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Designing Production Planning and Control Systems In Cable Rack Products (Cable Tray) With Programming Language At PT. Baruna Trayindo Jaya for Industry 4.0

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Abstract. Planning, production control, and inventory control in the company are carried out by the Production Planning and Inventory Control section or commonly abbreviated as PPIC. This section deals directly with various departments such as marketing, purchasing, and production. The PPIC division is tasked with translating the needs for the procurement of finished products into the form of production plans and the availability of raw materials. PT. Baruna Trayindo Jaya is engaged in manufacturing by producing cable ladders and cable trays and requires request data from October 2019 to September 2020 along with other data. The methods used are calculation with disaggregated aggregate, rough-cut capacity planning, material requirement planning, and capacity requirement planning. It is found that the results of the best forecasting calculations are using the DES forecasting method. for disaggregated aggregates in the form of a mixed shift and overtime scheduling with a total of Rp1,402,007,652, rough-cut capacity planning has no shortage of resources, material requirement planning using the AWW method for cable ladder amounting to Rp. 148,922,875.00 and cable tray Rp. 150,205,375.00, and in the capacity requirement planning capacity/availability is greater than the need, PT. Baruna Trayindo Jaya can meet the demand for 2020 to 2021 with all the resources it has. There is a lack of capacity in the electric welding machine, which can be overcome by overtime, so that the cost is IDR 247,680,000.

INTRODUCTION

In the manufacturing industry, one important part is planning. Good planning can increase the efficiency and profit of the company. Meanwhile, poor planning can cause waste, production delays, and high production costs. For this reason, planning needs to be done by considering various aspects that exist in the industry. Planning, production control, and inventory control in the company are carried out by the Production Planning and Inventory Control section or commonly abbreviated as PPIC. One of the companies that produce cable trays is PT. Baruna Trayindo Jaya. PT. Baruna Trayindo Jaya is engaged in manufacturing cable trays, cable support systems, and pipe poles. Cable racks (cable trays) are handy for various cables (power cables, telephone cables, data cables, etc.) besides that, cable racks are useful for protecting cable installations and using cable trays. This condition can simplify the maintenance and maintenance of cables, and the last use is to protect cables.

The purpose of the above research is to determine the appropriate forecasting method at PT. Baruna Trayindo Jaya, knowing that the factory capacity can meet future demand, and calculating the price of raw materials.

METHOD

The research method was carried out to determine the research flow that was carried out, starting from determining the thesis theme.

The research method was carried out to determine the research flow that was carried out, starting from determining the thesis theme. The final stage is to make conclusions and suggestions from the data that had been successfully processed in the flow diagram that had been compiled. Below is the flow of the research that has been made.

Determining Thesis Theme For the first step

Namely determining the research topic to be carried out to search for the company where the research was carried out.

Field Studies and Literature Studies

Field studies are carried out by going directly to the field and conducting interviews with the parties concerned to determine what problems are happening to the company.

Problem Identification

Problem identification is made to find out what causes the main problems in a company.

Problem Formulation

The formulation of the problem is carried out to determine the calculation using any method and minimize the cost of production errors in the company.

Research Objectives

The purpose of this research is to obtain appropriate forecasting methods, raw material control, and proper capacity planning for PT. Baruna Trayindo Jaya to produce cable trays, to obtain the minimum cost of supplies, provides the results of plans for ordering raw materials for the next 12 months.

Data Collection

The data used in this study include general company data and cable tray demand data from January 2020 to September 2020, lead time for raw materials, UMR salaries for production employees, raw material prices, and the last amount of inventory in the warehouse for raw materials. Cable rack (cable tray), cable support system, and pipe poles.

Perform Data Processing

The steps in data processing are:
Perform sales data forecasting calculations for 9 months using the methods[1][2]:
a). Single Moving Average
b). Double Moving Average
c). Weighted Moving Average
d). Single Exponential Smoothing
e). Double Exponential Smoothing
f). Linear Regression
g). Cyclic
h). Quadratic

Calculating the forecasting error's value to get the best forecasting results using the following methods:
a). Mean Absolute Deviation (MAD)
b). Mean Square Error (MSE)
c). Mean Absolute Percentage Error (MAPE)
d). Tracking signal functions to control errors in forecasting.
e) The Moving Range Chart is designed to compare the actual demand value with the forecast value.
f) Choosing a forecasting method is a production planning to adjust production capability in facing consumer demand.

