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PRODUCTIVITY MEASUREMENT OF SHOES PRODUCTION USING OBJECTIVE MATRIX METHOD

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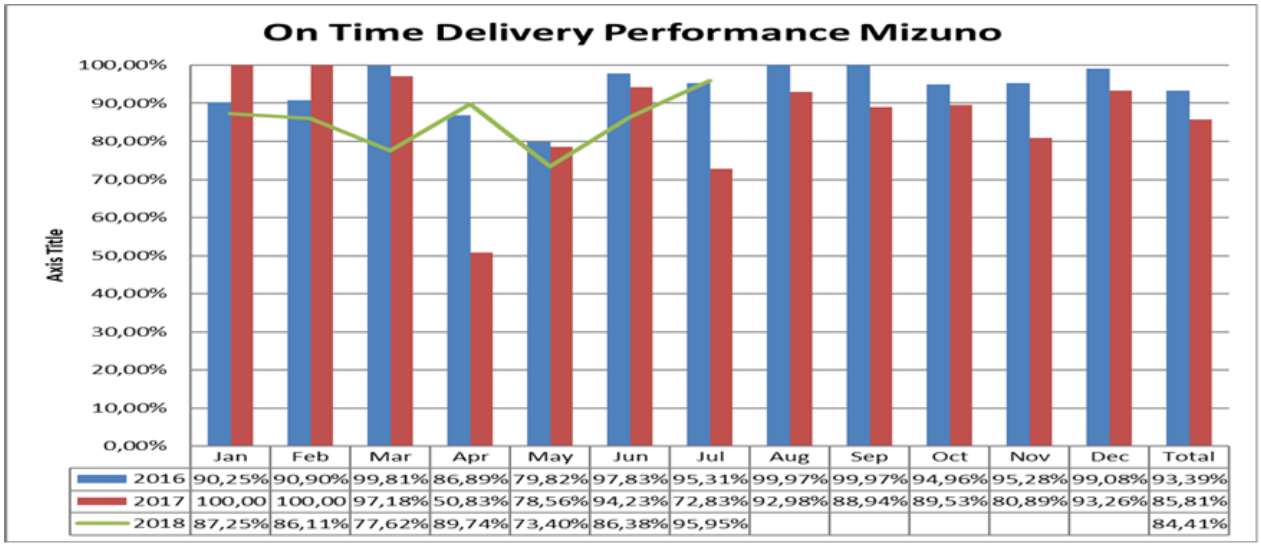
Abstract *– PT XYZ is the shoes manufacturer in Tangerang that produces Mizuno and Specs brand. Many competitors in the shoes industry enforce the company to improve all aspects; one of them is to improve the problem of low productivity achievement in Mizuno production line. This study aims to know the productivity measurement method by using Objective matrix, and to do an analysis of productivity criteria that dominantly contribute to the low productivity in the Mizuno production line. This research method was using Objective Matrix (OMAX), Pareto diagram, Fishbone diagram, and 5W1H. Base on the result, it was identified that the highest productivity performance indicator happened in August 2018 and the lowest productivity performance indicator happened in March 2018. While for productivity index, the lowest productivity index happened in March 2018 and the highest productivity index was happened in April 2018. Criteria that dominantly contributed to the decreased productivity in the Mizuno production line was on criteria 1 (utilization of material usage), criteria 6 (number of loss output/downtime), and criteria 2 (labor utilization), therefore the focus for improvement in this research was to prioritize these criteria to gain increased productivity in Mizuno production line.*

Keywords: *productivity; objective matrix; pareto; fishbone; 5W1H*

INTRODUCTION

The Shoes Industry in Indonesia that produce sports shoes based on customer orders (make to order base) both from local and overseas buyers. The sports shoe products produced by PT XYZ currently are Mizuno and Specs brand. Quite many competitors who produce Mizuno and Specs brand force PT XYZ to continue improving all aspects both from external and internal. Moreover, the demand from Mizuno is very high on the quality of the product, so it should be the main concern of all involved departments, begin from inputs, processes, and outputs. This became one of the factors that affected the productivity rate to decline in the Mizuno production line, thus contributing to the high delay of shoe exports to Mizuno customers.

