

ANALYSIS OF PRODUCTIVITY BASED ON KPI CASE STUDY AUTOMOTIVE PAINT INDUSTRY

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Abstract: *The automotive paint industry is very dependent on the automotive vehicle industry, whether it is two-wheeled or four-wheeled. Competition between the paint industry is currently getting tougher with the growth of several new companies, for that the company needs to know the level of productivity of the company so that the company can compete with the hope that the higher level of productivity then the company can provide competitive prices. This study measures productivity based on company KPI using the objective matrix method. The results of the study found that the company's productivity is quite low and continues to decline. Production often does not reach the target, which results in many products having empty stock, not achieving the output due to a complicated approval process, this condition affects many instabilities in other aspects such as overtime, waste, and electricity.*

Keywords: *Automotive Paint, Productivity, Key Performance Indicator, Objective Matrix, Improvement.*

1. Introduction

Productivity is an essential factor that must be maintained by the company in carrying out its production process. Productivity is a measure of the company's assessment to improve the company's performance [1][2]. The better the richness that the company has, it is expected that the company will be able to provide products at low prices and have good quality[3]. So that the company can compete with similar companies. [4][5] in his study studying the company's KPI as a basis for improving the company's productivity performance, where each variable was compared to determine the level of corporate performance.

The company that is the object of research is a manufacturing company engaged in the field of Automotive Paint. The company commits to being a market leader and able to compete with similar companies in Indonesia. The current condition of the company is that the company can become the market leader by controlling 58% of the four-wheel vehicle paint market. But the company was only able to control the market by 12% for two-wheeled vehicles.

Based on this condition, the company must make improvements to the performance of the company, to increase sales to be able to seize the two-wheeled market.

The actual condition in the company is that from January 2015 to June 2018, the production achievement was smaller than sales, so that the company experienced problems in meeting customer demand. Under these conditions, the company must make improvements so that the productivity of the company increases, and the company can have sufficient product stock to meet customer demand. The company's productivity control activities have only calculated the ratio of the number of employees working 1hours compared to the output produced, and the company has never measured the company's overall performance [6], [7]. So that research to analyse productivity by using the Objective Matrix method needs to be done where productivity will be measured by comparing six productivity ratios, which include efficiency and productivity of labour, machinery, and energy use. With these measurements, it is expected that the company will get an overview of the actual productivity that exists in the company.

The purpose of this study is to determine the performance value of company productivity.

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Published online at <http://jemis.ub.ac.id>

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So that it can be known the priorities of indicators that need improvement and can be given improvement proposals that can build the company's performance to be better and following the targets expected by the company.

2. Methodology

This study describes the condition of the company based on existing data, then evaluate the Performance Productivity activity in the company's business by using the indicators. The indicator is the amount of production, the number of sales, stock of raw materials, bad stock, electricity usage, loss production, machine breakdown, overtime hours, product stock productivity, and productivity of washing solvent usage. By using AHP, Key Performance Indicator and Objective Matrix method, it is expected that it will obtain the results of an optimal productivity performance calculation[3], [4], [8]–[11]. Descriptive analysis is used because the author explains what is contained in theory and compares it with the daily events or operations of the company[12][13]. After data collection is carried out, the data is processed so that it can be input for the company's productivity measurements using the Objective Matrix method. Data processed using existing achievement data and data collected based on company conditions. While descriptively can be explained by the phenomenon of terms of production, product stock, and sales. Analysis using a questionnaire with a variable consisting of indicators[14], [15].

3. Result

3.1. Formation of objective criteria

The overall potential Objective of the Company's Vision and Mission is:

1. Minimize defective products due to process failure
2. Minimizing the product returned by the customer
3. Efficient energy use
4. Efficient use of materials
5. Minimize engine breakdown
6. Cycle time efficiency
7. Minimizing overtime
8. Reducing the delay in the production schedule
9. minimize the use of solvent washing per month
10. Using raw materials of 100% SOC free.

There is Company Target must be achieved by the Department in the company [4], [16]:

Table 1. Key Performance Indicator

No	Criteria	KPI
1	Sales Actual/Month	100%
	Production Achievement/Month	
2	Sales Actual/Month	100%
	Sales Forecast/Month	
3	Raw Material Stock/Month	100%
	Minimum Stock/Month	
4	Bad Stock/Month	25% (from Past Year)
	Sales Qty/Month	
5	Electricity/Month	0.1% (from Past Years)
	Actual production Qty/Month	
6	Production Yield/Month	1 % (from Past Years)
	Raw Material Consumption/Month	
7	Machine Breakdown/Month	0,0
	Production Time Available	
8	Overtime/Month	10% (from Past Years)
	Total Production time/Month	
9	Actual Stock	100%
	Available/month Standard Stock/month	
10	Total Solvent wash	1% (from Past Years)
	Actual Production Qty/Month	

