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ANALYSIS OF RTRTO60K16 PKX YARN PRODUCTION PROCESS WITH OBJECTIVE MATRIX (OMAX) METHOD

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ABSTRACT

Productivity improvement research conducted at PT. XYZ with the core problem of minimizing waste and shortening lead time with the Objective Matrix (OMAX) method. The total percentage of product damage from January to October 2019 was 28.42% and the largest percentage of damage occurred in May amounting to 1009.26 bales of production and 33.89 bales of product damage with product damage percentage of 3.36%. The lowest damage occurred in March where the damage percentage was 2.74% with the number of products as much as 945.24 bales and damage struck as much as 25.88 bales. The results of the application using the objective matrix (OMAX) method are obtained that the selected productivity criteria include: Ratio 1 (Utility working hours), Ratio 2 (Electricity energy consumption), Ratio 3 (Labor utility), and Ratio 4 (Defective product) have a red value which means performance is still below standard performance and has not reached the target.

Keywords: Productivity; Waste; Omax.

1. INTRODUCTION

PT. XYZ is a company engaged in the manufacture of yarn and textiles. The majority of them produce yarns with different types and combinations of specifications. PT. XYZ performs production planning according to consumer demands, and consumers can choose the type of yarn they want. The production system is carried out by PT. XYZ is doing production when there are orders from consumers so it can be concluded that PT. XYZ uses a bespoke production system.

Product quality relates to good products and defective/damaged products. The number of products that are damaged must go through a repair process first so that it can affect the achievement of production targets [1]. Production targets can be achieved properly if productivity is increased and product quality is also always considered so as not to experience product defects [2].

Manufacturing companies are companies that require a process with the use of quite a lot of material and of course, this will result in the company having a lot of waste in the process. To increase productivity, companies must know activities that can increase the value-added of goods or services and eliminate waste. In line with the wishes of PT. XYZ to carry out sustainable development, it is necessary to develop gradually and continue to achieve the goals to be achieved. So that the company can compete abroad. Therefore, research is needed that can increase the value-added of goods or services, eliminate waste and shorten lead times

so that it has an impact on increasing company productivity.

Based on the background of the problem, the problem in this research can be formulated, the current condition of the production process of RTRTO60K16 47.2 PKX yarn and how to apply the application of the Objective Matrix (OMAX) Method at PT. XYZ to minimize waste.

Objective Matrix (OMAX) is a multi-criteria performance measurement method with performance indicators adjusted to the size of the organization. In addition, the Objective Matrix can combine several performance values from various performance indicators or criteria into a single performance value, so that the overall picture of higher education performance can be seen more clearly. By combining the key performance indicators of higher education and the Objective Matrix method, organizations will be better able to determine and manage performance by paying attention to the specified indicators and can improve the organizational decision-making process for a better one [3].

Objective Matrix combines productivity criteria into one integrated form and relates to each other. The advantages of the Objective Matrix method in measuring company productivity include being relatively simpler and more flexible, depending on the problem at hand, having clear and easy-to-understand productivity goals that will motivate workers to achieve them, various factors that influence productivity improvement can be identified by good and quantifiable, there is an understanding of weights that reflect the influence of each factor on increasing productivity, the determination of which requires management approval [4]. This model combines all the factors that influence the increase in productivity and is assessed in to one indicator or index. The form of this model is flexible, depending on the environment in which it is applied, in this case, it also means that the data needed in this model is easily obtained in the company environment where this model is used [5].

Nominal Group Technique (NGT) is one of the quality tools that are useful in making the best decisions, this method can be used for various things, from finding solutions to problems, to choosing new product development ideas. Thus, this priority issue will be followed up with an intervention plan.

METHODS

In processing this data, it consists of several stages, namely:

a. Grouping the Defective Products that occur in the RTRTO60K16 47.2 PKX yarn;
b. Making Fishbone from 3 (three) types of defects that often occur [6];
c. Performing 5W+1H Analysis [7];
d. Calculating the Ratio of Productivity Criteria [8];
e. Determining Targets and Weights [1];
f. Determining Standard Performance and Level Scale [9];
g. Calculating Performance Indicators [9];
h. Calculating the Productivity Index (IP) [10].

3. RESULT AND DISCUSSION

At this stage, a grouping of defective products that occur in the production process of RTRTO60K16 47.2 PKX yarn is carried out. The production data can be seen in Table 1.