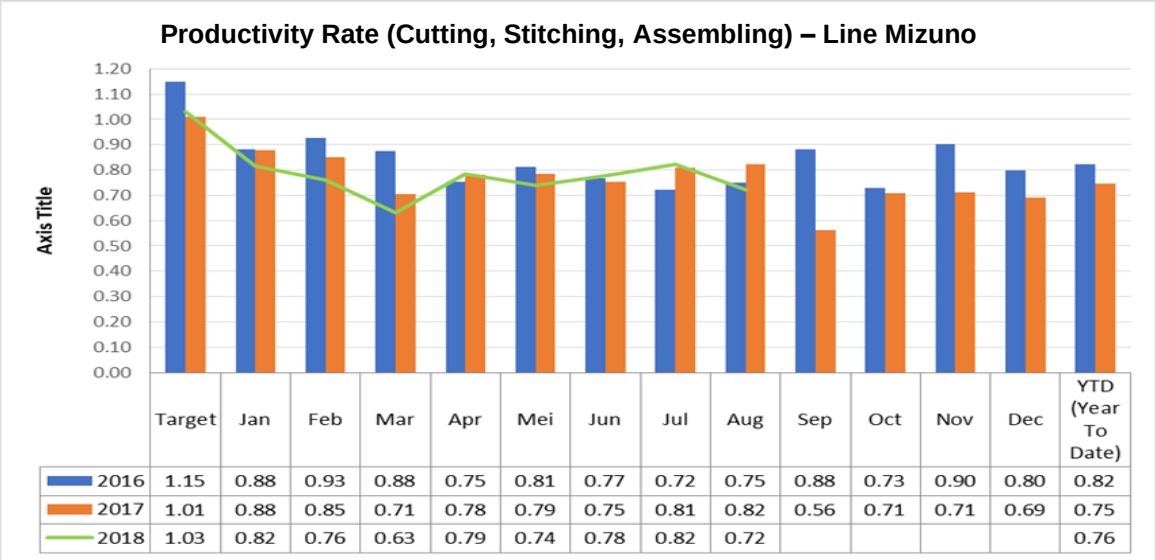


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2016	90,25%	90,90%	99,81%	86,89%	79,82%	97,83%	95,31%	99,97%	99,97%	94,96%	95,28%	99,08%	93,39%
2017	100,00	100,00	97,18%	50,83%	78,56%	94,23%	72,83%	92,98%	88,94%	89,53%	80,89%	93,26%	85,81%
2018	87,25%	86,11%	77,62%	89,74%	73,40%	86,38%	95,95%						84,41%

Figure 1. on Time Delivery Performance Mizuno
Source: internal report of PT XYZ (2016-August 2018)

The consequences of the delayed exports that occurred from 2016 to August 2018, the company was penalized by Mizuno customers by shipping the orders by air prepaid (cost borne by the company) which had cost more than 4 billion during that time. Also, the company got a penalty from customers by getting cut off an order from Mizuno, which is a cancellation order that couldn't be shipped on time, which resulted to the loss of sales revenue of more than 1 billion rupiahs during that time.

Currently production department in PT XYZ has only been doing calculations of productivity from the labor aspect only (labor productivity), without looking at other input factors. During the 3years from 2016 to August 2018, the Mizuno production line never reached the productivity targets set by the company, and even continued to show a decline trend in the year 2018 when compared to the achievement of Productivity in the years 2016 and 2017.



	Target	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD (Year To Date)
2016	1.15	0.88	0.93	0.88	0.75	0.81	0.77	0.72	0.75	0.88	0.73	0.90	0.80	0.82
2017	1.01	0.88	0.85	0.71	0.78	0.79	0.75	0.81	0.82	0.56	0.71	0.71	0.69	0.75
2018	1.03	0.82	0.76	0.63	0.79	0.74	0.78	0.82	0.72					0.76

Figure 2. Productivity Rate
Source: internal report (2016-August 2018)

By looking at the performance result of productivity rate at PT XYZ which tends to be declining from year on year, and loses are derived from performance efficiency (Nusraningrum & Setyaningrum, 2019). Therefore, the company must immediately review the productivity measurement methods that have been carried out with a more scientific and tested approach of productivity measurement system so that it can monitor and evaluate productivity rate in production department as a whole, or in each sub production department such as cutting, sewing, or assembling department. However, each measurement technique has weaknesses and strengths, so no technique has perfect approach to evaluate the performance (Nusraningrum, 2017).

LITERATURE REVIEW

Productivity

According to Fahmi (2012:80), productivity is the business ability to produce a product over a specified period (quarterly, semester or yearly). In the Operation Management book (Heizer, 2010), productivity is the relationship between inputs and outputs in a production system. Productivity is simply defined as a ratio comparison between outputs and inputs, with the formula: productivity = Output/Input. It can be concluded that productivity is a comparison between the results achieved (output) with the overall resources used (inputs) and productivity should be able to meet the element's effectiveness, efficiency, and quality.

Objective Matrix

Objective Matrix (OMAX) is a partial productivity measurement system developed to monitor productivity in a company or any part with productivity criteria according to the existence of the section (Supriadi, et. al. 2017). This Model was created by Prof. James L. Riggs, a productivity expert from the

United States in the year 1983. Measurement of productivity by using the OMAX model is essentially a combination of some measure of success or productivity criteria that have been weighted according to the degree of importance of each criteria within the company. Thus this model can be used to identify factors that are very influencing and that have less influencing effect.

Pareto Diagram

Vilfredo Federico Damaso Pareto, an economist and sociologist from France, was the one who brought the concept of Pareto efficiency, which Pareto law stating that 80% of the impact were originated or generated by 20% of the cause. Or it can also be translated with 80% of the business result is the impact of 20% of productive and optimal efforts. In a negative point of view, Pareto law can also contain meaning that 80% of failures are the responsibility of 20% of causes, or 80% of defective products are caused by 20% of the overall production factor (Tannady, 2015). Pareto then developed a diagram to map out the causal factors of a problem, then the problem solving should focus on or prioritize 80% of the majority/dominant cause. The benefit of using a Pareto Diagram is to figure out a statistical overview of the cause of the problem that is the initial focus to solve (Rahmatullah, et. al., 2017).

Fishbone Diagram

The Fishbone diagram or known as the Cause Effect diagram was presented first time by Prof Dr. Kaoru Ishikawa, a chemical engineering engineer from Japan. Another name of the Cause Effect Diagram is a fish bone diagram (Fishbone diagram) or Ishikawa Diagram. This Diagram resembles fish bones. In general, the Cause Effect Diagram is a graphical representation that displays data on the causal factor of failure or discrepancy to analyze to the least sub of the problem-causing factor (Tanady, 2015).

5W1H

5W1H is basically a method used to conduct investigations and research on problems occurring in the production process (Rahmatullah, et. al., 2017). 5W1H stands for What (what is the main target for improvement), Where (where the plan will be implemented), When (when this action will be implemented), Why (why is the action plan required), Who (who will work on the activity of the plan), and how (how to work on the plan) to the productivity increment.