Based on the results of the productivity data collection, the results of productivity achievement are obtained when compared with the actual months 1 to 6 of the productivity evaluation period. There are achievements for each criterion which can be seen in the following discussion:

Productivity Criteria 1

Criteria 1:

$$\frac{\text{Production Achievement/Month}}{\text{Production Target/Month}} \tag{1}$$

Table 2. Data Ratio for Criteria 1

Years	Month	Production Achievement (Month /Ton)	Production Target (Month/Ton)	Rasio (%)
2017	January	1,341.00	1,700.00	78.9
	February	1,283.00	1,529.41	83.9
	March	1,200.00	1,616.13	74.3
	April	1,383.00	1,472.43	93.9
	May	1,322.00	1,216.10	108.7

Cite this Article As Paduloh et al. (2020). Analysis Of Productivity Based On Kpi Case Study Automotive Paint Industry. *Journal of Engineering and Management in Industrial System*, 8(1), p1-12

Paper Accepted : 19 May 2020

Paper Published : 28 May 2020

	June	1,251.00	1,420.00	88.1
	July	1,362.60	1,372.80	99.3
	August	1,045.61	1,270.00	82.3
	September	1,425.04	1,700.00	83.8
	October	1,502.14	1,630.00	92.2
	November	1,344.40	1,600.00	84.02
	December	1,209.26	1,500.00	80.62
	Total	15,669.04	18,026.87	
	Average 2018	1,305.75	1,502.24	87.50
2018	January	1,232.29	1,430.00	86.17
	February	1,359.09	1,600.00	84.94
	March	1,378.27	1,600.00	86.14
	April	1,367.06	1,300.00	105.16
	May	1,114.60	1,250.00	89.17
	June	1,333.89	1,160.00	114.99
	Total	9,090.94	9,842.24	
Average 2018	1,297.53	1,390.00	94.43	

The lowest value on this criterion is the smallest ratio, with a value of 74.25%, which occurred in March 2017. This value is placed on a scale of 0 because it is the worst productivity value that occurs. As above, between the lowest value and the base value are interpolated. Interpolated done by calculating the difference in the base value with the lowest value then divided by the number of intervals between them.

$$\frac{\text{Target value} - \text{base value}}{\text{Interval}} = \frac{87.5 - 74.25}{3} = 4,41\%$$

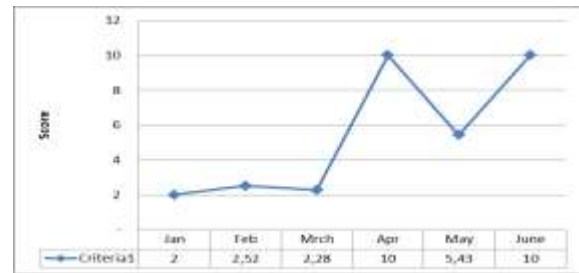


Fig. 2 Score production achievement

Based on Table 2, the basic value or initial standard value for this criterion is the number of ratios in 2017 that is 87.5. This value is placed on a scale score of 3 because it is the value of the current performance scale in the OMAX table. The target value for this criterion is based on the company's KPI, which is 100. The target value is placed on a scale of 10, which is the scale of achievement to be achieved.

The values between the base value and the target value are calculated by interpolation by calculating the difference between the target value and the base value, then divided by the interval values between them.

$$\frac{\text{Target value} - \text{base value}}{\text{Interval}} = \frac{100 - 87.5}{7} = 1,78\%$$

Based on the graph above, are percentage score for Production Achievement looks unstable, production results have increased in April, Have Down in May, and rose in June 2018. the percentage score of total production achievement is seen to be unstable, and production results have increased in April, declined again in May, and rose again in June 2016. To find out the causes of unpredictable production achievements were analysed using a causal diagram in Figure 3.