Table 1. Yarn Production Data January – October 2019

No	Month	Quantity (bale)		
		Gross	Nett	Defect
1	January	1110,71	1082,14	28,57
2	February	1160,32	1131,55	28,77
3	March	945,24	919,36	25,88
4	April	956,88	926,65	30,23
5	May	1009,26	975,37	33,89
6	June	1031,51	1001,67	29,84
7	July	1113,36	1083,58	29,78
8	August	1018,39	987,26	31,13
9	September	1094,18	1066,5	27,68
10	October	1015,24	985,15	30,09
	Total	**10455,09**	**10159,23**	**295,86**

In producing RTRTO60K16 47.2 PKX yarn, of course, there will be some product defects that occur which will affect the results of the good product produced. Where some types of these defective products can be seen in Table 2 below.

Table 2. Data on Yarn Production Defects January – October 2019

No	Month	Number of defect	Jenis Cacat (bale)				
			No Tail	Amayori	roll	Neps	Big thread
1	Januari	28,57	6,08	7,15	4,44	5,20	5,70
2	Februari	28,77	6,78	7,24	3,98	5,55	5,25
3	Maret	25,88	5,15	6,96	2,88	5,68	5,21
4	April	30,23	7,09	6,81	5,81	5,03	5,49
5	Mei	33,89	6,68	7,24	6,21	6,97	6,79
6	Juni	29,84	6,01	6,74	5,24	6,37	5,48
7	Juli	29,78	6,31	6,21	5,86	5,82	5,58
8	Agustus	31,13	6,52	6,46	6,07	6,06	6,02
9	September	27,68	5,43	6,47	4,47	5,54	5,77
10	Oktober	30,09	6,21	6,18	5,81	5,99	5,90

From table 2, there are 5 (five) types of yarn defects RTRTO60K16 47.2 PKX which have been recorded by the company, including No Tail (no tail on the yarn), Amayori (weak TPI/weak yarn strength), Roll (no thread spool). good), Neps (not good thread connection) and Large thread (incorrect thread size).

In making the P control chart (P-Chart), it is necessary to know the percentage of product damage every month. Based on the calculation results, the percentage of defective products obtained at PT. XYZ in Table 3.

Table 3. Percentage of Defective Products (P-Chart)

No	Month	Production quantity (*bale*)	Number of defect (*bale*)	Proportion of defect	P	UCL	LCL
1	January	1110,71	28,57	0,0257	0,0149	0,0432	0,0134
2	February	1160,32	28,77	0,0248	0,0146	0,0429	0,0137
3	March	945,24	25,88	0,0274	0,0162	0,0445	0,0121
4	April	956,88	30,23	0,0316	0,0161	0,0444	0,0122
5	May	1009,26	33,89	0,0336	0,0157	0,0440	0,0126
6	June	1031,51	29,84	0,0289	0,0155	0,0438	0,0128
7	July	1113,36	29,78	0,0267	0,0149	0,0432	0,0140
8	August	1018,39	31,13	0,0306	0,0156	0,0439	0,0127
9	September	1094,18	27,68	0,0253	0,0150	0,0433	0,0133
10	October	1015,24	30,09	0,0296	0,0156	0,0439	0,0127
	Amount	**10455,09**	**295,86**	**0,2842**	**0,1541**	**0,4371**	**0,1295**
	Average	**1045,509**	**29,586**	**0,0284**	**0,0154**	**0,0437**	**0,0130**

Based on Table 3, the total percentage of product damage PT. XYZ from January to October 2019 is 28.42%. It is known that the largest percentage is in May. In May, total production was 1009.26 bales with 33.89 bales damaged with a percentage of 3.36%. The lowest damage was in March, with a damage percentage of 2.74% and the number of products 945.24 bales, and the damage was 25.88 bales.

Based on data on yarn defects that occurred in the production of RTRTO60K16 47.2 PKX yarn, PT. XYZ concludes several causes of yarn defects through a causal diagram, as shown in Figure 4 below.

