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Productivity Analysis and Improvement of The Ground Robusta Coffee Powder Production Process at Company XYZ Using the Objective Matrix Method

Gde Agung Ramanda Pinangguh[1], I Wayan Gede Sedana Yoga[2], Lutfi Suhendra[3]

[1,2,3]*Department of Agroindustrial Technology, Faculty of Agricultural Technology, Udayana University, Indonesia*

Abstract - *Productivity is the value given to the production capability of a company. XYZ Company is one of the producers of Balinese robusta coffee powder that has been established for more than 50 years. Nowadays the company has problems meeting the increasing market demand. This study aims to measure and analyze the company's productivity using productivity indicators that are considered important by experts so that they can be used as a benchmark for improving productivity in the company's production department. The objective matrix (OMAX) method is used to measure productivity helped with analytical hierarchy process (AHP) as tools to weighting the productivity indicators and Fault Tree Analysis (FTA) method to analysis the roots of productivity problem. Based on analysis using Trafict Light System (TLS) method, the company's productivity index in 2023 was categorized as low with an average score of 3,105 that caused by the low performance of all five productivity indicators. These indicators are the main factors contributing to the low company productivity index, with a total potential increase in the productivity index of 222.08%. The problems that cause the company's low productivity value are roasting machine downtime and the number of days of leave taken by production staff. To significantly increase productivity, the company is recommended to replace the current machine with a modern one, provide training for production staff, and utilize information technology (IT).*

Key Words: fault tree analysis, objective matrix, productivity, robusta coffee.

I. INTRODUCTION

Productivity is a value used to measure the performance of individuals, organizations, and companies [1]. Therefore, productivity is a crucial factor in determining the sustainability of a company in the future. It involves the utilization of resources (inputs) as efficiently as possible to produce or increase outputs in the form of goods and services effectively [2], [3].A company's productivity needs to be measured periodically to determine whether the company's performance level has met the established targets or standards[4]. One method that can be used to measure productivity is the objective matrix (OMAX) method. The objective matrix method is a partial productivity measurement method that is easy to implement, easy to understand, and flexible so that it can be adapted to the company's conditions and needs [5], [6]. The OMAX method can provide an overview of how effective the production process is and how efficient the utilization of resources is by the company [7].

XYZ Company is one of the producers of powdered robusta coffee in Bali Province that has been established for more than 50 years. The company has experienced difficulties where the increasing level of market demand has become difficult for the company to meet. According to [1], if a company experiences high profitability but is not balanced with high productivity, the company will not be able to maintain that level of profitability in the long term because low productivity can erode the company's profits. To determine the factors that affect productivity, productivity measurement can be carried out using the Objective Matrix (OMAX) method. In the OMAX method, a method is needed to determine the weight of each productivity indicator. The Analytical Hierarchy Process (AHP) method is used in this weighting to prevent misinterpretation of the importance of each indicator. Indicators that show the accumulation of the worst performance figures are analyzed using the fault tree analysis (FTA) method to find the root of the problem.

Measuring the productivity index at XYZ Company has several objectives. The objectives of this study are to determine the value of the productivity index of XYZ Company, to identify the factors that most influence the low performance value of the production department of XYZ Company, and to provide recommendations for improvements that XYZ Company must make to improve the productivity of its production department.

II. LITERATURE RIVIEW

2.1. Productivity

Productivity is a value assigned to the production capacity of an individual, organization, or company [1]. [8] states that productivity is defined as the result obtained from each production process that uses one or more production factors. Productivity is usually calculated as an index or ratio of output to input and can be expressed in physical and financial measures. A similar opinion was

also expressed by [9], productivity implies the concept of effectiveness and efficiency. In this regard, An organization is said to be productive if it achieves its goals, and achieves them by carrying out the transformation process of inputs into outputs at the lowest cost. Based on the explanation, the greater the ratio between the output produced and the input or commonly called the production factor of a production system, the higher the productivity value of the company.

2.2. Objective Matrix (OMAX)

The Objective Matrix (OMAX) productivity measurement model was developed by Prof. James L. Riggs (Department of Industrial Engineering at Oregon State University). Objective Matrix (OMAX) is a partial productivity measurement system developed to monitor productivity in each part of a company with suitable productivity indicators [6], [10].