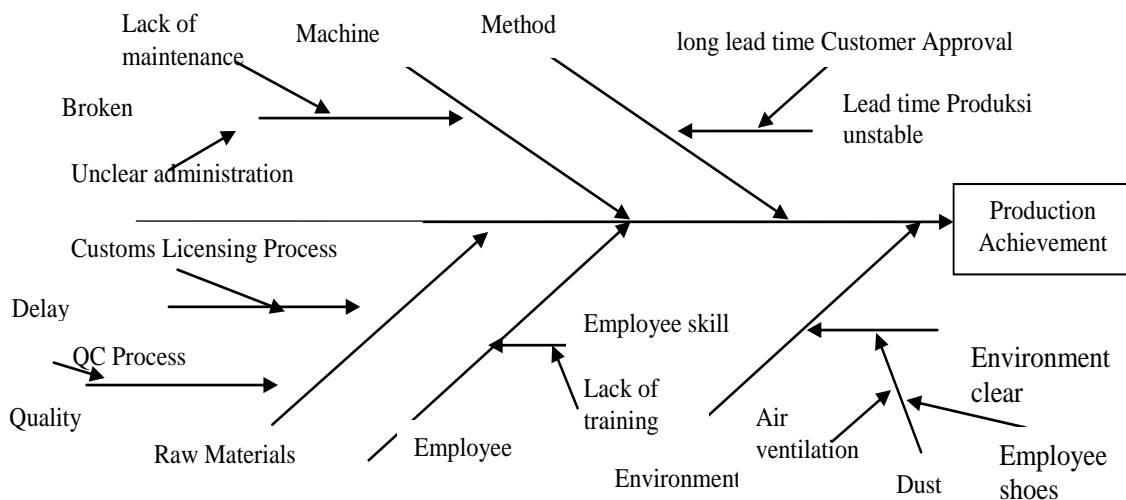


Fig. 3 Cause effect diagram for production achievement

Based on the cause-effect diagram in Figure 3, the production achievement is strongly influenced by Customer Approval. Method for the product being produced, the speed of the Customer Approval process significantly affects the production achievement. In other words, the faster the approval for the proposed product, the more production results obtained.

The condition of the machine also dramatically influences the results of production. The condition of the machine is not prime. Some machines are often jammed so that they must be repaired. Besides, the repair process requires a long time because they have to wait for the bidding process. The bidding process got the approval of the directors of the costs incurred to repair the machine. These conditions do not rule out the possibility because the shape of the engine is less maintenance and the age of the machine that is relatively old.

Because paint products are susceptible to environmental changes, contamination of dust, silicon, and foreign matter can interfere with product quality. The condition of the company is quite clean at the moment. However, the possibility of dust entering through raw materials, production pallets, employee clothing, and air movement is still massive, so the company must have a huge commitment to reduce the causes of the dirty production environment.

For some products, the company relies heavily on operator expertise, especially for coloured paint products, for that training to improve operational capability is very much needed because of the more skilled the operator, the faster the production lead time. The quality of raw materials and delivery time from suppliers is very influential in the achievement of production targets. Supplier selection is needed to do by the company, so in addition to considering the price of raw materials, the company must also find the quality of service and raw materials sent by the supplier.

Productivity Criteria 2

Criteria 2:

$$\frac{\text{Sales Actual/Month}}{\text{Sales Forecast / Month}} \quad (2)$$

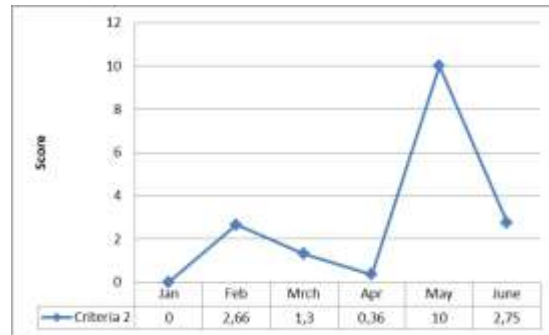


Fig 4. The score of sales achievement

From the chart above, it can show that the actual sales are below the sales forecast given, this can show in January to April 2018 where sales are far below the estimates provided, in May the sales score was excellent which got a score of 10 but returned to 2, 75 in June 2018. The factors that influence the discrepancy between the sales forecast and the actual are:

1. Only 10% of customers provide accurate predictions, the rest of the forecasts given are inappropriate. Besides, many customers cannot provide forecasts, so the estimated usage is based on the average customer workload based on the average usage of the last three months.
2. The condition of machines and working tools in the customer is very influential in the use of paint. If the tools and environmental conditions are not suitable can cause high production defects in the customer so that this also affects the demand for paint, this too often causes the amount of paint usage not following the forecast provided.

Productivity Criteria 3

Criteria 3:

$$\frac{\text{Actual Stock Raw material/Month}}{\text{Raw Material Stock Target/Month}} \quad (3)$$

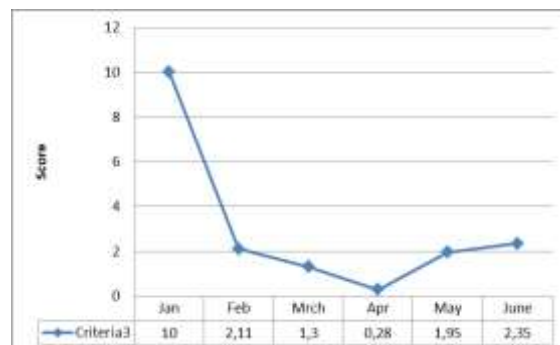


Fig 5. Chart of score raw material stock

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Paper Accepted : 19 May 2020

Paper Published : 28 May 2020

Condition Stock of raw material is a decline in January 2018. This condition is useful to improve the raw material stock condition. Company targets for the raw material stock as KPI are 1-month stock. Matters affecting raw material inventory include:

1. Forecast Sales, the lead time for ordering raw materials, is, on average, two months, so the purchase of raw materials is based on the 2-month sales forecast issued by the Dept. Sales marketing. The more accurate the sales forecast is given, the raw material inventory will also be more specific.
2. Changes in Formulation, each product is produced based on a formulation determined by the Dept. Technical To calculates the need for raw materials. The calculation is based on sales forecasts and formulations for the production of raw materials so that any raw materials must be provided. Changes to product formulations will significantly affect the supply of raw materials, so modifications to formulations must be gradual, given the average lead time for raw material purchases is two months.