METHODS

The methods of data analysis used in this research are:

1. Objective Matrix Method (OMAX)

   The method of data analysis using Objective Matrix model are as follows:

   1) Determination of criteria. In this stage will be determined the criteria's that will be used to calculate productivity by using OMAX method, which include productivity efficiency, effectiveness and inferential. 7 criteria's were determined based on interview with Production Deputy Director in PT XYZ, they are utility of material consumption, utility of labor, accuracy of production planning, defect product, number of shoes being repaired, number of loss output (downtime), and number of overtime hours.
   2) Calculation of ratio. In this stage, ratio calculation is used towards the set criteria, based on the formula below:
      a) Efficiency Criteria, shows how the resources is used or utilized. Those categorized in the efficiency criteria are as follows:

$$\text{Criteria 1 Utility of Material Consumption} = \frac{\text{Material consumption}}{\text{Inspected quantity}}$$

$$\text{Criteria 2 Utility of Labor} = \frac{\text{Produced quantity}}{\text{(Normal working hours + overtime hours)}} \times 100\%$$

      b) Effectiveness Criteria, shows how the industry achieves results when viewed from the timeliness of production. Those categorized in the effectiveness criteria are as follows:

$$\text{Criteria 3 Accuracy of Production Planning} = \frac{\text{Produced quantity}}{\text{Production planning quantity}} \times 100\%$$

$$\text{Criteria 4 Defect Product} = \frac{\text{C-grade shoes and upper}}{\text{Produced quantity}} \times 100\%$$

$$\text{Criteria 5 Number of shoes being repaired} = \frac{\text{Repaired shoes quantity}}{\text{Inspected quantity}} \times 100\%$$

$$\text{Criteria 6 Number of Loss Output (down time)} = \frac{\text{Loss output quantity}}{\text{Production planning quantity}} \times 100\%$$

c) Inferential Criteria, shows factors that do not directly affect productivity but if included into the matrix can help to take into account variables that affect other factors. Those categorized in the inferential criteria are as follows:

$$\text{Criteria 7 Number of Overtime Hours} = \frac{\text{Overtime hours}}{\text{Normal working hours}}$$

3) Calculation of Current performance, is the real score of productivity based on measurements over a set period. As for the steps that must be taken are:
   a) Standard performance measurement: obtained from the average ratio of each criteria at the specified period.
   b) Goal target determination: Determined based on company KPI as well as interview results with the Deputy Production Director.
   c) Formation of target matrix: Begins with specifying the level 0 score (from the company's lowest score during measured period), level 10 score (from the company's highest target) and level 3 score (obtained from the average score of each ratio performance that is taken and made into performance standard). The items at level 1,2, 4 to 9 are the intermediate level of achievement so that the target or score 10 can be achieved. The scale determination of level 1-2 and level 4-9 is done by using interpolation, with formulation as follows:

$$\text{For scale level 1-2} = \frac{\text{Level 3 - Level 0}}{3 - 0}$$

$$\text{For scale level 4-9} = \frac{\text{Level 10 - Level 3}}{10 - 3}$$

Herewith is the calculation of level 1 and level 2 for each criteria:
Level 1 = Level 0 + (interpolation standard level 1-2)
Level 2 = Level 1 + (interpolation standard level 1-2)
And herewith is the calculation of level 4 to level 9 for each criteria:
Level 4 = Level 3 + (interpolation standard level 4-9)
Level 5 = Level 4 + (interpolation standard level 4-9)
Level 6 = Level 5 + (interpolation standard level 4-9)
Level 7 = Level 6 + (interpolation standard level 4-9)
Level 8 = Level 7 + (interpolation standard level 4-9)
Level 9 = Level 8 + (interpolation standard level 4-9)

   d) Determination of Actual Scoring: Determined by the result of ratio measurement of each criterion at the specified period that is changed into the score of the corresponding target matrix.

e) Determination of Actual Value: Determined based on multiplication result between the actual score and the weighted criteria. The weighted criteria is obtained from the result of questionnaire.
f) Determination of Performance Indicator: Obtained from the sum of actual values of all measurement criteria performed.

4) The final step is measuring the productivity index. The productivity index measurement can be done when the entire matrix in the OMAX model has been fully filled, which is the ratio calculation has been done as well as the target and the weight has been determined and the current performance indicator value has been calculated. The end result of a matrix is the value of the productivity index with the interpretation that the larger the index value at a certain period, the productivity of a company in the period is getting higher as well. Here is the productivity index calculation formula:

- For productivity value index before the measurement period is called the base period and has a value of 300 because the period is considered as performance standard which means that the score for all criteria's are set at level 3. Thus, the formula will be as follows:

$$IP = \frac{\text{Performance indicator at the first measurement - 300}}{300} \times 100\%$$

- For productivity index measurement in the following month, the formula will be as follows:

$$IP = \frac{\text{Current Performance indicator - Previous Performance Indicator}}{\text{Previous Performance Indicator}} \times 100\%$$

2. Pareto Diagram
After identification of the amount of ratios that are below the standard productivity level is done (calculated based on the frequency of occurrence in the period from January to November 2018), then the next step is prioritizing the ratios for making improvements by using the Pareto Diagram tools.

3. Fishbone Diagram (cause-effect diagram)
Based on Pareto Diagram, then the next step is to analyze the root cause of problems using the Fishbone Diagram/cause-effect diagram.

4. 5W1H method
Once known root cause of problems of each low criterion with Fishbone Diagram, then the next step is to make proposal of improvement action plan efforts using 5W1H method.

