

## **Productivity Analysis Of Split Stone Production Using Objective Matrix (Omax) Method (A Case Study)**

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### **Abstract**

One of the building materials that has a high business prospect is split stone. Some building material management companies in one of their departments produce split stone, which in its production there are several types of products based on size to meet various consumer demands. In production, especially in the 2021 period, there will be fluctuating or uneven production levels, where in one month there will be high production, and in another period there will be a decrease in production. Based on this, this study aims to analyze the calculation of productivity to identify what factors cause the productivity of split stone production to fluctuate. This research was assisted by using the objective matrix (OMAX) and fault tree analysis (FTA) methods. the results of the productivity recapitulation found that the attendance data component obtained an average score of 2.3 which is the lowest average when compared to other components. therefore with these results, attendance is the strongest factor affecting fluctuating productivity.

**Keywords:** Objective Matrix (OMAX); Fault Tree Analysis (FTA); Fluctuative Production

### **INTRODUCTION**

One building materials business with good prospects is the split stone business. Split stone is a stone building material obtained by splitting or breaking large stones into small sizes. Split stone is also often referred to as split stone (Indriani et al, 2017).

Several natural stone management companies in one of their departments produce split stones. In their production, several types of products are based on size to meet various consumer demands. In production, especially in the 2021 period, there will be fluctuating or uneven production levels, where in one month there is a high production, and in another period there is a decrease in production.

A decrease in production can be caused by several factors, such as raw materials, operators, production machines, and others. This decline in productivity impacts the company's income which decreases and is also not balanced between periods due to fluctuating productivity. The occurrence of these fluctuations indicates the need for a productivity analysis with the help of the data contained in the company to identify what factors cause fluctuating productivity. Furthermore, after the cause is found, it is continued with suggestions regarding improvements that can be made by the company so that further improvements can be made. It is vital to carry out productivity measurements to see productivity measures that can determine whether the company meets productivity targets for production or not. (Irwansyah defy et al, 2022)

In processing and calculating this data using the Objective Matrix (OMAX), this method will help determine how the production level in a company is assisted by ratios or criteria that contain the main factors or components in the company's output. For example, in other studies that perform productivity analysis using the Objective Matrix method and can identify criteria that cause productivity declines (Andry et al, 2017). Another method, fault tree analysis (FTA), is used to see and analyze the causes of fluctuating productivity in production. Many things are factors that cause decreased productivity and failure, one of the things that most often is the human factor (Boryczko et al, 2022).

**LITERATURE REVIEW**

**Productivity**

Productivity is defined as the level of efficiency in producing goods or services: Productivity expresses how to utilize resources in making goods properly. (Haslindah et al, 2021). The word productivity will always be associated with the quantity on the input or input and output or output used in a production process, either services or goods. Productivity focuses on how efficiently and effectively the goods or services that have been produced and the costs that will be incurred as a result of a production process. (Mukti et al, 2021)

Definition productivity can vary depending on what context talked about. There are basically three types productivity, total Productivity (multi-factor productivity), partial productivity (single factor productivity), and total factor productivity. (Mail et al, 2018)

Manufacturers aim to meet customer satisfaction, which can be achieved by providing quality products on time at a reasonable cost, where productivity is essential to fulfilling this. (Atul & Pankaj, 2020)

**Objective Matrix Methode**

The Objective Matrix (OMAX) method is a productivity measurement method that, in its implementation, is useful for monitoring the level of productivity in each department in the company by using productivity criteria that follow the existence of that department (objective). The concept of this measurement is to combine several workgroup performance criteria into a matrix. (F. Tania & Ulkhaq, 2016). Omax is a partial productivity measurement system developed to monitor productivity in each part company with the criteria of productivity in accordance with the existence of a part of the (objective). The concept of this measurement, namely the incorporation of several working groups of the performance criteria into a matrix. (Yosan et al, 2016)

In this OMAX method, the steps must be taken to determine the criteria, calculate the ratio, calculate the interpolation of matrix values, set targets, assess weight ratios, and form a matrix using the Omax model. After calculating with Omax, a productivity change index will be obtained, which will then be evaluated for productivity and proposed plans for the future.. (Agustina & Nina, 2016).

There are advantages of applying the Objective Matrix (OMAX) method for measuring productivity levels in a department in the company, which are as follows. (Agustina & Nina, 2016):

1. The use and processing of data using the OMAX method is relatively more straightforward and also easier to understand
2. Besides being simple, the OMAX method is easy to implement and does not require special skills..
3. The use of data in this method is easy to find in the processing, namely data that is easily obtained at the company.
4. More flexible, depending on the problem at hand.

