14.099
Sep	21	14.058
Okt	22	14.017
Nov	23	13.976
Des	24	13.935
Total		169.926

Hasil

Tahap 12 merupakan tahap akhir perhitungan rekursif mundur, di mana fungsi biaya hanya mempertimbangkan biaya pembelian periode tersebut. Nilai ini menjadi dasar perhitungan tahap sebelumnya (n = 11).

Hasil perhitungan rekursif mundur tahap 12

f12(0) = cost of purchase	15000 - 0 = :(15000) = 10000000 + 47400 * 15000 = 721.000.000	dan	x12(0) = 15000 - 0 = 15.000
f12(1500) = cost of purchase	15000 - 1500 = :(13500) = 10000000 + 47400 * 13500 = 649.900.000	dan	x12(1500) = 15000 - 1500 = 13.500
f12(3000) = cost of purchase	15000 - 3000 = :(12000) = 10000000 + 47400 * 12000 = 578.800.000	dan	x12(3000) = 15000 - 3000 = 12.000
f12(4500) = cost of purchase	15000 - 4500 = :(10500) = 10000000 + 47400 * 10500 = 507.700.000	dan	x12(4500) = 15000 - 4500 = 10.500
f12(6000) = cost of purchase	15000 - 6000 = c(9000) = 10000000 + 47400 * 9000 = 436.600.000	dan	x12(6000) = 15000 - 6000 = 9.000
f12(7500) = cost of purchase	15000 - 7500 = c(7500) = 10000000 + 47400 * 7500 = 365.500.000	dan	x12(7500) = 15000 - 7500 = 7.500
f12(9000) = cost of purchase	15000 - 9000 = c(6000) = 10000000 + 47400 * 6000 = 294.400.000	dan	x12(9000) = 15000 - 9000 = 6.000
f12(10500) = cost of purchase	15000 - 10500 = c(4500) = 10000000 + 47400 * 4500 = 223.300.000	dan	x12(10500) = 15000 - 10500 = 4.500
f12(12000) = cost of purchase	15000 - 12000 = c(3000) = 10000000 + 47400 * 3000 = 152.200.000	dan	x12(12000) = 15000 - 12000 = 3.000
f12(13500) = cost of purchase	15000 - 13500 = c(1500) = 10000000 + 47400 * 1500 = 81.100.000	dan	x12(13500) = 15000 - 13500 = 1.500
f12(15000) = cost of purchase	15000 - 15000 = c(0) = 0	dan	x12(15000) = 15000 - 15000 = 0