Table-1: Objective Matrix Productivity Measurement Table

Productivity Indicator		1	2	3	4	5
Indicator Performance						
Achievement Level	10					
	9					
	8					
	7					
	6					
	5					
	4					
	3					
	2					
	1					
	0					
Indicator Achievement						
Weight						
Achievement Value						
Productivity Index						

According to [9],the OMAX model is simple and easy to understand, consisting of several parts, namely:

1. Productivity indicators: Show activities and factors that support productivity and are expressed as ratios.
2. Indicator performance: Performance value of each productivity indicators.
3. Achievement level: The value of each indicator performance determined by considering the highest, average, and lowest productivity values.
4. Indicator Achievement: These values are converted into values at the corresponding level.
5. Weights: Each indicator has a different influence on the level of productivity being measured, therefore, a percentage of importance must be included.
6. Achievement value: The sum of the indicator level value multiplied by the weight in a certain period.
7. Productivity index: The sum of indicator achievement in corresponding period.

The Objective Matrix (OMAX) categorizes the performance of each productivity indicator into 11 levels, ranging from level 0 to level 10. The reference levels are 0, 3, 8, and 10. The following formula is used to calculate the value of each level:

- Level 0 (The lowest achievement)
  The level is filled with the lowest achievement value of each productivity indicator.
- Level 3 (The average achievement)
  The level is filled with the average achievement value of each productivity indicator.
- Level 8 (Company's target achievement)
  The level is filled with the company's normal target achievement, which is 30% of the average indicator's achievement value of the productivity indicator. Level 8 can be calculated using the following formula:
  Level 8 = (Average achievement value × 0,3) + average achievement value
- Level 10 (Maximum achievement)
  The level is filled with the company's maximum target achievement, which is 30% of the highest indicator's achievement value of the productivity indicator. Level 10 can be calculated using the following formula:
  Level 10 = (Highest achievement value × 0,3) + average achievement value
- Level 1-2, 4-7, 9
  The level is filled using the interpolation formula between the reference level values above and below. These levels can be calculated using the following formula:
  Level 1-2 = ((Level 3-Level 0))/(3-0)
  Level 4-7 = ((Level 8-Level 3))/(8-3)
  Level 9 = ((Level 10-Level 8))/(10-8)

2.3. Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) is a decision support method developed by Dr. Thomas L. Saaty in 1970. AHP is a method for measuring factors arranged in a hierarchical structure for decision-making using a feedback assessment method [11]. Productivity indicators selected by experts are then weighted by distributing questionnaires to experts to determine the priority value comparison between one productivity indicator and another. The results of the questionnaire are arranged in the form of a pairwise comparison matrix to calculate the eigenvalue and eigenvector. The eigenvalue of each pairwise comparison matrix from the assessment is calculated by dividing each cell in each matrix by the total comparison value in the same column as that cell. The eigenvector is calculated by summing all eigenvalue values in the same row and then dividing the result by the total number of productivity indicators. For the weighting results to be used, consistency testing and iteration must be carried out first. Productivity weights are considered consistent if the Consistency Ratio (CR) is less than 10%.

The Consistency Index (CI) and Consistency Ratio (CR) can be calculated using the following formula:

- CI = ((λ max – n))/(n-1)
  Description:
  λ max = The sum of the multiplication of each indicator's eigenvector and the sum of cell value of the corresponding indicator.
  n = The number of productivity indicators used.
- CR = CI/RCI
  Description:
  RCI = Random Consistency Index.

The productivity indicator is considered reliable, and we can proceed to the next step if the Consistency Ratio (CR) is less than 10% (0.1). If the CR exceeds 10%, we kindly request the respondent to reconsider their answers. The corresponding random consistency index (RCI) values for different matrix sizes are provided in Table 2.