**METHODS**

This research was conducted for one month in one of the split stone industrial companies, namely PT. Lisna Jaya Utama. This research was carried out with the object of split stone production data for one year, namely split stone production in 2021. Data processing was assisted using the Objective Matrix method.

The level of productivity with the help of the OMAX method uses eight criteria or ratios, in which ratio data is obtained using company data from the field directly. The data set will be made into a matrix by going through several stages of data processing, namely the ranking of the weight values, the calculation of the upper and lower intervals, and the classification of types per value (bad, good enough, good) showed in table 1

**Table 1. Component Data**

Years	A	B	C	D	E	F	G	H	I	J	K
2021	Jan	1575	2350	204,8	8	7	200	14	105	2	9,1
2021	Feb	932	2066	93,2	8	9	184	12	62,1	3,5	10,5
2021	March	1054	2526	84,3	8	8	208	10	70,3	3	9,2
2021	April	1056	2185	84,5	8	12	200	11	70,4	1,5	12,7
2021	May	655	1831	39,3	8	15	176	6	43,7	2	13,6
2021	June	1680	1998	0	8	9	200	8	112	0	11,2
2021	July	1705	2016	34,1	8	8	208	13	113,7	4	17,3
2021	August	1917	2309	38,3	8	6	192	9	127,8	2	18,5

Years	A	B	C	D	E	F	G	H	I	J	K
2021	September	1172	1538	58,6	8	8	208	12	78,1	1,5	16,1
2021	October	1596	1599	79,8	8	7	200	10	106,4	1	12,3
2021	November	1323	1394	198,4	8	7	208	12	88,2	2,5	15,1
2021	Desember	837	792	125,6	8	8	208	8	55,8	3	16,7

Descriptions:

A = Periode (mons) (ton)

B = Split Stone Poductions (ton)

C = Raw Material (ton)

D = Losses (ton)

E = Labours

F = Attendance

G = Normal woring hour (hour)

H = Overtime (hour)

I = Normal machine working time (hour)

J = Breakdown machine time (hour)

K = Electrical energy (kWh)

## RESULT AND DISCUSSION

### Rank values

The weight here is defined as the level of importance of a criterion set in percent, where the result of the overall weight of the standards is 100%. Determination of the weight show in table 2, here was obtained from interviews with the production department. The provision of each weight is given to each criterion or ratio previously determined, where in this study, eight ratios were determined with each weight being different from one another (Andry et al, 2017).

Table 2. Ratio

No	Criteria	(%)
1	$\frac{\Sigma \text{ Split Stone Procution}}{\Sigma \text{ Energy Consumption}}$	10
2	$\frac{\Sigma \text{ Split Stone Procution}}{\Sigma \text{ Labours}}$	12,5
3	$\frac{\Sigma \text{ Split Stone Procution}}{\Sigma \text{ Raw Material}}$	20
4	$\frac{\Sigma \text{ Split Stone Procution}}{\Sigma \text{ Working Hour}}$	15
5	$\frac{\Sigma \text{ losses}}{\Sigma \text{ Split Stone Procution}}$	15
6	$\frac{\Sigma \text{ Attendance}}{\Sigma \text{ Labours}}$	12,5
7	$\frac{\Sigma \text{ Breakdown machine time}}{\Sigma \text{ Normal machine working}}$	10
8	$\frac{\Sigma \text{ Overtime}}{\Sigma \text{ Working hour}}$	5

Then calculated for each ratio was based on the company's component data. The results of the calculation of the ratio in each month are presented in table 3 below:

**Table 3. Whole Period Ratio Value**

Years	Periode	Ratio K1 (%)	Ratio K2 (%)	Ratio K3 (%)	Ratio K4 (%)	Ratio K5 (%)	Ratio K6 (%)	Ratio K7 (%)	Ratio K8 (%)
2021	Jan	173,077	196,88	67,02	7,875	13	87,5	1,905	7,000
2021	Feb	88,762	116,50	45,11	5,065	10	112,5	5,633	6,522
2021	March	114,565	131,75	41,73	5,067	8	100	4,269	4,808
2021	April	83,150	132	48,33	5,280	8	150	2,131	5,500
2021	May	48,162	81,88	35,77	3,722	6	187,5	4,580	3,409
2021	June	150	210	84,08	8,400	0	112,5	0	4,000
2021	July	98,555	213,13	84,57	8,197	2	100	3,519	6,250
2021	August	103,622	239,63	83,02	9,984	2	75	1,565	4,688
2021	September	72,795	146,50	76,20	5,635	5	100	1,920	5,769
2021	October	129,756	199,50	99,81	7,980	5	87,5	0,940	5,000
2021	November	87,616	165,38	94,91	6,361	15	87,5	2,834	5,769
2021	Desember	50,120	104,63	105,68	4,024	15	100	5,376	3,846