Productivity Criteria 4

Criteria 4:

$$\frac{\text{Bad Stock/Month}}{\text{Sales Qty/Month}} \quad (4)$$

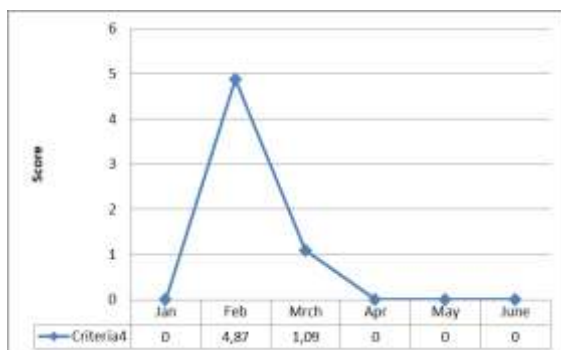


Fig 6. Score bad stock

The biggest challenge facing the company is reducing the number of existing bad product stocks in the company. Graph stock bad began to increase in January 2018 with a score of 4.87 but continued to decline to reach a score of 0 in April, May, June 2018, meaning that the target

for decreasing bad stock has never been reached and tends to increase every month.

The biggest challenge faced by the company is to reduce the number of B / C products in the company. Graphic stock BC began to increase in January 2016 with a score of 4.87, but it continued to decline until it reached a score of 0 in April, May, June 2016 This means that the target for the decline in B / C stock has never been reached and tends to increase every month. The product conditions categorized into B / C are as follows:

1. Expired products and raw materials are products and raw materials that have expired so that the products and raw materials cannot be used anymore and cannot be sold to customers. The cause of the product expiration is due to excess stock caused by changes in product formulation, excess inventory of raw materials, inaccurate forecasts, and the sudden cessation of product use at the customer.
2. Abnormal Process, products produced from the production process, but the quality does not meet specifications. It cannot be repaired, and abnormal processes can be caused due to unclean environmental factors, changes in machine specifications, operator negligence factors, and raw material factors that do not match specifications.
3. Abnormal Quality is the condition of the product whose quality does not meet customer specifications at the time of application in the customer's production line. This condition can be influenced by the customer's company environment and machine conditions. So the product specifications must be changed to follow the terms in the customer's company.

Productivity Criteria 5

Criteria 5:

$$\frac{\text{Electricity/Month}}{\text{Actual Production Qty/Month}} \quad (5)$$

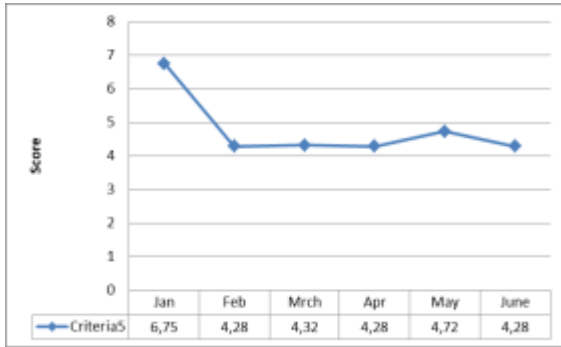


Fig 7. The score of electricity usage per month

From the graph of energy usage above, energy consumption can be concluded if energy consumption is increasing from January 2016, energy consumption is greater to stable in March to June 2104 with an average score of 4. The cause of the increase in energy consumption is the use of new factories, namely plant 3. In contrast, production targets and target sales do not increase so that this energy consumption increases because it is used for lighting, air conditioners, elevators, and supporting machines for factory operations 3.

Productivity Criteria 6

Criteria 6

$$\frac{\text{Loss of Raw Material/Month}}{\text{Total Raw Material Consumption/Month}} \quad (6)$$

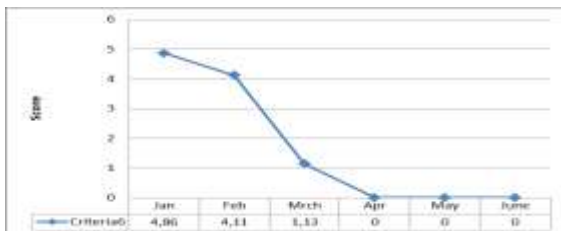


Fig 7. Score loss production

If seen from the graph of the score above the efficiency of suppressing the occurrence of raw material which is wasted increasingly decreases, in January, February score is at number four, while in March the score starts to fall and in April to June 2018 falls on the most exceptional score of 0. In terms of work methods, the things that most influence the high yield of production are:

- a. The length of the production lead time because products are manufactured using volatile solvent raw materials. The longer the production lead time, the more

evaporation occurs so that, the higher the yield.