RESULTS and DISCUSSION

1. Weight Determination of Productivity Criteria

Weight determination of productivity criteria is useful to know the importance value of each criterion measured. The weight of these productivity criteria is determined after the processing of the questionnaire with a Likert scale (5-level) which has been filled by 7 respondents, consist of Production Deputy Director, Production Manager plant 1, Production Manager plant 2, Supporting Production Senior Manager, Quality General Manager, Quality Senior Manager of Mizuno plant, and PPC Manager. Following is the result of weight criteria based on the questionnaire results.

Table 1. Weight Criteria

Respondent	Criteria 1 Utility of Material Consumption (IDR/pairs)	Criteria 2 Utility of Labor (pairs/hour)	Criteria 3 Production Planning Accuracy (%)	Criteria 4 Number of Defect Product (%)	Criteria 5 Number of Repaired Shoes (%)	Criteria 6 Loss output (down time) (%)	Criteria 7 Number of Overtime hours (%)	Amount
1 Production Deputy Director	5	5	4	4	4	5	4	31
2 PPC Manager	5	5	4	3	4	4	3	28
3 Supporting Production Senior Manager	4	5	5	5	4	5	4	32
4 Production Manager (plant 1)	5	5	5	5	4	5	4	33
5 Production Manager (plant 2)	5	5	5	3	5	4	3	30
6 Quality General Manager	2	5	5	5	5	5	5	32
7 Quality Senior Manager (Mizuno plant)	3	4	4	4	5	5	2	27
Total score	**29**	**34**	**32**	**29**	**31**	**33**	**25**	**213**
Weight	**13.62**	**15.96**	**15.02**	**13.62**	**14.55**	**15.49**	**11.74**	**100**

Source: Author Data processing (2019)

2. Productivity Ratio Calculation

The second stage is to calculate productivity ratio for each determined productivity criteria. The productivity ratio calculation for each criterion can be seen in table 3.

Table 2. Productivity Ratio

Month	Criteria 1 Utility of Material Consumption (IDR/pairs)	Criteria 2 Utility of Labor (pairs/hour)	Criteria 3 Production Planning Accuracy (%)	Criteria 4 Number of Defect Product (%)	Criteria 5 Number of Repaired Shoes (%)	Criteria 6 Loss output (down time) (%)	Criteria 7 Number of Overtime hours (%)
Jan-18	105,986.03	0.88	89.27%	0.048%	1.98%	21.28%	20.40%
Feb-18	100,418.08	0.75	79.01%	0.030%	1.67%	25.91%	26.50%
Mar-18	96,859.56	0.68	65.49%	0.049%	2.76%	30.02%	22.87%
Apr-18	114,849.42	0.87	83.29%	0.026%	2.05%	19.15%	36.00%
May-18	118,986.49	0.80	81.13%	0.019%	1.41%	27.20%	37.47%
Jun-18	107,707.97	0.84	78.03%	0.018%	1.01%	31.88%	23.57%
Jul-18	114,017.07	0.89	96.81%	0.011%	1.23%	17.54%	16.35%
Aug-18	110,163.84	0.85	104.98%	0.003%	1.04%	17.02%	0.05%
Sep-18	132,985.23	0.63	100.74%	0.016%	1.31%	52.41%	0.002%
Oct-18	114,745.79	0.71	93.90%	0.014%	1.32%	24.22%	0.000%
Nov-18	120,380.68	0.80	81.13%	0.026%	0.93%	11.07%	0.03%

Source : Author Data processing (2019)

3. Determination of standard performance and performance scale

After the productivity ratio of all criteria have been calculated, then the target matrix (Objective Matrix) can start to be formed, with the next step is to determine the standard performance (level 3), the worst productivity value (level 0), and the company's goal target (Level 10).

a. The standard performance value is derived from the average value of each performance ratio taken which is taken from its data for 3 months from January 2018 to March 2018 (Hamdani and Bambang, 2016). This standard performance value will be placed at level 3 in the Objective Matrix table.

Table 3. Level 3 Value

Month	Criteria 1 Utility of Material Consumption (IDR/pairs)	Criteria 2 Utility of Labor (pairs/hour)	Criteria 3 Production Planning Accuracy (%)	Criteria 4 Number of Defect Product (%)	Criteria 5 Number of Repaired Shoes (%)	Criteria 6 Loss output (down time) (%)	Criteria 7 Number of Overtime hours (%)
Jan-18	105,986.03	0.88	89.27%	0.048%	1.98%	21.28%	20.40%
Feb-18	100,418.08	0.75	79.01%	0.030%	1.67%	25.91%	26.50%
Mar-18	96,859.56	0.68	65.49%	0.049%	2.76%	30.02%	22.87%
Average Value	**101,087.89**	**0.77**	**77.92%**	**0.042%**	**2.13%**	**25.74%**	**23.26%**

Source: Author data processing (2019)

b. Next is, the determination of performance scale of the worst productivity value is represented by level 0 in the Objective Matrix (OMAX) table. Level 0 is the worst value of the ratio that was achieved during the period from January 2018 to November 2018. For the company's expected productivity scale (goal target) is represented by Level 10. The target

that the company wants to achieve was obtained from the result of the interview with Production Deputy Director of PT XYZ and also referring to the company's defined KPI targets.