Hasil

Hasil perhitungan rekursif mundur tahap 11

i	x			790(*i* + *x* -13976)+*c* (*x*)			*f12* (*i* + *x* -13976)		Total Cost Months 11,12	*f* 11(*i*) / *x* 11(*i*)		
0	15000	808.960	+	721.000.000	=	721.808.960	Rp 649.900.000	Rp	1.371.708.960	f11(0) =	Rp	1.371.708.960
										x11(0) =		15.000
1500	13500	808.960	+	649.900.000	=	650.708.960	Rp 649.900.000	Rp	1.300.608.960	f11(1500) =	Rp	1.300.608.960
1500	15000	1.993.960	+	721.000.000	=	722.993.960	Rp 578.800.000	Rp	1.301.793.960	x11(1500) =		13.500
3000	12000	808.960	+	578.800.000	=	579.608.960	Rp 649.900.000	Rp	1.229.508.960	f11(3000) =	Rp	1.229.508.960
3000	13500	1.993.960	+	649.900.000	=	651.893.960	Rp 578.800.000	Rp	1.230.693.960	x11(3000) =		12.000
3000	15000	3.178.960	+	721.000.000	=	724.178.960	Rp 507.700.000	Rp	1.231.878.960			
4500	10500	808.960	+	507.700.000	=	508.508.960	Rp 649.900.000	Rp	1.158.408.960	f11(4500) =	Rp	1.158.408.960
4500	12000	1.993.960	+	578.800.000	=	580.793.960	Rp 578.800.000	Rp	1.159.593.960	x11(4500) =		10.500
4500	13500	3.178.960	+	649.900.000	=	653.078.960	Rp 507.700.000	Rp	1.160.778.960			
4500	15000	4.363.960	+	721.000.000	=	725.363.960	Rp 436.600.000	Rp	1.161.963.960			
6000	9000	808.960	+	436.600.000	=	437.408.960	Rp 649.900.000	Rp	1.087.308.960	f11(6000) =	Rp	1.087.308.960
6000	10500	1.993.960	+	507.700.000	=	509.693.960	Rp 578.800.000	Rp	1.088.493.960	x11(6000) =		9.000
6000	12000	3.178.960	+	578.800.000	=	581.978.960	Rp 507.700.000	Rp	1.089.678.960			
6000	13500	4.363.960	+	649.900.000	=	654.263.960	Rp 436.600.000	Rp	1.090.863.960			
6000	15000	5.548.960	+	721.000.000	=	726.548.960	Rp 365.500.000	Rp	1.092.048.960			
7500	7500	808.960	+	365.500.000	=	366.308.960	Rp 649.900.000	Rp	1.016.208.960	f11(7500) =	Rp	1.016.208.960
7500	9000	1.993.960	+	436.600.000	=	438.593.960	Rp 578.800.000	Rp	1.017.393.960	x11(7500) =		7.500
7500	10500	3.178.960	+	507.700.000	=	510.878.960	Rp 507.700.000	Rp	1.018.578.960			
7500	12000	4.363.960	+	578.800.000	=	583.163.960	Rp 436.600.000	Rp	1.019.763.960			
7500	13500	5.548.960	+	649.900.000	=	655.448.960	Rp 365.500.000	Rp	1.020.948.960			
7500	15000	6.733.960	+	721.000.000	=	727.733.960	Rp 294.400.000	Rp	1.022.133.960			
9000	6000	808.960	+	294.400.000	=	295.208.960	Rp 649.900.000	Rp	945.108.960	f11(9000) =	Rp	945.108.960
9000	7500	1.993.960	+	365.500.000	=	367.493.960	Rp 578.800.000	Rp	946.293.960	x11(9000) =		6.000
9000	9000	3.178.960	+	436.600.000	=	439.778.960	Rp 507.700.000	Rp	947.478.960			
9000	10500	4.363.960	+	507.700.000	=	512.063.960	Rp 436.600.000	Rp	948.663.960			
9000	12000	5.548.960	+	578.800.000	=	584.348.960	Rp 365.500.000	Rp	949.848.960			