Rough Cut Capacity Planning (RCCP)

Determines the adequacy level of resources planned to implement JIP[3][4][5]. Master Production Schedule is the result of disaggregate planning that has been tested by RCCP so that it is suitable for use.

The MRP

Then, the MRP will be made based on several inputs, including the MPS, lead time, and inventory status. By calculating the MRP by comparing the methods in the lot-sizing technique, namely[6][7]:
a). Lot for Lot (LFL) Method
b). Periodic Order Quantity (POQ) Method
c). Economic Order Quantity (EOQ) Method
d). Least Unit Cost (LUC) Method
e). Silver Meal Algorithm method
f). Wagner Within Algorithm Method
Selecting the best MRP method with the minimum costing criteria.

Carry out capacity planning calculations

Carry out capacity planning calculations using the CRP method to get results in accordance with the conditions by PT. Baruna Trayindo Jaya [8].

Conducting Data Analysis and Discussion

The chosen forecasting method is carried out validation and verification with a tracking signal and a moving range chart by obtaining the smallest error value by forecasting.

Doing Software Development

Making this software is expected to make it easier for PT. Baruna Trayindo Jaya in entering the forecasting data into the system that has been created.

Make Conclusions and Suggestions

The conclusions and suggestions are drawn up when it reaches the final stage. Conclusions will be drawn up based on the results of data processing that have been carried out. The flowchart of the research methodology can be seen in Figure 1.

DATA COLLECTION

Data used in this research are demand data from October 2019 until September 2020 at PT. Baruna Trayindo Jaya for cable tray and cable ladder. For other data such as raw material data, machine capacity data.

RESULTS AND DISCUSSION

Forecasting

Forecasting is done using 1-year demand data from October 2019 to September 2020. In the forecasting research that has been done, the Double Exponential Smoothing (DES) method was chosen with the smallest error value of 0.2. Below is the 1-year demand data for PT. Baruna Trayindo Jaya, which can be seen in table 1.

TABLE 1. Data on Demand for October 2019 - September 2020

Period	Month	Demand (unit)
1	Oct-19	1247
2	Nov-19	1145
3	Dec-19	846
4	Jan-20	562
5	Feb-20	729
6	Mac-20	860
7	Apr-20	1503
8	May-20	553
9	Jun-20	1499
10	Jul-20	1731
11	Aug-20	1495
12	Sep-20	4163
Total		**16.333**

The next step is to determine the error value of the forecasting carried out through calculations to obtain the forecasting method with the smallest and best error values. Below are the error table results using the forecasting method which can be seen in table 2.

TABLE 2. Calculation of the Final Result Error

Error method	MAD	SSE	MSE	SDE	MPE	MAPE
CYCLE	907	19328950	1610746	1326	57	57
LINIER	552	6576903	548075	773	22	50
QUADRATIC	346	2863251	238604	510	8	28
DES 0,2	218	921941	92194	320	6	23

The results show that the best forecast is by the DES method, which is 0.2, the smallest error value of all methods. For the MAD error method, DES gets an error value of 218, the SSE error method gets a value of 921941, MSE gets an error value of 92194, SDE gets an error value of 320, MPE gets an error value of 6, and MAPE gets a value of 23.

Aggregate Disaggregate

Aggregate planning is a method that will be used in production planning to adjust production capabilities in the face of volatile consumer demand by maximizing the use of company resources to reduce the company's operational costs. Disaggregate planning is the next step after aggregate planning. The purpose of disaggregate planning is to break down the aggregate unit in aggregate planning into each product item and determine which item of a product will be produced. [3]

Aggregate Disaggregate Shift

Shift aggregate is useful for knowing the costs required in production planning in response to consumer demand in terms of production time and overtime costs, employee salaries, inventory costs. The next page is the aggregate shift disaggregate calculation table data, which can be seen in Table 3.