Table 2. Random Consistency Index

Matrix Size	*Random Consistency Index* (RCI)
1	0.00
2	0.00
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

After passing the consistency test, all pairwise comparison matrices from the experts' assessments can be used to calculate the weights of the productivity indicators. All pairwise comparison matrices are combined by calculating the geometric mean. The geometric mean is the result of multiplying each corresponding priority comparison value from the experts, then taking the root of the product to the power of the number of matrices. The geometric mean can be calculated using the following formula:

$$\text{Geomean} = \sqrt[n]{X_1 \times X_2 \times \ldots \times X_n}$$

The resulting geometric mean values will be used to create a new pairwise comparison matrix, from which the eigenvalue and eigenvector will be calculated. The eigenvector can then be used as the weight of the productivity indicator after iterating until there is no difference between the obtained eigenvector and the eigenvector from the previous iteration.

2.4. Traffic Light System (TLS)

The Traffic Light System (TLS) is a method that simplifies the assessment of company performance using three color categories: red, yellow, and green. These color categories are determined based on discussions with the company and are used to evaluate performance against set targets. The definitions for each color, as established by the company, are as follows:

- Red: Scores/levels between 0 and 3, indicating performance below target and unsatisfactory.
- Yellow: Scores/levels between 4 and 7, indicating adequate performance but not reaching the maximum target.
- Green: Scores/levels between 8 and 10, indicating very good performance that has met or exceeded the maximum target.

2.5. Fault Three Analysis (FTA)

Fault tree analysis (FTA) is an analytical method used to explore the occurrence of undesired events with the aim of identifying the root cause. A root cause analysis using FTA method will be conducted if the company's productivity index is deemed suboptimal. [12] Building a fault tree involves six stages as follows:

1. Determining the undesired event.
2. Understanding the system operation
3. Constructing the fault tree
4. Collecting quantitative data
5. Evaluating the probability in the fault tree
6. Analyzing the calculation results.

Considering that a fault tree is a graphical representation of the relationship between specific events and the top undesirable event, the creation of a fault tree will require several common symbols as depicted in Table 3 below.

Table 3. Fault Tree Symbol

Symbol	Name	Description
	Top Event	Events that require further elaboration
	Intermediate Event	Failure events leading to the Top Event
	Basic Event	Failure as the root of the problem.
	Undeveloped Event	Failure that cannot be analyzed further due to insufficient data
	External Event	Event that expected to occur normally and are not included in failure events.
	AND Gate	Output occur if all of root events happen
	OR Gate	Output occur if one or all of root events happen

No	Bulan	Production Input and Output Data in 2023						
		1 (ton)	2 (hour)	3 (ton)	4 (hour)	5 (ton)	6 (hour)	7 (hour)
1	January	54.632	1.914	72.230	1.860	47.874	0	440
2	February	45.053	1.751	61.653	1.704	47.770	0	400
3	March	50.962	1.826	62.856	1.938	49.724	80	460
4	April	54.261	1.652	70.524	1.740	48.080	60	400
5	May	70.564	1.975	88.230	1.938	50.725	10	460
6	June	48.487	1.805	68.162	1.860	40.400	60	440
7	July	56.001	1.809	59.017	1.818	50.630	20	420
8	August	57.827	1.953	66.450	1.938	52.830	10	460
9	September	52.453	1.819	53.311	1.818	51.600	10	420
10	October	52.107	1.878	55.480	1.860	48.620	10	440
11	November	57.938	1.898	59.855	1.860	52.532	10	440
12	December	59.904	1.871	63.663	1.818	71.600	0	420
Total		660.189	22.151	78.1431	22.152	612.385	270	5.200

III. RESEARCH METHOD

This research was conducted at XYZ Company, located in Buleleng Regency, Bali Province. Data was collected by accessing the company's historical data and conducting interviews with three experts: the factory supervisor, the company's general manager, and an academic expert in the field of productivity. Productivity indicators were determined through brainstorming with the experts, and the performance of these productivity indicators was then calculated on a monthly basis based on the company's historical data for 2023. The performance values of each productivity indicator were processed and analyzed using the Objective Matrix (OMAX) method to determine the monthly performance of each productivity indicator and obtain the company's productivity index value in 2023. The OMAX method was integrated with the Analytical Hierarchy Process (AHP) method, which was used as a tool to weight each productivity indicator. The level of achievement of the productivity index will be evaluated using Traffic Light System (TLS) method to determine whether corrective actions are needed for the company's production process, and then an analysis of the root causes of the low performance values of each indicator was conducted using Fault Tree Analysis (FTA). Solutions to the root causes of the company's low performance or productivity will be sought by conducting a literature review.