9000	13500	6.733.960	+	649.900.000	=	656.633.960	Rp 294.400.000	Rp	951.033.960			
9000	15000	7.918.960	+	721.000.000	=	728.918.960	Rp 223.300.000	Rp	952.218.960			
10500	4500	808.960	+	223.300.000	=	224.108.960	Rp 649.900.000	Rp	874.008.960	f11(10500) =	Rp	874.008.960
10500	6000	1.993.960	+	294.400.000	=	296.393.960	Rp 578.800.000	Rp	875.193.960	x11(10500) =		4.500
10500	7500	3.178.960	+	365.500.000	=	368.678.960	Rp 507.700.000	Rp	876.378.960			
10500	9000	4.363.960	+	436.600.000	=	440.963.960	Rp 436.600.000	Rp	877.563.960			
10500	10500	5.548.960	+	507.700.000	=	513.248.960	Rp 365.500.000	Rp	878.748.960			
10500	12000	6.733.960	+	578.800.000	=	585.533.960	Rp 294.400.000	Rp	879.933.960			
10500	13500	7.918.960	+	649.900.000	=	657.818.960	Rp 223.300.000	Rp	881.118.960			
10500	15000	9.103.960	+	721.000.000	=	730.103.960	Rp 152.200.000	Rp	882.303.960			
12000	3000	808.960	+	152.200.000	=	153.008.960	Rp 649.900.000	Rp	802.908.960	f11(12000) =	Rp	802.908.960
12000	4500	1.993.960	+	223.300.000	=	225.293.960	Rp 578.800.000	Rp	804.093.960	x11(12000) =		3.000
12000	6000	3.178.960	+	294.400.000	=	297.578.960	Rp 507.700.000	Rp	805.278.960			
12000	7500	4.363.960	+	365.500.000	=	369.863.960	Rp 436.600.000	Rp	806.463.960			
12000	9000	5.548.960	+	436.600.000	=	442.148.960	Rp 365.500.000	Rp	807.648.960			
12000	10500	6.733.960	+	507.700.000	=	514.433.960	Rp 294.400.000	Rp	808.833.960			
12000	12000	7.918.960	+	578.800.000	=	586.718.960	Rp 223.300.000	Rp	810.018.960			
12000	13500	9.103.960	+	649.900.000	=	659.003.960	Rp 152.200.000	Rp	811.203.960			
12000	15000	10.288.960	+	721.000.000	=	731.288.960	Rp 81.100.000	Rp	812.388.960			
13500	1500	808.960	+	81.100.000	=	81.908.960	Rp 649.900.000	Rp	731.808.960	f11(13500) =	Rp	731.808.960
13500	3000	1.993.960	+	152.200.000	=	154.193.960	Rp 578.800.000	Rp	732.993.960	x11(13500) =		1.500
13500	4500	3.178.960	+	223.300.000	=	226.478.960	Rp 507.700.000	Rp	734.178.960			
13500	6000	4.363.960	+	294.400.000	=	298.763.960	Rp 436.600.000	Rp	735.363.960			
13500	7500	5.548.960	+	365.500.000	=	371.048.960	Rp 365.500.000	Rp	736.548.960			
13500	9000	6.733.960	+	436.600.000	=	443.333.960	Rp 294.400.000	Rp	737.733.960			
13500	10500	7.918.960	+	507.700.000	=	515.618.960	Rp 223.300.000	Rp	738.918.960			
13500	12000	9.103.960	+	578.800.000	=	587.903.960	Rp 152.200.000	Rp	740.103.960			
13500	13500	10.288.960	+	649.900.000	=	660.188.960	Rp 81.100.000	Rp	741.288.960			
13500	15000	11.473.960	+	721.000.000	=	732.473.960	Rp0	Rp	732.473.960			
15000	0	808.960	+	0	=	808.960	Rp 649.900.000	Rp	650.708.960	f11(15000) =	Rp	650.708.960
										x11(15000) =		0