TABLE 3. Calculation of Aggregate Disaggregate Shift

Period	Average Production/hour	Number Of Production Days (Monday-Friday)	Number Of Production Days (Saturday)	Number Of Production Hours	Demand Forecasting (Unit)	Reguler Production Time (Unit)	Initial Inventory	Final Inventory	RT+OT Production (Unit)	Employee Salary	Inventory Cost	Total Cost
Oct-20	8	22	5	402	1205	3.216	2.011	2.011	3.216	Rp42.570.000	Rp3.352.337	Rp45.922.337
Nov-20	8	21	4	188	1059	1.504	2.456	2.456	1.504	Rp42.570.000	Rp4.094.152	Rp46.664.152
Dec-20	8	22	4	196	847	1.568	3.177	3.177	1.568	Rp42.570.000	Rp5.296.059	Rp47.866.059
Jan-21	8	20	5	185	762	1.480	3.895	3.895	1.480	Rp42.570.000	Rp6.492.965	Rp49.062.965
Feb-21	8	20	4	180	760	1.440	4.575	4.575	1.440	Rp42.570.000	Rp7.626.525	Rp50.196.525
Mar-21	8	23	4	204	1074	1.632	5.133	5.133	1.632	Rp42.570.000	Rp8.556.711	Rp51.126.711
Apr-21	8	22	4	196	872	1.568	5.829	5.829	1.568	Rp42.570.000	Rp9.716.943	Rp52.286.943
May-21	8	21	5	193	1205	1.544	6.168	6.168	1.544	Rp42.570.000	Rp10.282.056	Rp52.852.056
Jun-21	8	22	4	196	1509	1.568	6.227	6.227	1.568	Rp42.570.000	Rp10.380.409	Rp52.950.409
Jul-21	8	22	5	201	1426	1.608	6.409	6.409	1.608	Rp42.570.000	Rp10.683.803	Rp53.253.803
Aug-21	8	21	4	188	2551	1.504	5.362	5.362	1.504	Rp42.570.000	Rp8.938.454	Rp51.508.454
Sep-21	8	22	4	196	2695	1.568	4.235	4.235	1.568	Rp42.570.000	Rp7.059.745	Rp49.629.745
Jumlah										Rp510.840.000	Rp92.480.159	Rp603.320.159

From table 3, the total cost to be incurred by the company is IDR 603.320.159 for the next 12 months from October 2020 to September 2021. The total result of employee salaries for the next 12 months is IDR 510,840,000.

Overtime Disaggregate Aggregate

In the disaggregate aggregate, overtime is used to determine the costs incurred when overtime occurs.

TABLE 4. Calculation of the Final Result Error

Period	Average Production/ Time	Number Of Production Days (Monday-Friday)	Number Of Production Days (Saturday)	Number Of Production Hours	Demand Forecasting (Unit)	Reguler Production Time (Unit)	Initial Inventory	Final Inventory	RT+OT Production (Unit)	Employee Salary	Inventory Cost	Total Cost
Oct-20	8	22	5	402	1205	3.216	2.011	2.011	3.216	Rp 42.570.000	Rp 3.352.337	Rp 45.922.337
Nov-20	8	21	4	376	1059	3.008	3.960	3.960	3.008	Rp 42.570.000	Rp 6.601.320	Rp 49.171.320
Dec-20	8	22	4	392	847	3.136	6.249	6.249	3.136	Rp 42.570.000	Rp 10.417.083	Rp 52.987.083
Jan-21	8	20	5	370	762	2.960	8.447	8.447	2.960	Rp 42.570.000	Rp 14.081.149	Rp 56.651.149
Feb-21	8	20	4	360	760	2.880	10.567	10.567	2.880	Rp 42.570.000	Rp 17.615.189	Rp 60.185.189
Mar-21	8	23	4	408	1074	3.264	12.757	12.757	3.264	Rp 42.570.000	Rp 21.265.919	Rp 63.835.919
Apr-21	8	22	4	392	872	3.136	15.021	15.021	3.136	Rp 42.570.000	Rp 25.040.007	Rp 67.610.007
May-21	8	21	5	386	1205	3.088	16.904	16.904	3.088	Rp 42.570.000	Rp 28.178.968	Rp 70.748.968
Jun-21	8	22	4	392	1509	3.136	18.531	18.531	3.136	Rp 42.570.000	Rp 30.891.177	Rp 73.461.177
Jul-21	8	22	5	402	1426	3.216	20.321	20.321	3.216	Rp 42.570.000	Rp 33.875.107	Rp 76.445.107
Aug-21	8	21	4	376	2551	3.008	20.778	20.778	3.008	Rp 42.570.000	Rp 34.636.926	Rp 77.206.926
Sep-21	8	22	4	392	2695	3.136	21.219	21.219	3.136	Rp 42.570.000	Rp 35.372.073	Rp 77.942.073
Total										Rp 510.840.000	Rp 261.327.255	Rp 772.167.255

From Table 4, the total disaggregation cost by the company is IDR 772.167.255 for the next 12 months from October 2020 to September 2021. The total result of employee salaries for the next 12 months is IDR 510,840,000.