- b. The production process must be carried out efficiently. Raw materials must be poured into the entire production tank, the remaining material remaining in the drum must also be drained so that the remaining material in the packaging of raw materials is getting less.
- c. NG (Not Good) production process can also contribute to production yield when the product is reprocessed for repairs, the amount of material lost due to packaging changes, or waiting for the repair process can also occur.
- d. Product samples, to do a trial of paint (trial production) required paint samples from each lot, so the more often the prosecution failed, the higher the yield.

Efforts to improve the discipline and skill of operators must also continue to be carried out. Operators must carry out the draining of raw materials to the maximum. Besides, operator skills also significantly affect production yields. The higher the operator skills, the smaller the production error, so that the production yield will be lower.

Production yields can occur because of weighing errors or incorrect product considering conditions so that the contents of each can of products are not the same. Affect return if the product weight is much more substantial than standard with the better condition of the machine. The possibility of product failure is also getting smaller, so preventive maintenance must continue.

Productivity Criteria 7

Criteria 7

$$\frac{\text{Machine Breakdown/Month}}{\text{Total Raw Material Consumption/Month}} \quad (7)$$

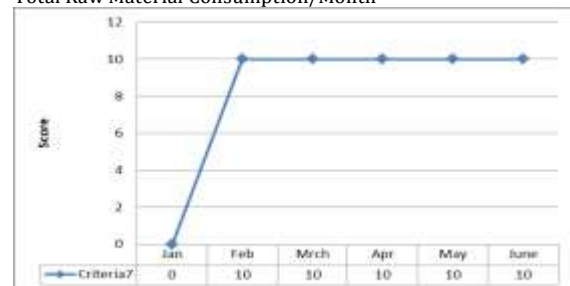


Fig 8. Score machine breakdown

From the above graph can be seen if the engine breakdown has decreased, from a score of zero in January 2018 to stable with a score of 10 from February to June 2018.

The cause of the engine breakdown that occurs is the mechanical seal of the engine that is leaking. The condition of the leak is caused by a loose bolt so that when the N2 pressure is smaller than the product, the engine will leak. The thing to do is to check N2 regularly when it will operate the machine.

Control and preventive maintenance on the engine are still lacking so that the damage to the machine cannot be known in advance. As a result, the machine cannot be used in a few days. Operational skills and discipline must be improved so that the inspection of the machine can be done periodically, not waiting for complaints or the machine is already damaged.

Productivity Criteria 8

Criteria 8:

$$\frac{\text{Total Overtime/Month}}{\text{Total Production Time/Month}} \quad (8)$$



Fig 9. Score overtime

From the graph above, it can be seen that the percentage score for work efficiency is quite good. It can also be seen the overtime graph increases in February, March, and April and then decreases again in May and June 2018, namely the scores of 3.28 and 3.76. Overtime conditions are usually used by companies to pursue production targets, which are caused by not achieving delivery targets to customers. Overtime is also used to solve problems due to abnormal production processes.

Productivity Criteria 9

Criteria 9:

$$\frac{\text{Actual Stock Product/Month}}{\text{Standard Stock Product/Month}} \quad (9)$$

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Paper Accepted : 19 May 2020

Paper Published : 28 May 2020

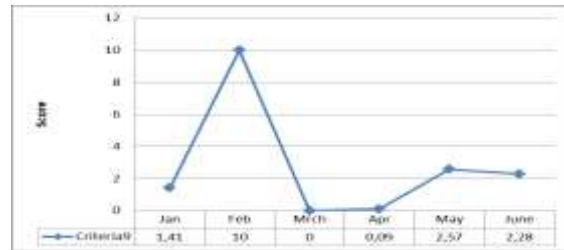


Fig 10. Score product stock condition

From the graph above, it can be seen that the existing product stock cannot meet the standards set by the company. In March and April 2018, the product stock reached the lowest level with a score of 0 and 0.09.

As for the things that affect the occurrence of discrepancies in the product stock are:

1. The more accurate the forecast obtained, the more precise the stock supply to meet customer demand. It means that sales to customers in accordance with projections provided, no more and no less. Only 10% of customers can accurately forecast.
2. For achieving production targets, Product stock shortages are often caused because production does not reach production targets, so product stocks do not meet standards.