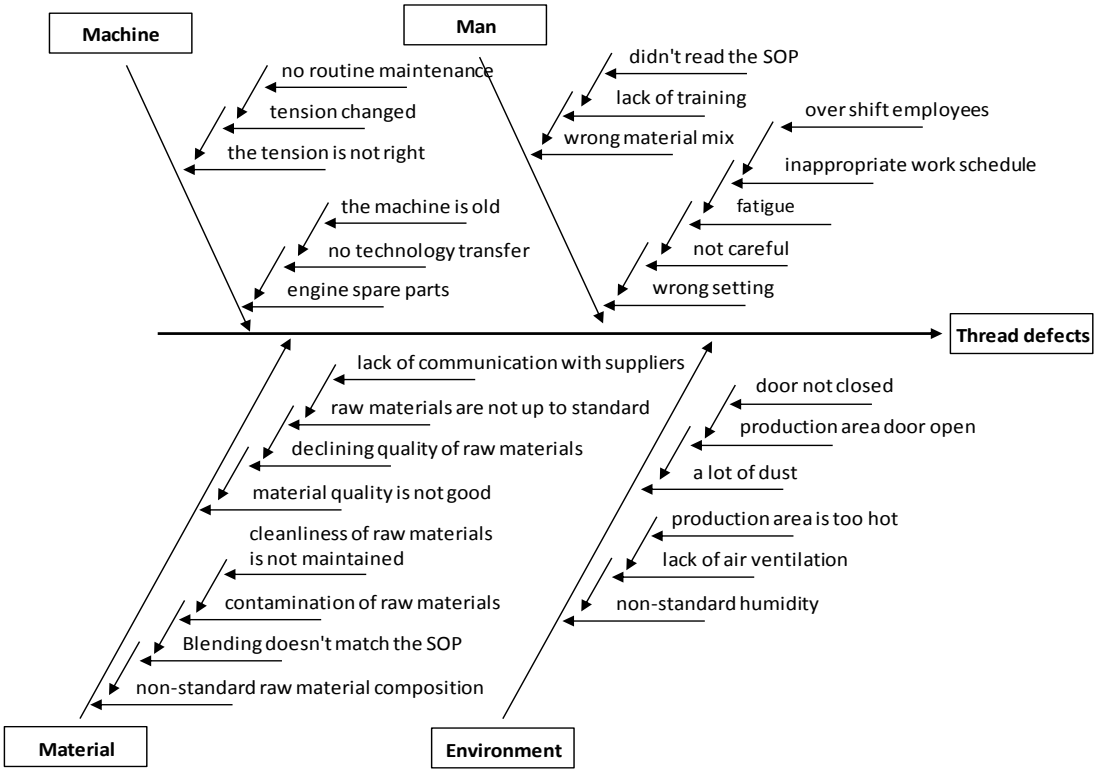

Figure 1. Fishbone Diagram of Thread Defect

Based on the various defects in the RTRTO60K16 47.2 PKX yarn (Prima Fithri, 2014) which have been explained using the Fishbone diagram above, calculations are also made using the Nominal Group Technique (NGT) as can be seen in Table 4 below.

Table 4. Calculation of Nominal Group Technique (NGT)

No	Cause	Assessment team					Score
		1	2	3	4	5	
1	Broken bolt	3	3	4	5	3	18
2	Spinning machine process is not optimal	2	1	2	1	2	8
3	Incorrect papercone installation	4	5	3	6	4	22
4	Lack of training	5	4	6	4	5	24
5	Broken machine spare parts	7	8	7	9	8	39
6	Shear tension during operation	9	7	8	7	9	40
7	Spindle stuck	8	9	9	8	7	41
8	Work fatigue	6	6	5	3	6	26
9	The cleanliness of the production area is not maintained	1	2	1	2	1	7
10	Wrong raw material composition	10	13	10	10	11	54
11	Can't make a tail on a thread	15	16	16	15	14	76
12	Not working according to SOP	11	11	11	13	10	56
13	Contamination in the raw material	13	14	12	11	12	62
14	Raw material quality is not good	14	12	13	12	13	64
15	Thread connection is not good	12	10	14	14	15	65
16	The machine is old/worn	16	15	15	16	16	78

resume:
NGT ≥ 1⁄2 N+1
NGT ≥ 1⁄2 (80)+1
NGT ≥ 40+1
NGT ≥ 41

Based on the results of the calculation of the causes of yarn defects RTRTO60K6 47.2 PKX

which has been calculated using the Nominal Group Technique (NGT) then is analyzed using 5W + 1H Analysis to describe more clearly what problems occur, what causes, why yarn defects occur, who is responsible for the problem. causes yarn defects, when yarn defects occur, in which department the yarn defects occur, and how to resolve defects that occur in RTRTO60K16 47.2 PKX yarn. as can be seen in Table 5.