Aggregate Disaggregate Mix Overtime Shift

In the mixed disaggregate aggregate overtime shift is used to determine the total cost that must be incurred when overtime and additional shifts occur.

TABLE 5. Overtime Shift Disaggregate Mixed Shift Aggregate Calculation

Period	Average Production /Time	Number Of Production Days (Monday-Friday)	Number Of Production Days (Saturday)	Number Of Production Hours	Demand Forecasting (Unit)	Reguler Production Time (Unit)	Initial Inventory	Final Inventory	RT+OT Production (Unit)	Employee Salary	Inventory Cost	Total Cost	
Oct-20	8	22	5	402	1205	3.216	2.011	2.011	3.216	Rp42.570.000	Rp3.352.337	Rp45.922.337	418,958
Nov-20	8	21	4	188	1059	1.504	2.456	2.456	1.504	Rp42.570.000	Rp4.094.152	Rp46.664.152	511,667
Dec-20	8	22	4	196	847	1.568	3.177	3.177	1.568	Rp42.570.000	Rp5.296.059	Rp47.866.059	661,875
Jan-21	8	20	5	185	762	1.480	3.895	3.895	1.480	Rp42.570.000	Rp6.492.965	Rp49.062.965	811,458
Feb-21	8	20	4	180	760	1.440	4.575	4.575	1.440	Rp42.570.000	Rp7.626.525	Rp50.196.525	953,125
Mar-21	8	23	4	204	1074	1.632	5.133	5.133	1.632	Rp42.570.000	Rp8.556.711	Rp51.126.711	1069,38
Apr-21	8	22	4	196	872	1.568	5.829	5.829	1.568	Rp42.570.000	Rp9.716.943	Rp52.286.943	1214,38
May-21	8	21	5	193	1205	1.544	6.168	6.168	1.544	Rp42.570.000	Rp10.282.056	Rp52.852.056	1285
Jun-21	8	22	4	196	1509	1.568	6.227	6.227	1.568	Rp42.570.000	Rp10.380.409	Rp52.950.409	1297,29
Jul-21	8	22	5	201	1426	1.608	6.409	6.409	1.608	Rp42.570.000	Rp10.683.803	Rp53.253.803	1335,21
Aug-21	8	21	4	188	2551	1.504	5.362	5.362	1.504	Rp42.570.000	Rp8.938.454	Rp51.508.454	1117,08
Sep-21	8	22	4	196	2695	1.568	4.235	4.235	1.568	Rp42.570.000	Rp7.059.745	Rp49.629.745	882,292
Jumlah										**Rp510.840.000**	**Rp92.480.159**	**Rp603.320.159**	

From table 5, the total cost to be incurred by the company is IDR 603.320.159 for the next 12 months from October 2020 to September 2021. The total result of employee salaries for the next 12 months is IDR 510,840,000.

Rough Cut Capacity Planning (RCCP)

Rough Cut Capacity Planning (RCCP) determines the adequacy level of the resources planned for implementing the MPS. The RCCP is more detailed than the RRP because it calculates the load for all items scheduled and in the actual time period. Below is a table of the calculation results of the final result of the RCCP error, which can be seen in Table 6.

TABLE 6. Time Capacity of the RCCP Calculation Machine

Work Center	Oct-20 (minute)	Nov-20 (minute)	Dec-20 (minute)	Jan-20 (minute)	Feb-20 (minute)	Mar-20 (minute)	Apr-20 (minute)	May-20 (minute)	Jun-20 (minute)	Jul-20 (minute)	Aug-20 (minute)	Sep-20 (minute)	Total (minute)
Shearing	15804	13590	19080	34527	28566	29913	29070	27918	27396	28170	32490	34578	321102
Punch 16 ton	84288	72480	101760	184144	152352	159536	155040	148896	146112	150240	173280	184416	1712544
Bending	63216	54360	76320	138108	114264	119652	116280	111672	109584	112680	129960	138312	1284408
Punch 60 ton	163308	140430	197160	356779	295182	309101	300390	288486	283092	291090	335730	357306	3318054
Miling	215988	185730	260760	471869	390402	408811	397290	381546	374412	384990	444030	472566	4388394
Electric Welding	84996	71226	108648	218061	177066	183483	178578	170802	166860	171558	203526	217134	1951938
Total Capacity Requirement	627600	537816	763728	1403488	1157832	1210496	1176648	1129320	1107456	1138728	1319016	1404312	12976440

From the above calculations, the machine time capacity is greater than the need, PT. Baruna Trayindo Jaya can meet the demand for 2020 to 2021 with all the resources it has.