Productivity Criteria 10

Criteria 10:

$$\frac{\text{Washing Solvent Used/Month}}{\text{Actual Total Production/Month}} \quad (10)$$

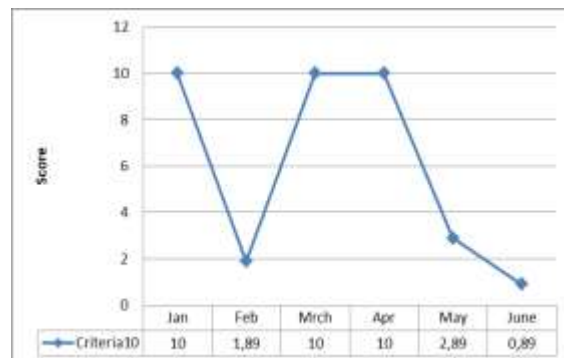


Fig 11. Score washing solvent used

The use of washing solvents from the graph above can be concluded to be very unstable, using solvent washing is sometimes very economical as in January, March, and April but can be very wasteful as happened in June 2018. the use of the washing solvent is greatly influenced by how difficult it is. The used

machines of the production process are washed and cleaned. Usually, the longer the production process, the more difficult the machine is cleaned because dirt has dried so that the washing solvent is used more and more. So that the more washing solvents used, the more waste is produced.

performance in 2017 with conditions from January to June 2018. then obtained indicators of achievement of the current value, index productivity, and productivity index changes in the production process starting from January 2018 to June 2018 is presented in Table 5.

3.2 Objective matrix data

In terms of the company's Productivity Index in total. The results of the productivity criteria data processing based on the analysis of each criterion. We use ten productivity criteria selected, which then compared the value of

Table 3. Objective Matrix January 2018

No	Criteria1	Criteria 2	Criteria3	Criteria4	Criteria5	Criteria6	Criteria7	Criteria8	Criteria9	Criteria10
	Prod	Sales	Stok RM	B/C	Electricity	Yield	Breakdown	OT	Stock FG	Waste
Target	100	100	100	0.25	0.1	1	0	10	100	1
Achv.	86.17	74	118.22	3.76	0.2503	1.1142	0.1354	98.45	94.24	0.9129
10	100	100	100	0.25	0.1	1	0	10	100	1
9	98,18	99,51	98,54	0,641	0,1403	1,0174	0,0014	24,52	100,03	1,0027
8	96,4	99,03	97,05	1,001	0,1773	1,0374	0,0029	39,06	100,055	1,005
7	94,62	98,55	95,56	1,361	0,2143	1,0574	0,0044	53,6	100,08	1,0073
6	92,84	98,07	94,07	1,721	0,251	1,0774	0,0059	68,14	100,105	1,0096
5	91,06	97,59	92,58	2,081	0,2883	1,0974	0,0074	82,68	100,13	1,0119
4	89,28	97,11	91,09	2,441	0,3253	1,117	0,0089	97,22	100,155	1,0142
3	87,5	96,63	89,6	2,801	0,3623	1,1374	0,0104	111,76	100,18	1,0165
2	83,09	91,93	83,3	2,971	0,3823	1,1864	0,0484	123,47	95,97	1,1135
1	78,68	87,23	77	3,141	0,4023	1,2354	0,0864	135,18	91,76	1,2105
0	79,3	82,52	70,61	3,304	0,4241	1,287	0,125	146,9	87,55	1,3063
Score	2.3	0	10	0	6.75	4.86	0	3.08	1.41	10
Weight	12	11.5	11.1	10.1	9.6	9.1	9.6	8.7	10.1	8.2
Value	27.6	0	111	0	64.8	44.226	0	26.796	14.241	82
Present Value	Before Value		Productivity Index							
370.66	0		0							

Table 4. Objective Matrix February 2018

No	Criteria1	Criteria 2	Criteria3	Criteria4	Criteria5	Criteria6	Criteria7	Criteria8	Criteria9	Criteria10
	Prod	sales	Stock RM	B/C	Electricity	Yield	Breakdown	OT	Stock FG	Waste
Target	100	100	100	0.25	0.1	1	0	10	100	1
Achv.	84.9	93.5	88.9	2.4	0.3	1.1	0	137.5	102.0	1.2
10	100	100	100	0.25	0.1	1	0	10	100	1
9	98,18	99,51	98.54	0.641	0.1403	1.0174	0.0014	24.52	100.03	1.0027
8	96,4	99,03	97.05	1.001	0.1773	1.0374	0.0029	39.06	100.055	1.005
7	94,62	98,55	95.56	1.361	0.2143	1.0574	0.0044	53.6	100.08	1.0073
6	92,84	98,07	94.07	1.721	0.2513	1.0774	0.0059	68.14	100.105	1.0096
5	91,06	97,59	92.58	2.081	0.2883	1.0974	0.0074	82.68	100.13	1.0119
4	89,28	97,11	91.09	2.441	0.33	1.12	0.0089	97.22	100.155	1.0142
3	87,5	96,63	89.6	2.801	0.3623	1.1374	0.0104	111.76	100.18	1.0165
2	83,09	91,93	83.3	2.971	0.3823	1.1864	0.0484	123	95.97	1.1135
1	78,68	87,2	77	3.14	0.4023	1.2354	0.0864	135.18	91.76	1.2105
0	79,3	82,52	70.61	3.304	0.4241	1.287	0.1251	146.9	87.6	1.3063
Score	2,59	2,66	2.11	4.87	4.28	4.11	10	0.2	10	1.89
Weight	12	11,5	11.1	10.1	9.6	9.1	9.6	8.7	10.1	8.2
Value	31,08	30,59	23.421	49.187	41.088	37.401	96	1.74	101	15.498
Current Value	Before Value		Productivity Index							
427.01	370.66		15.20%							