Table 4. Level 0 and 10 Value

	Criteria 1 Utility of Material Consumption (IDR/pairs)	Criteria 2 Utility of Labor (pairs/hour)	Criteria 3 Production Planning Accuracy (%)	Criteria 4 Number of Defect Product (%)	Criteria 5 Number of Repaired Shoes (%)	Criteria 6 Loss output (down time) (%)	Criteria 7 Number of Overtime hours (%)
Worst productivity value	132,985.23	0.63	65.49%	0.049%	2.76%	52.41%	37.47%
Company's goal target	92,000.00	1.00	95.00%	0.01%	0.50%	5.00%	0.00%

Source: Author's data processing (2019)

c. Afterwards, determination of scale level 1-2 and level 4-9 by interpolating.

Table 5. Interpolation Standard Value

Criteria	Worst Performance (level 0)	Average Performance (level 3)	Expected Performance (level 10)	Interpolation of Level 1-2	Interpolation of Level 4-9
Criteria 1	132,985.23	101,087.89	92,000.00	-10,632.45	-1,298.27
Criteria 2	0.63	0.77	1.00	0.05	0.03
Criteria 3	65.49%	77.92%	95.00%	0.04	0.02
Criteria 4	0.049%	0.042%	0.01%	0.00	0.00
Criteria 5	2.76%	2.13%	0.50%	0.00	0.00
Criteria 6	52.41%	25.74%	5.00%	-0.09	-0.03
Criteria 7	37.47%	23.26%	0.00%	-0.05	-0.03

Source: Author data processing (2019)

4. Measurement of Productivity Index

The final step of productivity measurement using the Objective Matrix (OMAX) method is to calculate the productivity index value. The productivity index measurement (IP) is performed to determine the increase or decrease of the measured period. The productivity index was measured against the previous period and against the standard period (300). Herewith is an example of OMAX table for period of January 2018.

Table 6. OMAX Table period January 2018

Criteria	Efficiency		Effectiveness				Inferential	Level Score
	Criteria 1 Utility of Material Consumption (IDR/pairs)	Criteria 2 Utility of Labor (pairs/hour)	Criteria 3 Production Planning Accuracy (%)	Criteria 4 Number of Defect Product (%)	Criteria 5 Number of Repaired Shoes (%)	Criteria 6 Loss output (down time) (%)	Criteria 7 Number of Overtime hours (%)	
Performance	105,986.0	0.88	89.27%	0.048%	1.98%	21.28%	20.30%	
Target	92,000.00	1.00	95.00%	0.01%	0.50%	5.00%	0.00%	10
	93,298.27	0.97	92.56%	0.0146%	0.73%	7.96%	3.32%	9
	94,596.54	0.93	90.12%	0.0192%	0.97%	10.93%	6.64%	8
	95,894.81	0.90	87.68%	0.0238%	1.20%	13.89%	9.97%	7
	97,193.08	0.87	85.24%	0.0285%	1.43%	16.85%	13.29%	6
	98,491.35	0.84	82.80%	0.0331%	1.67%	19.81%	16.61%	5
	99,789.62	0.80	80.36%	0.0377%	1.90%	22.78%	19.93%	4
Average	101,087.89	0.77	77.92%	0.042%	2.13%	25.74%	23.26%	3
	111,720.34	0.72	73.78%	0.044%	2.29%	34.63%	28.00%	2
	122,352.78	0.67	69.63%	0.047%	2.52%	43.52%	32.74%	1
Worst	132,985.23	0.63	65.49%	0.049%	2.76%	52.41%	37.47%	0
Score	3	6	8	1	4	4	4	
Weight (%)	13.62	15.96	15.02	13.62	14.55	15.49	11.74	
Value	40.85	95.77	120.19	13.62	58.22	61.97	46.95	
Performance Indicator	Current	Previous	Productivity Index					
	437.56	300.00	45.85					

Source: Author data processing (2019)

After calculating the OMAX table per month has been completed, then it can be created a recapitulation of the performance value of each productivity ratio in the period from January 2018 to November 2018 as seen in table 7 as below.

Table 7. Recapitulation of Performance Value

Month	Performance Value							Performance Indicator
	Criteria 1 Utility of Material Consumption (IDR/pairs)	Criteria 2 Utility of Labor (pairs/hour)	Criteria 3 Production Planning Accuracy (%)	Criteria 4 Number of Defect Product (%)	Criteria 5 Number of Repaired Shoes (%)	Criteria 6 Loss output (down time) (%)	Criteria 7 Number of Overtime hours (%)	
Jan-18	40.85	95.77	120.19	13.62	58.22	61.97	46.95	437.56
Feb-18	40.85	47.89	60.09	81.69	72.77	46.48	35.21	384.98
Mar-18	81.69	15.96	0.00	0.00	0.00	30.99	35.21	163.85
Apr-18	27.23	95.77	75.12	81.69	58.22	77.46	11.74	427.23
May-18	27.23	63.85	60.09	108.92	87.32	46.48	0.00	393.90
Jun-18	40.85	79.81	45.07	108.92	116.43	30.99	35.24	457.31
Jul-18	27.23	111.74	150.23	136.15	101.88	92.96	58.69	678.87
Aug-18	27.23	95.77	150.23	136.15	116.43	92.96	117.37	736.15
Sep-18	0.00	0.00	150.23	122.54	87.32	0.00	117.37	477.46
Oct-18	27.23	31.92	135.21	122.54	87.32	46.48	117.37	568.08
Nov-18	13.62	47.89	60.09	95.31	116.43	123.94	117.37	574.65
Sum of value	**353.99**	**686.38**	**1006.57**	**1007.51**	**902.35**	**650.70**	**692.52**	**5300.03**
Average value	***32.18***	***62.40***	***91.51***	***91.59***	***82.03***	***59.15***	***62.96***	***481.82***
The best value	**81.69**	**111.74**	**150.23**	**136.15**	**128.70**	**124.72**	**117.37**	**749.35**
The worst value	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**163.85**

Source: Author data processing (2019)

5. Analysis and Discussion

After the result of data processing productivity calculations with Objective Matrix (OMAX) method has been obtained, then the next step is to conduct analysis towards the processed results. The analysis that will be conducted is the analysis of score achievement of each criterion, analysis of performance indicators and productivity index, and the analysis of the cause of Low Productivity Performance.