Material Production Planning (MRP)

The MRP function is to determine the safety stock for each raw material with a safety level of 95%. Below is a table of the safety stock of raw materials, shown in Table 7.

TABLE 7. Safety Stock of Raw Materials

Raw Material	Safety Stock
ALUMUNIUM	14342
Black Plate SPHC	37212
White Plate SPSS	37212
PRE-GALVANISED	37450
STAINLESS STEEL	37450

Below is the result of the calculation and the comparison result of the total Material Production Planning (MRP) cost for each raw material shown in Table 8.

TABLE 8. Results of Comparison and Total Calculation of MRP Costs

Technique	Raw Material									
	Alumunium (IDR)		Black Plat SPHC (IDR)		White Plat SPSS (IDR)		Pre-Galavnised (IDR)		Stainless Steel (IDR)	
LFL	Rp	354.059.364	Rp	972.657.648	Rp	975.336.912	Rp	921.787.608	Rp	1.022.693.244
EOQ	Rp	306.812.527	Rp	820.896.864	Rp	786.736.345	Rp	811.801.231	Rp	878.657.119
POQ	Rp	307.880.229	Rp	713.925.612	Rp	812.971.830	Rp	602.026.234	Rp	610.435.037
LUC	Rp	276.281.891	Rp	972.657.648	Rp	604.870.266	Rp	851.832.494	Rp	787.248.993
Silver Meal	Rp	282.421.650	Rp	972.657.648	Rp	908.393.178	Rp	707.271.186	Rp	707.271.186
AWW	**Rp**	**123.703.358**	**Rp**	**314.697.348**	**Rp**	**108.293.988**	**Rp**	**105.788.014**	**Rp**	**114.196.817**

From the results of the above calculations it is known that of all the MRP techniques that have been carried out, it is known that the AWW technique gets the smallest cost.

Capacity Requirement Planning (CRP)

Capacity Requirement Planning (CRP) is a calculation method used to determine the capacity required for material requirements planning (MRP). Below is the result of the time required and the time available, shown in table 9. below.

TABLE 9. Time Required and Time Available

Work Center	Oct-20 (minute)	Nov-20 (minute)	Dec-20 (minute)	Jan-21 (minute)	Feb-21 (minute)	Mar-21 (minute)	Apr-21 (minute)	May-21 (minute)	Jun-21 (minute)	Jul-21 (minute)	Aug-21 (minute)	Sep-21 (minute)
Shearing Available Time	3.615,00	3.177,00	2.541,00	2.286,00	2.280,00	3.222,00	2.616,00	3.615,00	4.527,00	4.278,00	7.653,00	8.085,00
Punch 16 Ton Available Time	19.280,00	16.944,00	13.552,00	12.192,00	12.160,00	17.184,00	13.952,00	19.280,00	24.144,00	22.816,00	40.816,00	43.120,00
Bending Available Time	14.460,00	12.708,00	10.164,00	9.144,00	9.120,00	12.888,00	10.464,00	14.460,00	18.108,00	17.112,00	30.612,00	32.340,00
Punch 60 Ton Available Time	37.387,00	32.861,00	26.289,00	23.654,00	23.592,00	33.326,00	27.064,00	37.387,00	46.811,00	44.238,00	79.113,00	83.577,00
Milling Available Time	49.417,00	43.431,00	34.739,00	31.254,00	31.172,00	44.046,00	35.764,00	49.417,00	61.881,00	58.478,00	104.603,00	110.507,00
Welding Available Time	25.309,00	22.243,00	17.791,00	16.006,00	15.964,00	22.558,00	18.316,00	25.309,00	31.693,00	29.950,00	53.575,00	56.599,00

From the results above, it is known that the capacity/availability is greater than the need, then PT. Baruna Trayindo Jaya can meet the demand for 2020 to 2021 with all the resources it has. Because some machines are not sufficient, the CRP solution is carried out; below is a CRP solution that has been done, which can be seen in Table 10. below.