The basis of the matrix is the calculation of performance indicators (Employment Indicators). The results of the comparison of operations that can take place at the top of the matrix body, then adjusted to the level of the matrix body and then recorded in the value row after being changed according to the existing values. If there is a comparison between two levels, interpolation is doing to find out the numbers between the two values. Examples of how to interpolate are as follows, an example calculation in January 2016 for criterion 1: Achievement Value: 86.17

The value is between column 2 with a value of 82.47 and column 3 with a value of 87.5. The interpolation calculation is as follows:

$$\frac{2 - X}{3 - X} = \frac{87.5 - 86.17}{82.47 - 86.17}$$

$$\frac{2 - X}{3 - X} = \frac{1.33}{-3.7}$$

$$X = 2.17$$

The number in the weight bar indicates the degree of importance of each criterion to the level of productivity measured. The weight is multiplied by the top value (score) and then recorded in the value row. The sum of these values is a performance indicator of a certain period. scale division consists of three levels, namely:

1. Level 0

Is the lowest level recorded in the period, in other words, the worst result or the worst possible result achieved by each criterion in that period?

3. Level 3

Are the results achieved under normal conditions during the measurement process?

4. Level 10

It contains realistic estimates of the best results that may be achieved by the company within a certain period or a certain period. Thus level 3 is the basis for the start of calculations in the OMAX matrix.

The way to calculate the Productivity Index is as follows, Example of February 2016 Productivity Index calculation:

Current Value: 426.17

Previous Value: 369.1

Productivity Index:

$$\frac{\text{Current Value} - \text{Previous Value}}{\text{Previous Value}} \times 100\%$$

$$\frac{426.17 - 369.1}{369.1} \times 100\%$$

$$15.20 \%$$

Table 5. Productivity Index

Month	Value	Productivity Index (%)	Index Changes (%)
January	370.66	0	0
February	427.01	15.20	15.2
March	323.18	-24.31	-39.51
April	356.9	10.43	-13.88
May	392.87	10.07	-0.36
June	377.84	-3.83	-13.9

Based on the table above, we can represent the change in productivity as the chart below.

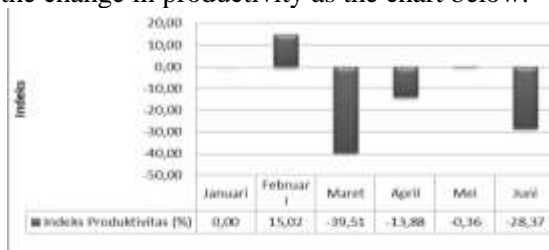


Fig 12. Productivity Index Chart

Productivity index chart in the Production Department from January to June 2018. In January 2018 the initial calculation period changes in productivity index occur in March 2018 equal to -39.51%. With the current value of 323.18 this value has increased in April and May 2018 and declined again in June 2018 with a productivity index -13.9% and the present value of 377.84 due to the human, method and environmental factors.

3.3 Analysis Productivity

The highest productivity index occurred in February 2018 at 15.2% and 427.01, the current change in value. Still, the productivity index above refers to the decline and increase, of course, related to productivity criteria. It can be seen from a Fig. 12 above that the company has a low productivity index. Based on the condition of the company's productivity, the target of improving the richness of the company can be seen in Fig. 14, which shows the criteria for productivity criteria every month. From the graph, it can be seen what measures have increased or decreased the overall productivity index so that improvements can be made.