Table 5. Proposed improvements to 5W + 1H

No	Cause	*Why*	*What*	*Where*	*When*	*Who*	*How*
1	Wrong setting	In order not to set the wrong	Employee training	*Back Spinning*	February 2020	*Maintenance*	Making training materials on how to set up the machine
2	Can't make a tail on a thread	In order to make a tail on the thread	Creating training materials	*Winding*	February 2020	Winding Employees	Making training materials on how to make a tail on a thread
3	Wrong mix of materials	So as not to say hello to mixing materials	Making SOP	*Mixing*	February 2020	Mixing employee	Make SOP for mixing raw materials
4	Machine is worn out	So that spare parts are maintained	Replace spare parts	*Back/Front Spinning*	March 2020	*Maintenance*	Create a maintenance schedule
5	Spindle problem	So that the spindle does not have problems	Machine check	*Winding*	March 2020	*Maintenance*	Create a maintenance schedule
6	Thread connection is visible	So that the thread connection is not visible	Machine check	*Winding*	April 2020	*Maintenance*	Create a maintenance schedule
7	Improper installation of tension	In order to install the right tension	Machine check	*Winding*	April 2020	*Maintenance*	Create a maintenance schedule
8	Raw material quality is not good	In order for quality raw materials	Quality check	*Warehouse & Mixing*	May 2020	Mixing employee	Perform periodic raw material control
9	Inadequate composition of raw materials	In order for the composition of raw materials to match	Raw material control	*Mixing*	May 2020	Mixing employee	Perform periodic raw material control
10	Dirty raw materials	To keep raw materials clean	Maintain cleanliness	*Mixing*	May 2020	Mixing employee	Perform 5S kontrol control

Productivity Criteria Ratio Calculation

The selected productivity criteria have 6 (six) criteria, namely: Working Hours Utility, Electrical Energy Consumption, Labor Utilities, Defective Product Ratio, Good Product Ratio, and Machine Damage Ratio. Table 6 below.

Table 6. Productivity Ratio

Month	Utility working hours (Cheese/hour)	Electrical energy consuption (Cheese/Kwh)	Labor utility (Cheese/ person)	Product defect (%)	Good product (%)	Machine breakdown (%)
January	25.39	0.0154	4.4968	0.0257	0.0264	0.11048
February	28.83	0.0154	4.6599	0.0248	0.0254	0.10766
March	21.61	0.0154	3.9716	0.0274	0.0282	0.22476
April	21.03	0.0154	4.0205	0.0316	0.0326	0.19780
May	23.07	0.0154	4.1194	0.0336	0.0347	0.10286
June	22.67	0.0154	4.2102	0.0289	0.0298	0.11172
July	31.81	0.0154	4.5075	0.0267	0.0275	0.10238
August	22.38	0.0154	4.1064	0.0306	0.0315	0.09524
September	25.01	0.0154	4.3767	0.0253	0.0260	0.09333
October	22.31	0.0154	4.1438	0.0296	0.0305	0.09341
Amount	**244.11**	**0.1538**	**42.6130**	**0.2842**	**0.2926**	**1.23964**
Average	**24.41**	**0.0154**	**4.2613**	**0.0284**	**0.0293**	**0.12396**
Max	**31.81**	**0.0154**	**4.6599**	**0.0336**	**0.0347**	**0.22476**
Min	**21.03**	**0.0154**	**3.9716**	**0.0248**	**0.0254**	**0.09333**

Performance Indicator Measurement

The measurement of performance indicators is the sum of the overall values of each criterion in the Objective Matrix Table which is equipped with level 3, level 10, and level 0 values and the level values between them and the weight value for each of the measured productivity criteria.

The measurement period carried out in this study was from January to October 2019. Measurement of performance indicators was carried out in February 2016 in the Yarn Production Section of RTRTO60K16 47.2 PKX, which can be seen in Table 7 Measurement of Performance Indicators.