TABLE 10. Summary of Cost Solutions to Capacity Problems

Solusi	16 Ton Punch Machine (IDR)		Bending Machine (IDR)		60 Ton Punch Machine (IDR)		Milling Machine (IDR)		Electric Welding Machine (IDR)	
Shift increments	Rp	415.117.887	Rp	109.781.832	Rp	222.839.439	No Need		Rp	21.837.640
Shift reduction	Rp	330.429.405	Rp	109.781.832	Rp	101.488.683	No Need		No Need	
Overtime	No Need		No Need		Rp	127.233.655	Rp	38.786.224	Rp	38.786.224
Addition of machines	No Need		No Need		No Need		Rp	25.280.000	Rp	48.147.773

From the results that have been obtained in the table above, it is known that there is a lack of capacity in the electric welding machine which can be overcome by the existence of overtime so that the cost to be incurred is IDR 38,786,224. For a 16 ton punch machine, it is necessary to add an additional shift of IDR 415,117,877, for a bending machine it has to do an additional shift of IDR 107,781,832, for a 60 ton punch machine there is also overtime of IDR 127,233,655, and finally the milling machine must overtime is IDR 38,786,224 and there is no need for shift reduction

CONCLUSION

From the results of all forecasting methods that have been done, it is known that with DES the smallest error value is 0.2 for 2 products, namely the cable ladder and cable tray for PT. Baruna Trayindo Jaya. For the selected aggregate planning is the aggregate shift and overtime because it has the lowest cost value with the total costs incurred by the company PT. Baruna Trayindo Jaya, amounting to IDR 603,320,159. Furthermore, for the calculation of RCCP and CRP there is no shortage of production time capacity, and also the CRP value is smaller than the RCCP value, but the two methods meet and exceed the existing demand data. MRP calculations for material requirements planning with lot sizing LFL, EOQ, POQ, Silver Meal, AWW, LUC for cable ladder and cable tray data obtained the most suitable results, namely AWW.

REFERENCES

1. Eris, P.N., Nohe, D.A., dan Wahyuningsih, S. 2014. Forecasting with Smoothing and Verification Methods with Moving Range (MR) Control Chart (Case Study: Production of Pure Water at PDAM Tirta Kencana Samarinda). Jurnal Eksponensial. Vol. 5. No. 2 (Nopember 2014): 203-210.

2. Samuel, Patrick. "PENENTUAN METODE PERAMALAN PERMINTAAN BARANG SETENGAH JADI DI PT. XYZ." Jurnal Ilmiah Teknik Industri 8.1 (2020)

3. Lefta, F., L. Gozali, and I. A. Marie. "Aggregate and Disaggregate Production Planning, Material Requirement, and Capacity Requirement in PT. XYZ." IOP Conference Series: Materials Science and Engineering. Vol. 852. No. 1. IOP Publishing, 2020.

4. Herjanto, Eddy. Manajemen Operasi, Edisi Ketiga. Jakarta: Grasindo, 2009.

5. Heizer, Jay, and Barry Render. "Manajemen Operasi Buku 1 Edisi 9." Jakarta: Salemba 4 (2009).

6. Gozali, L., Andres, and Handika, R. 2013. Usulan Penentuan Teknik Lot Sizing Terbaik Dengan Meminimasi Biaya Dalam Perencanaan Dan Pengendalian Kebutuhan Canvas EP 200 Conveyor Belt di PT. XWZ. Jurnal Kajian Teknologi. Vol. 9. No. 2 (Juli 2013): 135-144

7. Gozali, Lina. "Material Requirement Planning and Inventory Control Application Program of Crispy Retail at PT. Diva Mitra Bogatama with Application Program Based on c# Programming Language."

8. Plossl, G. W., & Orlicky, J. (1994). Orlicky's material requirements planning. McGraw-Hill Professional.

9. Gozali, L., Ariyanti, S., & Stevian, S. (2013). Usulan Perencanaan Kebutuhan Bahan Baku Centrifugal Pump di PT. Dimensi Utama Teknindo.

10. Gozali, L., & Ariyanti, S. (2013). Perencanaan Penjadwalan Produksi pada PT Harapan Widyatama Pertiwi untuk Produk Pipa PVC. Teknik dan Ilmu Komputer, 2(8).