IV. RESULTS AND DISCUSSION

4.1. Productivity Indicators and Input-Output Data

Productivity indicators employed in the Objective Matrix (OMAX) methodology are selected based on the availability of historical input and output data. A literature review and expert brainstorming were conducted to determine the most suitable indicators. Table 4 presents the specific productivity indicators and their corresponding functions used in this research.

Table 4. Productivity Indicators

No	Productivity Indicator	Function
1	$\frac{\text{production quantity (1)}}{\text{Actual Labor Working Hour (2)}}$	Measuring labor efficiency
2	$\frac{\text{production quantity (1)}}{\text{Material Usage Quantity(3)}}$	Measuring material usage efficiency
3	$\frac{\text{Actual Labor Working Hour (2)}}{\text{Standart Labor Working Hour (4)}}$	Measuring labor working hour effectiveness
4	$\frac{\text{Production Quantity(1)}}{\text{Production Plan (5)}}$	Measuring production effectiveness
5	$\frac{\text{Machine Maintenance Total Hour (6)}}{\text{Machine Total Working Hour (7)}}$	Measuring machine downtime

The data used to calculate the monthly performance of each productivity indicator at XYZ Company is the historical output and input data for the robusta coffee powder production process from January to December 2023. Table 5 presents the data used for calculating the company's productivity.

Table 5. Productions Input and Output Data in 2023

4.2. Productivity Indicator Weight Calculation with Analytical Hierarchy Process (AHP) Method

The weighting is carried out by distributing a pairwise comparison questionnaire to several experts and then processed using the Analytical Hierarchy Process (AHP) method. Table 6 shows the calculation results from the expert's judgement regarding the importance of each productivity indicator, in the form of eigenvalues and eigenvectors.

Table 6. Productivity Indicators Experts Judgement Eigenvalue

Indicator	Eigenvalue					Sum	Eigenvector
1	0,1231	0,1374	0,1015	0,1260	0,0960	0,5840	11,68%
2	0,3398	0,3790	0,3611	0,3862	0,4302	1,8963	37,93%
3	0,1776	0,1537	0,1464	0,1170	0,1997	0,7944	15,89%
4	0,2617	0,2628	0,3352	0,2678	0,1978	1,3253	26,51%
5	0,0977	0,0671	0,0559	0,1031	0,0762	0,4001	8,00%

After obtaining the eigenvalues and eigenvectors, calculations were performed to determine the CR value. The calculation results show that the CR value of the pairwise comparison matrix in Table 5 is 0.0150. This CR value, which is below 10%, indicates that the eigenvector is consistent and can proceed to the iteration stage. The eigenvector value can be used when it shows consistent numbers after three iterations of eigenvector calculation. Table 7 shows the results of the eigenvector calculation in the third iteration, which is used as the weight for each productivity indicator.

Table 7. Productivity Indikator's Weight

Productivity Indicator	Weight
Indicator 1	11,63%
Indicator 2	37,98%
Indicator 3	15,88%
Indicator 4	26,57%
Indicator 5	7,93%

4.3. Productivity Indicator Performance Calculation

The monthly indicator performance of each indicator is calculated based on the company's historical data in

2023. Table 8 shows the performance values of each productivity indicator.

Table 8. Performance of Each Productivity Indicator in 2023.