Hasil

Hasil perhitungan rekursif mundur tahap 10

i	x			790(*i* + *x* - 14017)+*c* (*x*)		*f11* (*i* + *x* - 14017)	Total Cost Months 10-12	*f* 10(*i*) / *x* 10(*i*)
0	15000	776.570	+	721.000.000	= 721.776.570	Rp 1.300.608.960	Rp 2.022.385.530	f10(0) = Rp 2.022.385.530
								x10(0) = 15.000
1500	13500	776.570	+	649.900.000	= 650.676.570	Rp 1.300.608.960	Rp 1.951.285.530	f10(1500) = Rp 1.951.285.530
1500	15000	1.961.570	+	721.000.000	= 722.961.570	Rp 1.229.508.960	Rp 1.952.470.530	x10(1500) = 13.500
3000	12000	776.570	+	578.800.000	= 579.576.570	Rp 1.300.608.960	Rp 1.880.185.530	f10(3000) = Rp 1.880.185.530
3000	13500	1.961.570	+	649.900.000	= 651.861.570	Rp 1.229.508.960	Rp 1.881.370.530	x10(3000) = 12.000
3000	15000	3.146.570	+	721.000.000	= 724.146.570	Rp 1.158.408.960	Rp 1.882.555.530	
4500	10500	776.570	+	507.700.000	= 508.476.570	Rp 1.300.608.960	Rp 1.809.085.530	f10(4500) = Rp 1.809.085.530
4500	12000	1.961.570	+	578.800.000	= 580.761.570	Rp 1.229.508.960	Rp 1.810.270.530	x10(4500) = 10.500
4500	13500	3.146.570	+	649.900.000	= 653.046.570	Rp 1.158.408.960	Rp 1.811.455.530	
4500	15000	4.331.570	+	721.000.000	= 725.331.570	Rp 1.087.308.960	Rp 1.812.640.530	
6000	9000	776.570	+	436.600.000	= 437.376.570	Rp 1.300.608.960	Rp 1.737.985.530	f10(6000) = Rp 1.737.985.530
6000	10500	1.961.570	+	507.700.000	= 509.661.570	Rp 1.229.508.960	Rp 1.739.170.530	x10(6000) = 9.000
6000	12000	3.146.570	+	578.800.000	= 581.946.570	Rp 1.158.408.960	Rp 1.740.355.530	
6000	13500	4.331.570	+	649.900.000	= 654.231.570	Rp 1.087.308.960	Rp 1.741.540.530	
6000	15000	5.516.570	+	721.000.000	= 726.516.570	Rp 1.016.208.960	Rp 1.742.725.530	
7500	7500	776.570	+	365.500.000	= 366.276.570	Rp 1.300.608.960	Rp 1.666.885.530	f10(7500) = Rp 1.666.885.530
7500	9000	1.961.570	+	436.600.000	= 438.561.570	Rp 1.229.508.960	Rp 1.668.070.530	x10(7500) = 7.500
7500	10500	3.146.570	+	507.700.000	= 510.846.570	Rp 1.158.408.960	Rp 1.669.255.530	
7500	12000	4.331.570	+	578.800.000	= 583.131.570	Rp 1.087.308.960	Rp 1.670.440.530	
7500	13500	5.516.570	+	649.900.000	= 655.416.570	Rp 1.016.208.960	Rp 1.671.625.530	
7500	15000	6.701.570	+	721.000.000	= 727.701.570	Rp 945.108.960	Rp 1.672.810.530	
9000	6000	776.570	+	294.400.000	= 295.176.570	Rp 1.300.608.960	Rp 1.595.785.530	f10(9000) = Rp 1.595.785.530
9000	7500	1.961.570	+	365.500.000	= 367.461.570	Rp 1.229.508.960	Rp 1.596.970.530	x10(9000) = 6.000
9000	9000	3.146.570	+	436.600.000	= 439.746.570	Rp 1.158.408.960	Rp 1.598.155.530	
9000	10500	4.331.570	+	507.700.000	= 512.031.570	Rp 1.087.308.960	Rp 1.599.340.530	
9000	12000	5.516.570	+	578.800.000	= 584.316.570	Rp 1.016.208.960	Rp 1.600.525.530	