1) Analysis of Score Achievement of Each Criterion.

Analysis of the score achievement of each criterion is an analysis that aims to oversee the scores of each criteria to see whether it is below, meet target, or above standard performance. A score of 0 (zero) symbolized a productivity in its worst condition, a score of 3 is symbolized productivity in standard performance, and a score of 10 is symbolized productivity in the best condition and reached the company's goal target. The following is a table of score achievement for each productivity criteria per month.

Table 8. Score Achievement of Each Criteria

Month	Criteria 1 Utility of Material Consumption (IDR/pairs)	Criteria 2 Utility of Labor (pairs/hour)	Criteria 3 Production Planning Accuracy (%)	Criteria 4 Number of Defect Product (%)	Criteria 5 Number of Repaired Shoes (%)	Criteria 6 Loss output (down time) (%)	Criteria 7 Number of Overtime hours (%)
Jan-18	3	6	8	1	4	4	4
Feb-18	3	3	4	6	5	3	3
Mar-18	6	1	0	0	0	2	3
Apr-18	2	6	5	6	4	5	1
May-18	2	4	4	8	6	3	0
Jun-18	3	5	3	8	8	2	3
Jul-18	2	7	10	10	7	6	5
Aug-18	2	6	10	10	8	6	10
Sep-18	0	0	10	9	6	0	10
Oct-18	2	2	9	9	6	3	10
Nov-18	1	3	4	7	8	8	10
Sum	26	43	67	74	62	42	59

Green color (with a threshold of level 7 to level 10) means that performance has reached the target.

Yellow color (with a threshold of level 3 to level 6) means that performance has not reached the target but has approached the target to be achieved.

Red color (with a threshold of below level 3) means that performance is completely below standard.

Source: Author data processing (2019)

2) Analysis of Performance Indicator and Productivity Index.

This analysis will determine how much the current performance indicator level changes to the standard productivity value (first) and against the previous period achievement indicator. Analysis of performance indicators and productivity index aims to see if there is increased productivity or declined productivity.

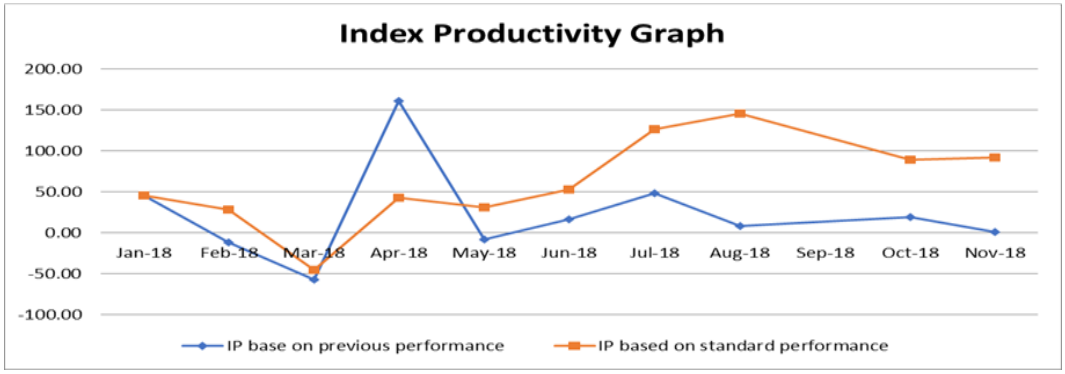


Figure 3. Index Productivity
Source: Author data processing (2019)

From the productivity index chart shown in Figure 3, it can be seen that the decline in the productivity index occurred in February, March, May, August, September and November 2018, and the lowest achievement of the productivity index during the measurement period occurred in March 2018 of -57.44%.

And the following in Figure 4 shows a graph of performance indicators from January to November 2018. From the performance indicator graph, it can be seen that the highest achievement of performance indicators occurs in August 2018 (with a value of 736.15), while the lowest performance indicator occurs in March 2018 (with a value 163.85).

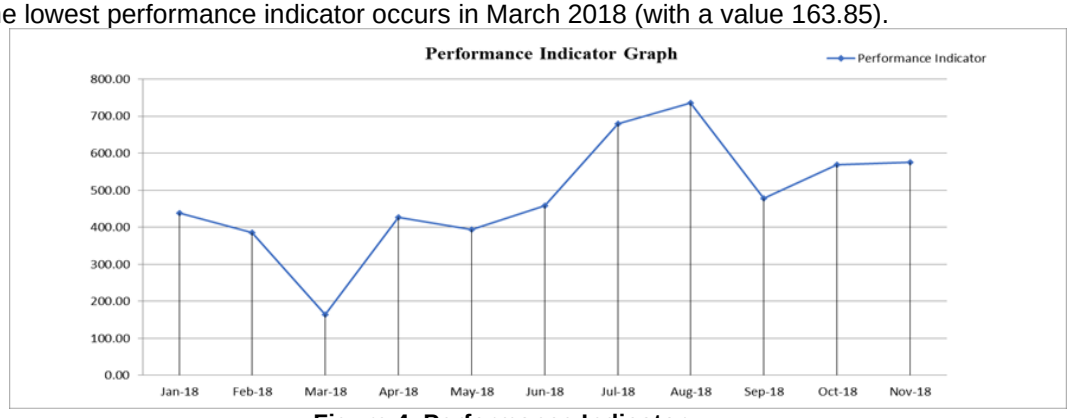


Figure 4. Performance Indicator
Source: Author data processing (2019)

3) Analysis of Causes of Low Productivity Performance.