Month	Productivity Indicator Performance in 2023				
	1	2	3	4	5
January	28,5434	0,7564	1,0290	1,1412	0,0000
February	25,7298	0,7307	1,0276	0,9431	0,0000
March	27,9093	0,8108	0,9422	1,0249	0,1739
April	32,8456	0,7694	0,9494	1,1286	0,1500
May	35,7288	0,7998	1,0191	1,3911	0,0217
June	26,8626	0,7114	0,9704	1,2002	0,1364
July	30,9569	0,9489	0,9950	1,1061	0,0476
August	29,6094	0,8702	1,0077	1,0946	0,0217
September	28,8359	0,9839	1,0006	1,0165	0,0238
October	27,7462	0,9392	1,0097	1,0717	0,0227
November	30,5259	0,9680	1,0204	1,1029	0,0227
December	32,0169	0,9410	1,0292	0,8366	0,0000

4.4. Calculation of the Value of Each Level and Productivity Index Using the Objective Matrix (OMAX) Method

The value of each level in the objective matrix is calculated based on the monthly performance values of productivity indicators. These values are considered to calculate the productivity index of XYZ Company. The indicator achievement of each indicator is obtained by considering its achievement level. The productivity index is obtained by summing the achievement value of each indicator. The achievement value of an indicator is the result of multiplying the indicator achievement of each indicator by its weight. Below is Table 9, which shows one of the monthly productivity index calculations using the Objective Matrix (OMAX) method.

Table 9. Productivity Measurement in January 2023

Productivity Indicator		1	2	3	4	5
Indicator Performance		28,5434	0,7564	1,0290	1,1412	0,0000
Achievement Level	10	1,2791	0,6595	1,8085	0,0000	0,0000
	9	1,1936	0,6798	1,6115	0,0181	0,0181
	8	1,1082	0,7000	1,4146	0,0362	0,0362
	7	1,0571	0,7600	1,3493	0,0393	0,0393
	6	1,0059	0,8200	1,2840	0,0424	0,0424
	5	0,9548	0,8800	1,2187	0,0455	0,0455
	4	0,9036	0,9400	1,1534	0,0486	0,0486
	3	0,8525	1,0000	1,0881	0,0517	0,0517
	2	0,8054	1,0097	1,0043	0,0925	0,0925
	1	0,7584	1,0194	0,9205	0,1332	0,1331
	0	0,7114	1,0292	0,8366	0,1739	0,1739
Indicator Achievement		1,9645	0,9568	0,0124	3,8123	10,0000
Weight		11,63%	37,98%	15,88%	26,57%	7,93%
Achievement Value		0,2285	0,3634	0,0020	1,0130	0,7934
Productivity Index		2,4003				

All productivity values of each period in 2023 were calculated using the Objective Matrix (OMAX) method and then compiled into a table. Table 10 is a compilation of the achievement values of each indicator per month, which is used to determine whether an analysis to find root causes of the problem is necessary.

Table 10. Achievement Value

Month	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5	Productivity Index
January	0,2285	0,3634	0,0020	1,0130	0,7934	2,4003
February	0,0000	0,1566	0,0257	0,3375	0,7934	1,3132
March	0,1770	0,8027	0,6296	0,5968	0,0000	2,2061
April	0,5309	0,4687	0,6105	0,9617	0,0466	2,6184
May	0,7170	0,7140	0,1646	2,0303	0,6981	4,3241
June	0,0920	0,0000	0,5549	1,2532	0,0731	1,9732
July	0,4090	1,8554	0,4897	0,8703	0,3429	3,9673
August	0,3151	1,2713	0,3504	0,8235	0,6981	3,4583
September	0,2522	2,1152	0,4681	0,5702	0,6891	4,0948
October	0,1637	1,8412	0,3187	0,7452	0,6938	3,7626
November	0,3812	1,9971	0,1427	0,8573	0,6938	4,0721
December	0,4774	1,7964	0,0000	0,0000	0,7934	3,0672
Average	0,3120	1,1152	0,3131	0,8382	0,5263	3,1048

Based on the analysis using the Traffic Light System (TLS), the average productivity index of the production department stands at 3,1048, indicating a productivity performance as it falls within levels 3 and 4. However, given its proximity to level 3, there is a need for improvements to optimize productivity. Consequently, a Fault Tree Analysis (FTA) should be conducted on all productivity indicators to pinpoint the root causes of their suboptimal performance.