9000	13500	6.701.570	+	649.900.000	= 656.601.570	Rp 945.108.960	Rp 1.601.710.530	
9000	15000	7.886.570	+	721.000.000	= 728.886.570	Rp 874.008.960	Rp 1.602.895.530	
10500	4500	776.570	+	223.300.000	= 224.076.570	Rp 1.300.608.960	Rp 1.524.685.530	f10(10500) = Rp 1.524.685.530
10500	6000	1.961.570	+	294.400.000	= 296.361.570	Rp 1.229.508.960	Rp 1.525.870.530	x10(10500) = 4.500
10500	7500	3.146.570	+	365.500.000	= 368.646.570	Rp 1.158.408.960	Rp 1.527.055.530	
10500	9000	4.331.570	+	436.600.000	= 440.931.570	Rp 1.087.308.960	Rp 1.528.240.530	
10500	10500	5.516.570	+	507.700.000	= 513.216.570	Rp 1.016.208.960	Rp 1.529.425.530	
10500	12000	6.701.570	+	578.800.000	= 585.501.570	Rp 945.108.960	Rp 1.530.610.530	
10500	13500	7.886.570	+	649.900.000	= 657.786.570	Rp 874.008.960	Rp 1.531.795.530	
10500	15000	9.071.570	+	721.000.000	= 730.071.570	Rp 802.908.960	Rp 1.532.980.530	
12000	3000	776.570	+	152.200.000	= 152.976.570	Rp 1.300.608.960	Rp 1.453.585.530	f10(12000) = Rp 1.453.585.530
12000	4500	1.961.570	+	223.300.000	= 225.261.570	Rp 1.229.508.960	Rp 1.454.770.530	x10(12000) = 3.000
12000	6000	3.146.570	+	294.400.000	= 297.546.570	Rp 1.158.408.960	Rp 1.455.955.530	
12000	7500	4.331.570	+	365.500.000	= 369.831.570	Rp 1.087.308.960	Rp 1.457.140.530	
12000	9000	5.516.570	+	436.600.000	= 442.116.570	Rp 1.016.208.960	Rp 1.458.325.530	
12000	10500	6.701.570	+	507.700.000	= 514.401.570	Rp 945.108.960	Rp 1.459.510.530	
12000	12000	7.886.570	+	578.800.000	= 586.686.570	Rp 874.008.960	Rp 1.460.695.530	
12000	13500	9.071.570	+	649.900.000	= 658.971.570	Rp 802.908.960	Rp 1.461.880.530	
12000	15000	10.256.570	+	721.000.000	= 731.256.570	Rp 731.808.960	Rp 1.463.065.530	
13500	1500	776.570	+	81.100.000	= 81.876.570	Rp 1.300.608.960	Rp 1.382.485.530	f10(13500) = Rp 1.382.485.530
13500	3000	1.961.570	+	152.200.000	= 154.161.570	Rp 1.229.508.960	Rp 1.383.670.530	x10(13500) = 1.500
13500	4500	3.146.570	+	223.300.000	= 226.446.570	Rp 1.158.408.960	Rp 1.384.855.530	
13500	6000	4.331.570	+	294.400.000	= 298.731.570	Rp 1.087.308.960	Rp 1.386.040.530	
13500	7500	5.516.570	+	365.500.000	= 371.016.570	Rp 1.016.208.960	Rp 1.387.225.530	
13500	9000	6.701.570	+	436.600.000	= 443.301.570	Rp 945.108.960	Rp 1.388.410.530	
13500	10500	7.886.570	+	507.700.000	= 515.586.570	Rp 874.008.960	Rp 1.389.595.530	
13500	12000	9.071.570	+	578.800.000	= 587.871.570	Rp 802.908.960	Rp 1.390.780.530	
13500	13500	10.256.570	+	649.900.000	= 660.156.570	Rp 731.808.960	Rp 1.391.965.530	
13500	15000	11.441.570	+	721.000.000	= 732.441.570	Rp 650.708.960	Rp 1.383.150.530	
15000	0	776.570	+	Rp -	= 776.570	Rp 1.300.608.960	Rp 1.301.385.530	f10(15000) = Rp 1.301.385.530
								x10(15000) = 0