Table 7. Measurement of Performance Indicators

Ratio 1	Ratio 2	Ratio 3	Ratio 4	Ratio 5	Ratio 6	
Utility working hours (Cheese/hour)	**Electrical energy consuption (Cheese/Kwh)**	**Labor utilitas (Cheese/ person)**	**Product defect (%)**	**Good Product (%)**	**Machine breakdown (%)**	***Productivity Criteria***
28,8278	**0,0154**	**4,6599**	**0,0248**	**0,0254**	**0,1077**	***Performance***
39,7628	**0,0208**	**6,0579**	**0,0168**	**0,0521**	**0,1124**	**10**
37,5697	0,0200	5,8012	0,0185	0,0489	0,1140	9
35,3765	0,0192	5,5446	0,0201	0,0456	0,1157	8
33,1833	0,0185	5,2879	0,0218	0,0423	0,1173	7
30,9901	0,0177	5,0313	0,0234	0,0391	0,1190	6
28,7969	0,0169	4,7746	0,0251	0,0358	0,1207	5
26,6038	0,0162	4,5180	0,0268	0,0325	0,1223	4
24,4106	**0,0154**	**4,2613**	**0,0284**	**0,0293**	**0,1240**	**3**
23,2838	0,0154	4,1647	0,0296	0,0280	0,1342	2
22,1571	0,0154	4,0682	0,0309	0,0267	0,1444	1
21,0303	**0,0154**	**3,9716**	**0,0248**	**0,0254**	**0,0933**	**0**
5	3	5	3	0	10	*Score*
17,86	16,07	17,86	17,86	17,86	12,50	*Weight (%)*

Ratio 1	Ratio 2	Ratio 3	Ratio 4	Ratio 5	Ratio 6	
Utility working hours (Cheese/hour)	**Electrical energy consuption (Cheese/Kwh)**	**Labor utilitas (Cheese/ person)**	**Product defect (%)**	**Good Product (%)**	**Machine breakdown (%)**	***Productivity Criteria***
89,29	48,21	89,29	53,57	0,00	125,00	*Value*
					Performance index	**405,36**

Improvement Analysis and Productivity Improvement

From the results of the analysis, the core of the problems that occurred on the production floor of PT. XYZ, recommends improvements based on the root cause. The results of improvement recommendations can be applied to the production floor of PT. XYZ can be seen in Table 8 Proposed Productivity Improvements.

Table 8. Proposed Productivity Improvement

No.	Root cause	Company condition	Recommendations for improvement	Person in charge
1	Production operator training	The implementation of training has been carried out for staff and supervisors, but it is not intensive	Intensive and periodic training for employees to improve skills	Head of HR departement
2	Work Scheduling Management	Production operator work shift scheduling is sometimes still unstable due to the influence of other operators (illness, permission, absence, etc.)	Make a work schedule according to the number of employees Prepare a backup operator schedule, in case the operator does not come to work	Head of Production
3	SOP installation is not good	SOP is not properly installed at the production operator and every Lot of yarn must be changed to a different SOP	Production process SOPs are installed near working operators operator Conduct production preparation briefings and final briefings to ensure the tidiness and cleanliness of the production floor in accordance with SOPs	Head of Back Spinning Department
4	Inspection Management	Inspection of the production process is carried out at the end of production, namely the Packing section, there is no inspection at every stage	Added a new SOP in the Inspection Section to check every process, from the initial production process to the final production process Make a checksheet for checking production conditions in each production section	Head of Quality Control

No.	Root cause	Company condition	Recommendations for improvement	Person in charge
5	Raw Material Management	It is not uncommon for the arrival of raw materials to experience delays and routine checks of raw materials are not carried out in the warehouse	Perform routine checks on raw materials in the warehouse and plan the ordering of raw materials appropriately so that there are no delays in raw materials	Head of Logistics Department
6	Regulations for the use of electrical energy	No rules for starting and stopping the engine	Turning off production machines that are not in use to reduce excessive electricity usage listrik	Head of Utility