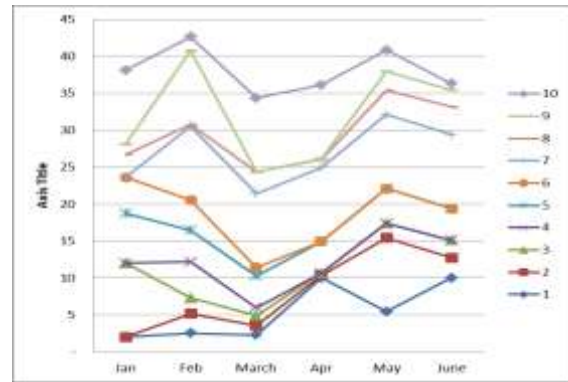


Fig 14. Score Total Productivity

Based on Fig. 14 all existing product categories in the company can be seen that in March 2018 all categories experienced a decline in productivity, these conditions began to rise in April 2018 except for the production productivity index experienced a high increase but in May 2018 when all other productivity criteria rose again. In fact, the upside experienced by the criteria of production productivity goes back down. And the same thing also happened in the following month when other criteria decreased, precisely the production criteria again rose in June 2018.

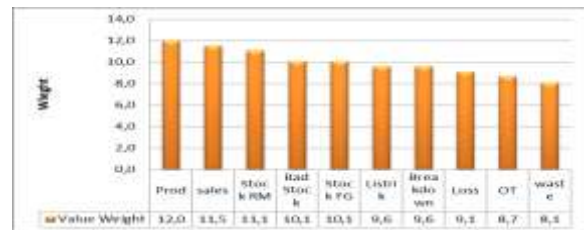


Fig 15. Productivity Criteria Weight

Based on the calculation of the weight derived from the questionnaire given to the Management level. The most critical loads of Objective matrix, in Fig.15. There are the criteria of production achievement, monthly sales achievement, availability of raw materials, availability of product stock, bad stock, breakdown of the machine, electricity usage, Production Loss, Amount of Over Time and Amount of Solvent Washing. Criteria for Achievement of production is the most critical factor that should affect other criteria. Still, from the graph, it is found that the pattern is not patterned following the increase in the amount of production. When all criteria decreased, production criteria stabilized from January to March 2106 and experienced relatively high

growth in April 2106. Production activities were influenced by the availability of raw materials, which in the process caused maintenance costs, electricity, employee overtime, waste, and costs due to production loss. At the same time, bad stock arises because of excess inventory of raw materials that cause expiration, the excess of damaged and expired finished products, and products that fail in the production process.

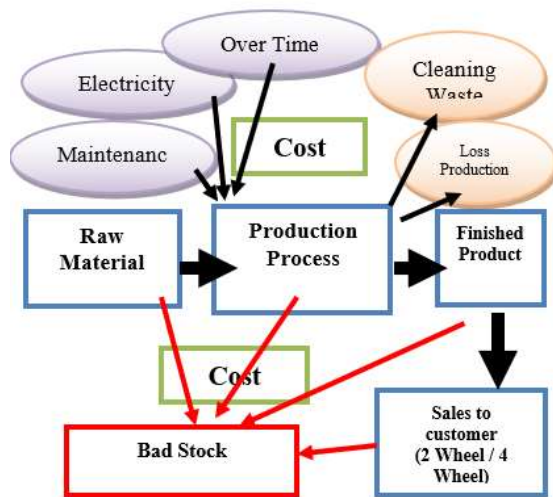


Fig 16. Input-Output Model

To analyse the relationship of all productivity criteria, the following is a description of the relationship chart of all productivity criteria that measured Fig. 16. In the pattern of relations, it is illustrated that the criteria for the amount of production affect the rise and fall of productivity of other criteria. The increase in production volume does not necessarily affect the increase in the productivity index of different criteria. Production activities should be influenced by the availability of raw materials, which in the process causes maintenance costs, electricity, over time, waste, and costs due to production losses. Temporary bad stock (B / C Stock) arises because of an excess inventory of raw materials, which causes expiration, excess damaged and expired finished products and products that fail in the production process.

From figure 16, it can also be obtained that bad stock can come from unused raw materials in the end, unacceptable production processes and final products that are damaged due to expiration. Also, available products that do not meet the specifications are then offered.

What if the company wants to improve productivity? Not only at the level of the production process such as the efficiency of electricity costs, overtime, waste, production losses, maintenance costs, but also the company must overcome the emergence of bad stock resulting from raw materials, damaged and expired products, and opinions from customers for various reasons.

4. Conclusion

Based on the results of the analysis of the productivity of the company that does not achieve the company targets, the lowest productivity occurred in March 2018, and there was a slight increase in April to June 2018. Based on the weighting of the criteria, the number of productions should affect other productivity aspects such as sales, employee overtime, raw materials, electricity, production loss, which occurs within the company. Still, the increase in production productivity does not affect other productivity. When production productivity rose, the productivity of other supporters decreased. These different conditions indicate that the productivity of the amount of production can continue to be improved and make more robust controls for other activities in line with production activities.

Further research advice is to conduct more in-depth research on factors that affect production productivity from the amount of production, to obtain the right correlation and make continuous improvements to other factors.

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