By referring to the basic calculation of Pareto principle that to achieve the impact of 80% improvement, it must be determined which criteria should be improved. In this research, the calculation base is inversely proportional to the usual Pareto analysis, which is the determination of criteria that must be improved productivity starting from ascending order, which is from the criteria that has lowest to highest productivity score, because the lower the

productivity score means the worse the productivity performance achieved by each criterion and the more important and become top priority To be done on the improvement effort. The following is productivity score values per criterion based on the Pareto calculation principle that starts from the order of lowest productivity score.

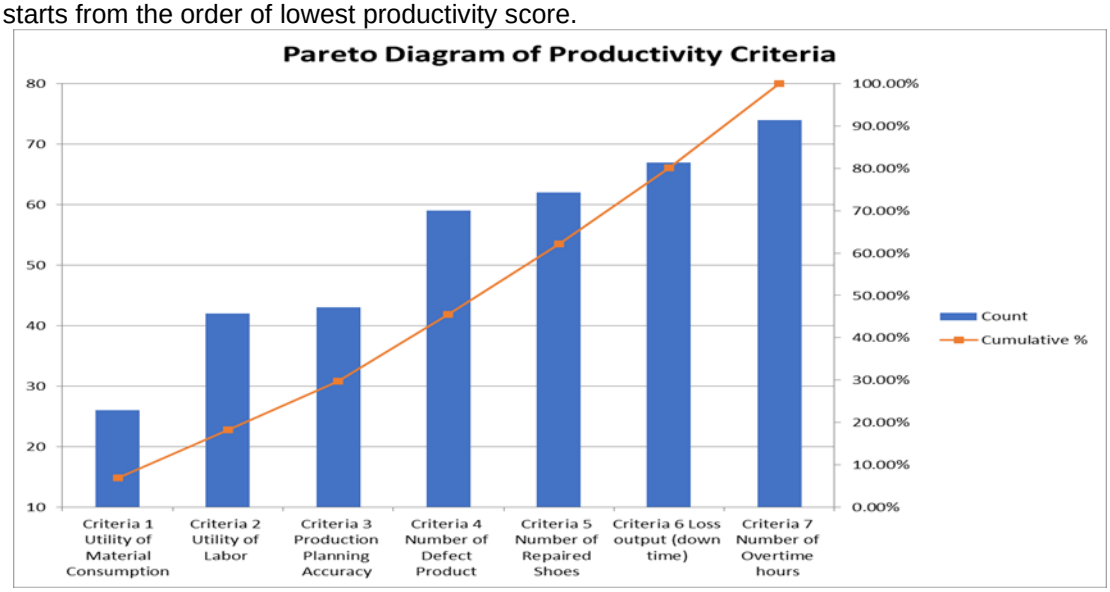


Figure 5. Pareto Diagram of Productivity Criteria
Source: Author data processing (2019)

From the Pareto diagram, it can be seen which criteria has critical value starting from the lowest to the highest productivity score. The author will focus on the three lowest criteria that have a critical productivity score for increasing productivity as a main priority, they are criteria 1 for utility of material consumption, criteria 6 loss output (down time), and criteria 2 utility of labor.

Before stepping into a corrective action, finding the root cause of the low productivity performance for the three critical productivity criteria must be done using the fishbone diagram. From the results of fishbone diagrams carried out to find the root cause of the problem for the three critical productivity criteria showing the number of similarities between the thress causes of low productivity performance thus if depicted in one fishbone diagram as a whole regarding the low productivity of shoe production at PT XYZ, the following is a diagram of fish bone diagram.

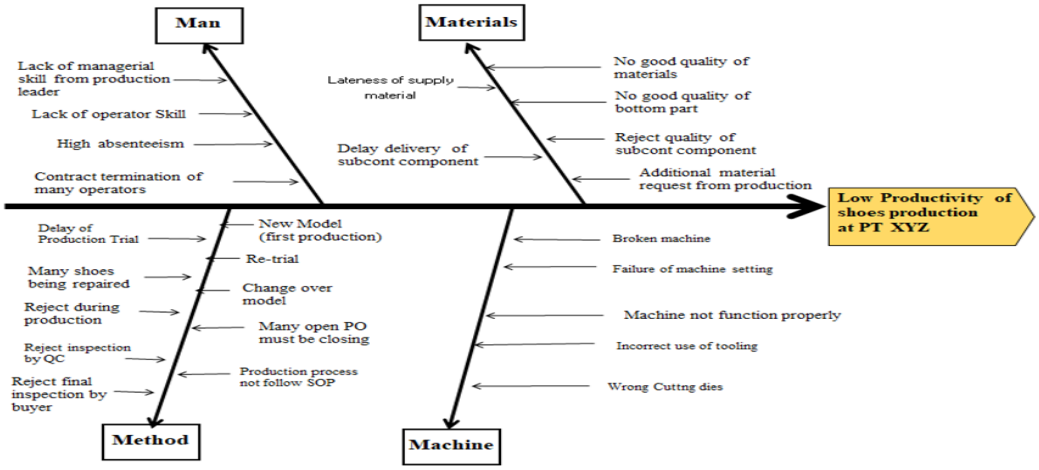


Figure 6. Pareto Diagram of Productivity Criteria
Source: Author data processing (2019)