4.5. Problem Analysis Using Fault Tree Analysis (FTA) Method

The low productivity index of the company in 2023 was identified as the top event (TE) and its root causes were sought from each productivity indicator, which served as intermediate events (IE). A brainstorming session with experts involved in previous stages was conducted to identify these causes. Two basic events (BE) were found to be the root problems: the number of leaves taken by production staff (BE1) and the downtime of the roasting machine (BE2). The hierarchical relationships between these events were structured into an FTA diagram and their probabilities were calculated. Table 11 presents the data on the number of leaves of production staff, working days of production staff, downtime hours, and roasting machine usage hours, which were used to calculate the probabilities of basic event 1 (BE1), basic event 2 (BE2), and the top event (T).

Table 11. Basic Event Data

Month	Number of Leave Days	Number of Working Days	Downtime (Hour)	Machine Usage Working Hour
January	23	222	0	440
February	16	204	0	400
March	37	231	80	460
April	30	210	60	400
May	26	231	10	460
June	23	222	60	440
July	17	219	20	420
August	27	231	10	460
September	18	219	10	420
October	20	222	10	440
November	17	222	10	440
December	21	219	0	420
Average	275	2652	270	5,200

The data used to calculate the probability of (BE 1) was the roasting machine downtime data and the machine

usage time. The following is the calculation of the probability value for (BE 1):

P (BE 1) = 270/5.200
= 0,0519

The data used to calculate the probability of (BE 2) was the number of leaves taken by production staff and the number of working days of production staff. The following is the calculation of the probability value for (BE 2):

P (BE 2) = 275/2652
= 0,1037

After obtaining the probability values for each basic event (BE), the probability for each intermediate event (IE) was calculated. The value of IE is obtained by calculating the probability value of the related BE. An IE related to a single BE will have the same probability value as that BE, whereas an IE related to more than one input will be calculated according to the logic gate calculation. Since (IE 2) and (IE 5) are only related to (BE 1), the probability value of (IE 2) and (IE 5) is 0.0519. (IE 1), (IE 3), and (IE 4) are related to both (BE 1) and (BE 2) using an OR logic. Therefore, their probability values are the sum of the probability values of (BE 1) and (BE 2). The following is the calculation of the probability values for (IE 1), (IE 3), and (IE 4):

IE 1 = 0,0519 + 0,1037

IE 3 = 0,0519 + 0,1037

IE 4 = 0,0519 + 0,1037

After obtaining all data, including the hierarchical arrangement of all events and their interrelationships, a Fault Tree Analysis (FTA) diagram can be constructed. Figure 5 presents the FTA diagram for the company's low productivity index.

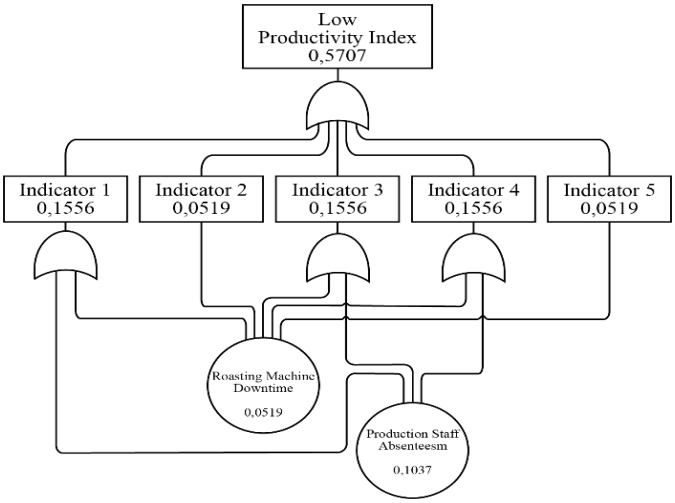

Figure 1. FTA Diagram of Company's Low Productivity Index

Based on the data in Figure 1, the fault tree analysis diagram resulting from brainstorming with experts, it can be seen that all productivity problems identified from the five productivity indicators examined originated from two basic events or primary factors: roasting machine downtime and the number of leaves taken by production staff. The high downtime is due to the relatively old age of the roasting machine currently in use, resulting in many parts of the machine no longer functioning optimally or being damaged. Therefore, the machine requires frequent maintenance, causing downtime. Frequent downtime can cause production staff to be unproductive, especially those working in the roasting section. The number of leaves taken by production staff is also a root problem because the staff working in the factory are burdened with productivity targets and take overtime due to reduced production capacity as a result of staff taking leave. High working hours cause employees to experience fatigue, which has a negative impact on the physiological and mental health of the workforce, leading to a decrease in productivity [13].