Hasil

Hasil perhitungan rekursif mundur tahap 9

i	x			790(*i* + *x* -14058)+*c* (*x*)		*f10* (*i* + *x* -14058)	Total Cost Months 9-12	*f* 9(*i*) / *x* 9(*i*)	
0	15000	744.180	+	721.000.000	= 721.744.180	Rp 1.951.285.530	Rp 2.673.029.710	f9(0) =	Rp 2.673.029.710
								x9(0) =	15.000
1500	13500	744.180	+	649.900.000	= 650.644.180	Rp 1.951.285.530	Rp 2.601.929.710	f9(1500) =	Rp 2.601.929.710
1500	15000	1.929.180	+	721.000.000	= 722.929.180	Rp 1.880.185.530	Rp 2.603.114.710	x9(1500) =	13.500
3000	12000	744.180	+	578.800.000	= 579.544.180	Rp 1.951.285.530	Rp 2.530.829.710	f9(3000) =	Rp 2.530.829.710
3000	13500	1.929.180	+	649.900.000	= 651.829.180	Rp 1.880.185.530	Rp 2.532.014.710	x9(3000) =	12.000
3000	15000	3.114.180	+	721.000.000	= 724.114.180	Rp 1.809.085.530	Rp 2.533.199.710		
4500	10500	744.180	+	507.700.000	= 508.444.180	Rp 1.951.285.530	Rp 2.459.729.710	f9(4500) =	Rp 2.459.729.710
4500	12000	1.929.180	+	578.800.000	= 580.729.180	Rp 1.880.185.530	Rp 2.460.914.710	x9(4500) =	10.500
4500	13500	3.114.180	+	649.900.000	= 653.014.180	Rp 1.809.085.530	Rp 2.462.099.710		
4500	15000	4.299.180	+	721.000.000	= 725.299.180	Rp 1.737.985.530	Rp 2.463.284.710		
6000	9000	744.180	+	436.600.000	= 437.344.180	Rp 1.951.285.530	Rp 2.388.629.710	f9(6000) =	Rp 2.388.629.710
6000	10500	1.929.180	+	507.700.000	= 509.629.180	Rp 1.880.185.530	Rp 2.389.814.710	x9(6000) =	9.000
6000	12000	3.114.180	+	578.800.000	= 581.914.180	Rp 1.809.085.530	Rp 2.390.999.710		
6000	13500	4.299.180	+	649.900.000	= 654.199.180	Rp 1.737.985.530	Rp 2.392.184.710		
6000	15000	5.484.180	+	721.000.000	= 726.484.180	Rp 1.666.885.530	Rp 2.393.369.710		
7500	7500	744.180	+	365.500.000	= 366.244.180	Rp 1.951.285.530	Rp 2.317.529.710	f9(7500) =	Rp 2.317.529.710
7500	9000	1.929.180	+	436.600.000	= 438.529.180	Rp 1.880.185.530	Rp 2.318.714.710	x9(7500) =	7.500
7500	10500	3.114.180	+	507.700.000	= 510.814.180	Rp 1.809.085.530	Rp 2.319.899.710		
7500	12000	4.299.180	+	578.800.000	= 583.099.180	Rp 1.737.985.530	Rp 2.321.084.710		
7500	13500	5.484.180	+	649.900.000	= 655.384.180	Rp 1.666.885.530	Rp 2.322.269.710		
7500	15000	6.669.180	+	721.000.000	= 727.669.180	Rp 1.595.785.530	Rp 2.323.454.710		
9000	6000	744.180	+	294.400.000	= 295.144.180	Rp 1.951.285.530	Rp 2.246.429.710	f9(9000) =	Rp 2.246.429.710
9000	7500	1.929.180	+	365.500.000	= 367.429.180	Rp 1.880.185.530	Rp 2.247.614.710	x9(9000) =	6.000
9000	9000	3.114.180	+	436.600.000	= 439.714.180	Rp 1.809.085.530	Rp 2.248.799.710		
9000	10500	4.299.180	+	507.700.000	= 511.999.180	Rp 1.737.985.530	Rp 2.249.984.710		
9000	12000	5.484.180	+	578.800.000	= 584.284.180	Rp 1.666.885.530	Rp 2.251.169.710		
9000	13500	6.669.180	+	649.900.000	= 656.569.180	Rp 1.595.785.530	Rp 2.252.354.710		