4) Productivity Improvement Effort

After finding the root cause of low productivity of shoes production at PT XYZ as illustrated in the fishbone diagram in Figure 6, then the last step is to make improvement plan to solve the problem of low productivity of shoes production at PT XYZ. The following is an example of 5W1H table that has been formed from the results of a focus group discussion with all relevant departments:

Table 9. Productivity Improvement Man Factor

No	What	Why	Who	Where	When	How
1	Lack of managerial skill from production leader	So that the production leaders can arrange the work planning properly to achieve the planned production target.	HR Training & Development	Training room	Aug-19	Conduct leadership training for all production leaders starting from the unit head level, section head to plant manager.
2	Lack of operator skill	So that the operator can perform its duties and responsibilities with good results in accordance with the specified job provided.	HR Training & Development	Production line	Aug-19	Routine performs multi-skill analysis of operators once every 3 months along with the Continuous Improvement production plant and then produce the results of the analysis in the form of a multi skill operator matrix report.
			Unit head produksi	Production line	Sep-19	Teach and supervise operator who is still lacking of skill (base on validated matrix of operator skills)

Source: Author data processing (2019)

Table 10. Productivity Improvement Material Factor

No	What	Why	Who	Where	When	How
1	Additional material request from production	Minimize the amount of additional material usage from production.	Plant Manager	Production departemen	Aug-19	Carry out a control system for the request of additional material usage from production by having approval from Deputy Production Director first for each additional requesst form and the production cell must show the proof of rejected components or shoes along with an explanation of the reasons why they were rejected during the production process.
2	No good quality of materials	So that there is no quality problem coming from the raw material when the subcont component treatment process is done at the supplier, or during the shoe making process or after the shoes are finished.	QC Incoming material	Gudang material	Jul-19	1. Ensure that each supplier includes lab test results for the material delivered. 2. Perform lab tests per batch of material arrivals.
3	No good quality of bottom part	So that there is no quality problem from the bottom part during the stockfit process (attaching the outsole with the midsole) or after the upper part is affixed to the bottom.	QC Incoming material	Gudang material	Jul-19	1. Memastikan setiap supplier menyertakan hasil lab testnya untuk bottom part yang dikirim. 2. Mengukur panjang pendek dan ketebalan bottom part sesuai dengan spesifikasi yang ditentukan.

Source: Author data processing (2019)

Table 11. Productivity Improvement Method Factor

No	What	Why	Who	Where	When	How
1	Reject final inspection by buyer	all POs inspected by the buyer can be declared as "released" at one time.	QC Inspection	Inspection room	Jul-19	Conduct internal inspections before the final inspection by the buyer.
2	Reject inspection by QC	To make sure all POs transferred to finished goods warehouse are the good quality of shoes	QC toll gate	Area Production Toll-gate	Jul-19	Check the quality of shoes strictly for each pair of shoes produced by the production cell before they are handed to the packing operators to pack the shoes into innerbox.
3	Reject during production	To ensure quality of WIP upper or bottom during production process is maintained properly.	QC CSA	Production line	Jul-19	Check component quality at each stage of the production process strictly before the component continues to the next stage.
4	Delay of production trial	To ensure production trial schedule that has been informed by the development department to the PPC (Production Planning Control) and production is realized as planned (not delay).	Mizuno Development Senior Manager, dan Mizuno Development Commercializ ation Manager	Production line	Jul-19	1. Ensuring that the developer completes the development work on time according to the timeline (confirm sample shoes have been approved by Mizuno's buyer headquarter in Japan and the product meeting handover has been done on time). 2. Monitor the availability of materials, bottom parts and subcont component to arrive on time according to the timeline specified.

Source: Author data processing (2019)

CONCLUSION

From the results of data processing and analysis that has been carried out on the measurement of shoe production productivity using the Objective Matrix (OMAX) method at PT XYZ, the authors can draw some conclusions that the highest productivity increase with performance indicator values occurs in August 2018 with a value of 736.15, whereas the decline in productivity with the lowest value of performance indicators occurred in March 2018 with a value of 163.85. Criteria that have a critical productivity value (criteria that have many red values, which means the performance is still below standard performance and have never reached the target) are Criteria 1 utility of material consumption, criteria 6 Number of loss output (downtime), and criteria 2 Utility of Labor; These three criteria are the dominant ones causing a decline in productivity in the Mizuno line production section. The proposed improvement efforts for increasing shoe production productivity at the Mizuno line PT XYZ are using the 5W1H method and focusing on three critical value of productivity criteria, they are Criteria 1 Utility of material consumption, criteria 6 Number of loss output (down time), and criteria 2 Utility of Labor.

And base on productivity calculation shows that the use of the Objective Matrix (OMAX) method is better to be used as a performance measurement standard if compared with performance measurement standards which currently only use labor productivity calculations to measure company productivity, then the author’s advice is company to change productivity measurement using the Objective Matrix (OMAX) method by further expanding the use of criteria in order to know the extent of performance that has been achieved by the company and can analyze the factors that inhibit or encourage productivity. Monthly assessment of productivity index KPI needs to be done so that it can be used for evaluation if there is a change in the productivity index every month and it is expected that the activities of all employees in the operational section will also assess, improve and maintain their own unit performance. Likewise, companies need to implement the recommendation of productivity improvement plan immediately and emphasize to all employees the importance of increasing

productivity for the company so that employees are accustomed to dealing with changes towards improvement and improvement.

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