**Upper and lower interval calculation**

The upper interval and the lower gap are searched by calculating the average standard value, target value, and worst ratio value. The results of these calculations will later be used to fill in the body of the matrix in the Objective Matrix (OMAX) method. The worst ratio value will be used as the 0-level value for the related ratio component. Then the average standard value will be used as a level 3 value for the related ratio components. Finally, the target value is used as the value at level 10 in the corresponding ratio component.

a. Target Ratio

$$\begin{aligned}
 & (\text{ratio max value } n \times \text{company target}) + \text{ratio max value } n \\
 & \text{Example in ratio K1} \\
 & = (173,077 \times 15\%) + 173,077 \\
 & = 25,962 + 173,077 \\
 & = 199,04
 \end{aligned}$$

b. Leveling up 1-3

$$\begin{aligned}
 & = \frac{(\text{level 3} - \text{level 0})}{3 - 0} \\
 & \text{Example in ratio K1} \\
 & = \frac{(100,01 - 48,16)}{3 - 0} \\
 & = \frac{51,85}{3} \\
 & = 17,28
 \end{aligned}$$

c. Leveling up 3-10

$$= \frac{(\text{level } 10 - \text{level } 3)}{10 - 3}$$

Example in ratio K1

$$= \frac{(199,04 - 100,01)}{10 - 3}$$

$$= \frac{99,03}{7}$$

$$= 14,146$$

For the overall calculation results are shown in table 4 below:

**Table 4. Overall Component Value Ratio**

Ratio K1	Ratio K2	Ratio K3	Ratio K4	Ratio K5	Ratio K6	Ratio K7	Ratio K8	Rank
199,04	275,57	121,53	11,48	17,26	215,63	6,48	8,05	10
184,89	259,27	114,48	10,77	15,85	200,30	5,97	7,64	9
170,75	242,97	107,43	10,05	14,45	184,97	5,45	7,24	8
156,60	226,67	100,39	9,33	13,04	169,64	4,94	6,83	7
142,45	210,37	93,34	8,62	11,63	154,32	4,43	6,43	6
128,31	194,08	86,29	7,90	10,23	138,99	3,91	6,02	5
114,16	177,78	79,24	7,18	8,82	123,66	3,40	5,62	4
100,01	161,48	72,19	6,47	7,42	108,33	2,89	5,21	3
82,73	134,94	60,05	5,55	4,94	97,22222	1,93	4,61	2
65,44	108,41	47,91	4,64	2,47	86,11111	0,96	4,01	1
48,16	81,88	35,77	3,72	0	75	0	3,41	0

Then an analysis of the calculation of each ratio for the entire period is carried out, where the value of the ratio in each period is substituted for the component value of the overall ratio to determine the classification of the value of each component in each period. For example, it can be seen in the analysis of the January period in table 5 below.:

**Table 5. January Period Ratio Value Analysis**

January									
Ratio K1	Ratio K2	Ratio K3	Ratio K4	Ratio K5	Ratio K6	Ratio K7	Ratio K8		
173,08	196,88	67,02	7,88	13,00	87,50	1,90	7,00	Performance	Description
199,04	275,57	121,53	11,48	17,26	215,63	6,48	8,05	10	
184,89	259,27	114,48	10,77	15,85	200,30	5,97	7,64	9	
170,75	242,97	107,43	10,05	14,45	184,97	5,45	7,24	8	Good
156,60	226,67	100,39	9,33	13,04	169,64	4,94	6,83	7	
142,45	210,37	93,34	8,62	11,63	154,32	4,43	6,43	6	
128,31	194,08	86,29	7,90	10,23	138,99	3,91	6,02	5	
114,16	177,78	79,24	7,18	8,82	123,66	3,40	5,62	4	Good Enough
100,01	161,48	72,19	6,47	7,42	108,33	2,89	5,21	3	
82,73	134,94	60,05	5,55	4,94	97,22	1,93	4,61	2	Bad
65,44	108,41	47,91	4,64	2,47	86,11	0,96	4,01	1	