9000	15000	7.854.180	+	721.000.000	= 728.854.180	Rp 1.524.685.530	Rp 2.253.539.710		
10500	4500	744.180	+	223.300.000	= 224.044.180	Rp 1.951.285.530	Rp 2.175.329.710	f9(10500) =	Rp 2.175.329.710
10500	6000	1.929.180	+	294.400.000	= 296.329.180	Rp 1.880.185.530	Rp 2.176.514.710	x9(10500) =	4.500
10500	7500	3.114.180	+	365.500.000	= 368.614.180	Rp 1.809.085.530	Rp 2.177.699.710		
10500	9000	4.299.180	+	436.600.000	= 440.899.180	Rp 1.737.985.530	Rp 2.178.884.710		
10500	10500	5.484.180	+	507.700.000	= 513.184.180	Rp 1.666.885.530	Rp 2.180.069.710		
10500	12000	6.669.180	+	578.800.000	= 585.469.180	Rp 1.595.785.530	Rp 2.181.254.710		
10500	13500	7.854.180	+	649.900.000	= 657.754.180	Rp 1.524.685.530	Rp 2.182.439.710		
10500	15000	9.039.180	+	721.000.000	= 730.039.180	Rp 1.453.585.530	Rp 2.183.624.710		
12000	3000	744.180	+	152.200.000	= 152.944.180	Rp 1.951.285.530	Rp 2.104.229.710	f9(12000) =	Rp 2.104.229.710
12000	4500	1.929.180	+	223.300.000	= 225.229.180	Rp 1.880.185.530	Rp 2.105.414.710	x9(12000) =	3.000
12000	6000	3.114.180	+	294.400.000	= 297.514.180	Rp 1.809.085.530	Rp 2.106.599.710		
12000	7500	4.299.180	+	365.500.000	= 369.799.180	Rp 1.737.985.530	Rp 2.107.784.710		
12000	9000	5.484.180	+	436.600.000	= 442.084.180	Rp 1.666.885.530	Rp 2.108.969.710		
12000	10500	6.669.180	+	507.700.000	= 514.369.180	Rp 1.595.785.530	Rp 2.110.154.710		
12000	12000	7.854.180	+	578.800.000	= 586.654.180	Rp 1.524.685.530	Rp 2.111.339.710		
12000	13500	9.039.180	+	649.900.000	= 658.939.180	Rp 1.453.585.530	Rp 2.112.524.710		
12000	15000	10.224.180	+	721.000.000	= 731.224.180	Rp 1.382.485.530	Rp 2.113.709.710		
13500	1500	744.180	+	81.100.000	= 81.844.180	Rp 1.951.285.530	Rp 2.033.129.710	f9(13500) =	Rp 2.033.129.710
13500	3000	1.929.180	+	152.200.000	= 154.129.180	Rp 1.880.185.530	Rp 2.034.314.710	x9(13500) =	1.500
13500	4500	3.114.180	+	223.300.000	= 226.414.180	Rp 1.809.085.530	Rp 2.035.499.710		
13500	6000	4.299.180	+	294.400.000	= 298.699.180	Rp 1.737.985.530	Rp 2.036.684.710		
13500	7500	5.484.180	+	365.500.000	= 370.984.180	Rp 1.666.885.530	Rp 2.037.869.710		
13500	9000	6.669.180	+	436.600.000	= 443.269.180	Rp 1.595.785.530	Rp 2.039.054.710		
13500	10500	7.854.180	+	507.700.000	= 515.554.180	Rp 1.524.685.530	Rp 2.040.239.710		
13500	12000	9.039.180	+	578.800.000	= 587.839.180	Rp 1.453.585.530	Rp 2.041.424.710		
13500	13500	10.224.180	+	649.900.000	= 660.124.180	Rp 1.382.485.530	Rp 2.042.609.710		
13500	15000	11.409.180	+	721.000.000	= 732.409.180	Rp 1.301.385.530	Rp 2.033.794.710		
15000	0	744.180	+	0	= 744.180	Rp 1.951.285.530	Rp 1.952.029.710	f9(15000) =	Rp 1.952.029.710
15000	1500	1.929.180	+	81.100.000	= 83.029.180	Rp 1.880.185.530	Rp 1.963.214.710	x9(15000) =	0