4. CONCLUSION

Based on the results of research on the production process at PT. XYZ can get several conclusions as follows: The results of the production process total percentage of product damage from January to October 2019 was 28.42%. The largest percentage of damage occurred in May, the number of products produced was 1009.26 bales and product damage was 33.89 bales with the percentage of product damage was 3.36%. The lowest damage occurred in March where the percentage of damage was 2.74% with a total of 945.24 bales of product and 25.88 bales of damage. and analysis of defective products using a Cause and Effect diagram on RTRTO60K16 47.2 PKX yarn products, there are 3 (three) types of defects that dominate, including Amayori defect of 67.46 bales, No Tail defects of 62.26 bales, and Neps defects of 58.21 bales; The results of the application using the Objective Matrix (OMAX) method show that the selected productivity criteria include: Ratio 1 (Utilities working hours), Ratio 2 (Electrical energy consumption) and Ratio 3 (Utilities of labor) and Ratio 4 (Defective products) has a red value which means the performance is still below the standard performance and has not reached the target.

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REFERENCES

[1] L. A. Silalahi, Rispianda, and Yuniar, "Usulan Strategi Peningkatan Produktivitas Berdasarkan Hasil Analisis Pengukuran Objective Matrix (OMAX) pada Departemen Produksi Transformer(Studi Kasus di PT. XYZ)," *J. Online Inst. Teknol. Nas. Jur. Teh. Ind. No.03*, vol. 02, no. Peningkatan Produktivitas, pp. 84–95, 2014.

[2] D. Avianda, Y. Yuniati, and Yuniar, "Strategi Peningkatan Produktivitas di Lantai Produksi Menggunakan Metode Objective Matrix (OMAX)," *J. Online Inst. Teknol. Nas.*, vol. 01, no. 04, pp. 202–213, 2014.

[3] D. Surjasa, . A., and E. Irawati, "Pengukuran Kinerja Supply Chain Cv. X Berdasarkan Lima Proses Inti Model Supply Chain Operations Reference (Scor)," *J. Ilm. Tek. Ind.*, vol. 5, no. 1, pp. 28–35, 2018, doi: 10.24912/jitiuntar.v5i1.1774.

[4] P. P. Wardoyo and Y. Hadi, "Peningkatan Produktivitas Umkm Menggunakan Metode Objective Matrix," *J. Ilm. Tek. Ind.*, vol. 4, no. 1, pp. 1–8, 2017, doi: 10.24912/jitiuntar.v4i1.458.

[5] M. Bahrudin and H. C. Wahyuni, "Pengukuran Produktivitas Kerja Karyawan pada Bagian Produksi dengan Menggunakan Metode Objective Matrix (OMAX) Dan Root Cause Analyze (RCA)," *PROZIMA (Productivity, Optim. Manuf. Syst. Eng.*, vol. 1, no. 2, p. 116, 2018, doi: 10.21070/prozima.v1i2.1299.

[6] M. M. Ulkhaq, D. R. Rasyida, P. Studi, T. Industri, F. Teknologi, and U. Diponegoro, "Aplikasi Seven Tools Dan Analisis 5W + 1H Untuk Mengurangi Cacat Produk Galon : Studi Kasus Di Pt . Berlina , Tbk .," *Unisbank Semarang*, pp. 330–338, 2016.

[7] H. Kartika, "Analisis Pengendalian Kualitas Produk CPE Film Dengan Metode Statistical Process Control Pada Pt . MSI," *Ilm. Tek. Ind.*

Univ. Mercu Buana Jakarta, vol. 1, no. 1, pp. 50–58, 2013, [Online]. Available: digilib.mercubuana.ac.id.

[8] F. Agustina and N. A. Riana, "Analisis Produktivitas dengan Metode Objective Matrix (OMAX) di PT. X," *J. Tek. dan Manaj. Ind.*, vol. 6, no. 2, pp. 150–158, 2011.

[9] D. Wibisono, "Analisis Produktivitas Dengan Menggunakan Pendekatan Metode Objective Matrix (OMAX) Studi Kasus di PT. XYZ," *JOTI J. Optimasi Tek. Ind.*, vol. 1, no. 1, pp. 1–7, 2019, [Online]. Available: internal-pdf://0.0.0.208/3423.html.

[10] A. Mail, T. Alisyahbana, A. Saleh, R. Malik, and I. Ibrahim, "Analisis Produktivitas Dengan Metode Objektive Matrix (Omax) Pada Cv. Bintang Jaya," *J. Ind. Eng. Manag.*, vol. 3, no. 2, p. 48, 2018, doi: 10.33536/jiem.v3i2.234.