January								
Ratio K1	Ratio K2	Ratio K3	Ratio K4	Ratio K5	Ratio K6	Ratio K7	Ratio K8	
173,08	196,88	67,02	7,88	13,00	87,50	1,90	7,00	Performance
48,16	81,88	35,77	3,72	0	75	0	3,41	Description
8	5	3	5	7	1	2	7	Scor
10	12,5	20	15	15	12,5	10	5	Wight
80	62,5	60	75	105	12,5	20	35	Value
450								INDEKS

In the table 5, it can be seen that the K1 ratio is included in the performance of 8, which indicates the K1 ratio is good, then the K2 ratio is considered quite good with performance 3, and for the ratio K6, it goes into bad with performance 1. Then the results of the analysis in other periods it is shown in table 6 below:

**Table 6. The Result of the Overall Period Ratio Calculation Analysis**

Ratio / Periode	R1 (Energy Consumption)	R2 (Labours)	R3 (Raw Material)	R4 (Working Hours)	R5 (Oil Losses)	R6 (Attendance)	R7 (Machine Productivity)	R8 (overtime)
Jan	8	5	3	5	7	1	2	7
Feb	2	1	1	1	5	3	8	6
March	4	2	1	1	3	2	6	2
April	2	2	1	2	3	6	2	4
May	0	0	0	0	3	8	6	0
June	7	6	5	6	0	3	0	1
July	3	6	5	5	1	2	4	6
August	3	8	5	8	1	0	6	2
September	1	2	4	2	2	2	2	4
October	5	5	7	5	2	1	1	3
November	2	3	6	3	8	0	3	4
Desember	0	1	8	0	8	2	8	1
Jumlah	37	41	46	38	43	30	48	40
Rata-Rata	3,1	3,4	3,8	3,2	3,6	2,5	4,0	3,3

These results have been classified based on the performance of each ratio in each period. For the description of the red color itself is a ratio with poor performance, then for the green color is a ratio with quite good performance, and for the yellow color is a ratio with good performance. Then after the overall results are obtained, the average is carried out for each ratio. The table shows that the K6 ratio (attendance) gets an average value of 2.5 or the lowest when compared to the average value in other ratios, and the K7 ratio (engine performance) it gets an average value of 4 or an average value. Highest compared to the different average ratios.

The results of data analysis using the OMAX method obtained performance indicator values. The following shows the performance indicator values with the graph in Figure 1 per month period.



Figure 1. Whole Period Performance Indicator

From the table of performance indicators, it can be seen that the company's productivity level of split stone production is still not stable. The graph shows the periods of February, March, April, and May, which experienced a significant decline from January. Then from June to August, there was a substantial increase in productivity after a decline until May. Then in September there was a decline again followed by the rise in October.

In response to this, a corrective step was taken using fault tree analysis (FTA). In the fault tree analysis, improvements were made to the leading cause of productivity instability in the production. Located in the recapitulation of scores in each ratio, ratio six, or the ratio regarding absenteeism, appears to have the lowest average score (2.5) compared to the score obtained in other ratios. Then the criteria or ratios that are less productive are then analyzed using the fault tree analysis method, can seed in figure 2.

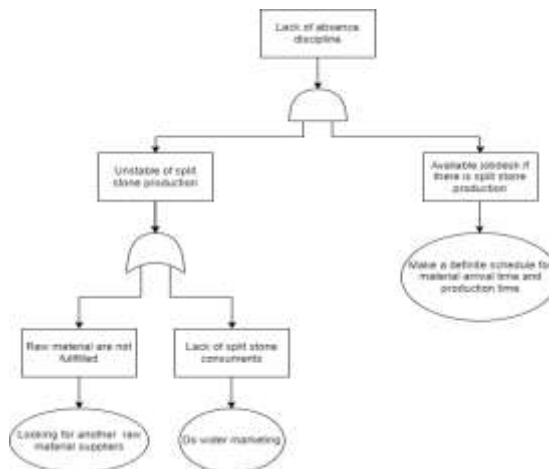


Figure 2. Fault Tree Analysis Factor Ratio Unproductive

## CONCLUSION

The following conclusions are obtained from the results of processing company data using the help of Objective Matrix (OMAX) and the Fault Tree Analysis method.:

1. In the company's productivity, there was a significant decline in productivity in February, March, April, May, and also September. Where this can be seen in the productivity index, it can be seen that in February, there was a decline of up to -3.3%, then March -20%, April -15%, May -13.7%, and September -20%. The calculation of performance indicators in January produced the highest performance indicator with a score of 450, for the lowest performance indicator result was in May with a score of 205 points.
2. Referring to the results of the scores of each ratio in each month, in the recapitulation of productivity, all ratios are above the standard (3) except for the ratio 6 or absenteeism criteria. For this ratio, 6 has average productivity for each period of 2.5 or still below the standard, namely 3, so the attendance component is the main factor in the decline in productivity.
3. To overcome the fluctuating productivity, problem-solving can be done with the help of Fault Tree Analysis on the main factor in the form of absenteeism components. Namely, it can be in the procurement of a definite schedule regarding the time of material arrival and production time.