Hasil

Periode	Persediaan Akhir	i (*state* awal)	x	$790(i+x-Sn)+c(x)$	$fn+1(i+x-Sn)$	Total Cost	$fn(i)$ / $xn(i)$
Januari	614	0	15000	Rp 721.485.060	Rp 7.155.532.050	Rp 7.877.017.110	$f1(0)$ = Rp 7.877.017.110 $x1(0)$ = 15.000
Februari	655	1500	13500	Rp 650.417.450	Rp 6.505.114.600	Rp 7.155.532.050	$f2(1500)$ = Rp 7.155.532.050 $x2(1500)$ = 13.500
Maret	696	1500	13500	Rp 650.449.840	Rp 5.854.664.760	Rp 6.505.114.600	$f3(1500)$ = Rp 6.505.114.600 $x3(1500)$ = 13.500
April	737	1500	13500	Rp 650.482.230	Rp 5.204.182.530	Rp 5.854.664.760	$f4(1500)$ = Rp 5.854.664.760 $x4(1500)$ = 13.500
Mei	778	1500	13500	Rp 650.514.620	Rp 4.553.667.910	Rp 5.204.182.530	$f5(1500)$ = Rp 5.204.182.530 $x5(1500)$ = 13.500
Juni	819	1500	13500	Rp 650.547.010	Rp 3.903.120.900	Rp 4.553.667.910	$f6(1500)$ = Rp 4.553.667.910 $x6(1500)$ = 13.500
Juli	860	1500	13500	Rp 650.579.400	Rp 3.252.541.500	Rp 3.903.120.900	$f7(1500)$ = Rp 3.903.120.900 $x7(1500)$ = 13.500
Agustus	901	1500	13500	Rp 650.611.790	Rp 2.601.929.710	Rp 3.252.541.500	$f8(1500)$ = Rp 3.252.541.500 $x8(1500)$ = 13.500
September	942	1500	13500	Rp 650.644.180	Rp 1.951.285.530	Rp 2.601.929.710	$f9(1500)$ = Rp 2.601.929.710 $x9(1500)$ = 13.500
Oktober	983	1500	13500	Rp 650.676.570	Rp 1.300.608.960	Rp 1.951.285.530	$f10(1500)$ = Rp 1.951.285.530 $x10(1500)$ = 13.500
November	1024	1500	13500	Rp 650.708.960	Rp 649.900.000	Rp 1.300.608.960	$f11(1500)$ = Rp 1.300.608.960 $x11(1500)$ = 13.500
Desember	1065	1500	13500				$f12(1500)$ = Rp 649.900.000 $x12(1500)$ = 13.500

Perhitungan rekursif mundur tahap 12–1 menghasilkan keputusan pembelian optimal dengan total biaya minimum. Jalur solusi optimal selama 12 periode.

Pembahasan

Hasil peramalan menggunakan metode regresi linear menunjukkan bahwa kebutuhan round bar AISI 4135 tahun 2026 relatif stabil dengan rata-rata sekitar 14.000 kg per bulan dan total proyeksi kebutuhan sebesar 169.926 kg selama satu tahun. Meskipun data aktual berfluktuasi, nilai kesalahan peramalan (MAD, MAPE, dan MSE) masih dalam batas yang dapat diterima sehingga model layak digunakan sebagai dasar dalam tahap optimasi persediaan.

Pembahasan

Hasil perhitungan rekursif mundur menunjukkan bahwa keputusan pembelian optimal diperoleh dengan mempertimbangkan biaya periode berjalan dan biaya minimum periode berikutnya. Model menghasilkan kebijakan pembelian yang relatif konsisten sebesar 13.500 kg pada sebagian besar periode, dengan penyesuaian tertentu untuk menjaga keseimbangan persediaan. Penerapan metode Dynamic Programming menghasilkan total biaya persediaan minimum sebesar Rp 7.877.017.110, lebih rendah dibandingkan kebijakan sebelumnya, sehingga mampu mengontrol fluktuasi pembelian, menghindari overstock, dan meminimalkan total biaya karena setiap keputusan mempertimbangkan dampaknya terhadap periode berikutnya.

Temuan Penting Penelitian

Penelitian ini mengidentifikasi beberapa faktor yang menyebabkan kurang optimalnya pengendalian persediaan bahan baku pada perusahaan. Berdasarkan hasil analisis menggunakan metode regresi linear dan dynamic programming yaitu:

1. Permintaan relatif stabil hasil regresi (±14.000 kg/bulan).
2. Kebijakan optimal 13.500 kg meminimalkan biaya.
3. Terjadi penghematan 10,40%.
4. Rekursif mundur efektif untuk pengendalian multi-periode.

Manfaat Penelitian

1. Memberikan dasar perencanaan pembelian bahan baku yang lebih terukur melalui hasil peramalan permintaan.
2. Membantu perusahaan dalam menentukan kebijakan pembelian optimal untuk meminimalkan total biaya persediaan.
3. Mengurangi risiko overstock dan meningkatkan efisiensi pengendalian persediaan multi-periode.
4. Menjadi referensi penerapan metode *Dynamic Programming* dalam pengambilan keputusan persediaan di industri manufaktur

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