## SUGGESTIONS

Suggestions that can be given based on the results of data calculations using the help of the Objective Matrix (OMAX) method and also Fault Tree Analysis are as follows:

1. In the primary production, there is fluctuating productivity of split stone production, based on this, it is advisable to look for suppliers of spare raw materials. This is intended so that consumer demand can be overcome so that productivity tends to be stable.
2. Setting sales targets and socializing so that production has a sales benchmark. In addition, with the existence of this target, it can create a motivation for employees to cover the predetermined target.
3. Then for ratios that do not meet the standards, namely the attendance criteria, a strict rule or regulation can be held regarding the discipline of employee arrivals. Hold a definite schedule regarding material arrival time and production time.

## REFERENCE

- Andry Andoko Sirait, Rommel, Noveicalistus H.Djanggu, dan Dedi Wijayanto. 2017. Pengukuran dan Evaluasi Produktivitas Lini Produksi Menggunakan Metode Objective Matrix dan Fault Tree Analysis. Fakultas Teknik Universitas Tanjungpura: Pontianak.
- Haslindah, Andi, Andrie, Abdul Rahmad Wahyudi, Muhammad Taslim Zakaria. 2021. Analisis Dampak Produktivitas di Masa New Normal Pada Kawasan Industri Makassar Dengan Metode Omax. *Jurnal Teknik Industri*, 16(01),1-5.
- Agustina, Fitri, dan Nina Aris Riana. 2016. Analisis Produktivitas dengan Metode Objective Matrix (OMAX) di PT. X. *Jurnal Teknik dan Manajemen Industri*, 6(2), 150-158.
- Mukti, Ajeng Risky, Qurotul A'yun, Suparto. 2021. Analisis Produktivitas Menggunakan Metode Objective Matrix (OMAX) (Studi Kasus: Departemen Produksi PT Elang Jagad). *Jurnal Teknologi dan Manajemen*, 2(1), 13-18.
- Mail, Abdul, Takdir Alisyahbana, Anis Saleh, Rahmania Malik, Ibrahim. 2018. Analisis Produktivitas Dengan Metode Objektive Matrix (Omax) Pada Cv. Bintang Jaya. *Journal of Industrial Engineering Management*, 3(2), 93-100.
- Yosan, R Bagus, Kholil Muhammad, Winny Soraya. 2016. Increasing Productivity With Objective Matrix Method Case Study On Building Maintenance Management Pio Pt. Xxx. *International Seminar on Industrial Engineering and Management*.
- Irwansyah, Defi, Cut Ita Erliana, Fadlisyah, Mutamminul Ula, Mahlil Fahrozi. 2022. Increasing Productivity In CPO Production Using The Objective Matrix (OMAX) Method. *International Journal of Engineering, Science & InformationTechnology*, 2(2), 14-20.
- Indriani, Andi Marini, Agus Sugianto, Faisal. 2017. Analisis Penggunaan Batu Split Long Ikis Terhadap Karakteristik Campuran AC-WC (Asphalt Concrete- Wearing Course). *Jurnal Teknologi Terpadu*, 2(3), 87-92.
- Boryczko, K.; Szapak, D.; Żywiec, J.; Tchórzewska-Cieślak, B. The Use of a Fault Tree Analysis (FTA) in the Operator Reliability Assessment of the Critical Infrastructure on the Example of Water Supply System. *Energies* 2022, 15, 4416. <https://doi.org/10.3390/en15124416>
- Atul Palange, Pankaj Dhatrak, Lean manufacturing a vital tool to enhance productivity in manufacturing, *Materials Today: Proceedings*, Volume 46, Part 1, 2021, Pages 729-736, ISSN 2214-7853, <https://doi.org/10.1016/j.matpr.2020.12.193>.
- F. Tania, and M. Ulkhaq, "PENGUKURAN DAN ANALISIS PRODUKTIVITAS DI PT. TIGA MANUNGGAL SYNTHETIC INDUSTRIES DENGAN MENGGUNAKAN METODE OBJECTIVE MATRIX (OMAX)," *Industrial Engineering Online Journal*, vol. 5, no. 4, Nov. 2016.