4.6. Improvement Sugestion

After identifying the root causes of the low productivity index, the next step is to find solutions to address these problems. Problem-solving is done by brainstorming and conducting a literature review to find solutions relevant to the company's conditions. The following are recommendations for improving the company's production process:

1. The problem of downtime on the roasting machine can be overcome by replacing the current roasting machine with a modern one. This technological upgrade can reduce downtime due to machine maintenance and repairs. This can happen because spare parts and expert technicians for newer machines are easier to find than for the current machine. According to [14], the utilization of effective technology can increase productivity. Modern machines with the latest technology are more efficient in terms of energy, raw materials, and labor in the production process because modern technology is already supported by automation systems, so it can produce products that meet the expected quality and quantity.
2. The problem of a large number of leaves taken by factory staff can be addressed by providing training and development for production staff. According to [15], providing training to the workforce can increase company productivity due to an increase in the workforce's ability to carry out production activities and handle various problems faced in the field. The distribution of training must be done fairly to be effective in achieving the desired performance level. In addition, the company must also utilize information technology (IT) such as enterprise resource planning (ERP) and artificial intelligence (AI). The utilization of IT can significantly increase

company productivity as it can facilitate communication, decision analysis, and completing repetitive and time-consuming tasks [16].

If the problems of downtime on the roasting machine and the large number of leaves taken by factory staff can be optimally resolved, the company's productivity index has the potential to increase by 222.08% in the following years.

V. CONCLUSION AND SUGGESTION

Based on the measurement and analysis of productivity in the company's production process using the Objective Matrix (OMAX) method, the following conclusions and recommendations can be drawn.

5.1. Conlusion

1. The productivity index values of the production department in company XYZ from January to December 2023 were as follows: 2,400, 1,313, 2,206, 2,618, 4,324, 1,973, 3,967, 3,458, 4,095, 3,763, 4,072, and 3,067. The highest productivity achievement was in May, while the lowest was in June. The average productivity index for 2023 was 3,105.

2. Factors affecting the low productivity of the production department were downtime of the roasting machine and the number of leaves taken by production staff. High downtime disrupted the company's production process as it could cause production staff to be unable to carry out production activities. Production staff taking leave could burden the working staff, thereby increasing overtime hours.

3. Recommended Improvements for the Company: To mitigate the recurring issue of roasting machine downtime, it is recommended that the company invest in a modern, technologically advanced replacement for the current aging machine. This strategic upgrade is expected to enhance overall production efficiency and effectiveness, ensuring consistent output that adheres to quality and quantity standards. Additionally, to optimize labor productivity, particularly during periods of staff absence, the implementation of information technology solutions, such as Enterprise Resource Planning (ERP) and Artificial Intelligence (AI), is strongly suggested. Concurrently, a comprehensive training and development program for production staff should be established to elevate their capabilities and overall performance.

5.2. Suggestion

Based on the findings of this research, it is recommended that the company implement the recommended productivity improvements and continue to conduct periodic productivity measurements and analyses. These results can then be used as a reference for future productivity planning.

REFERENCES

[1] V. Gasperz, *Manajemen Produktivitas Total Srategi Peningkatan Bisnis Global*. Jakarta: PT Gramedia Pustaka Utama, 1998.

[2] N. I. Douw, M. S. Maarif, and L. M. Baga, "Peningkatan produktivitas kerja karyawan development di tambang bawah tanah DMLZ (Deep mill level zone) PT. Freeport Indonesia," *Jurnal Aplikasi Bisnis dan Manajemen*, vol. 7, no. 2, pp. 316–329, 2021, doi: 10.17358/jabm.7.2.316.

[3] T. Coelli, D. S. P. Rao, C. J. O'Donel, and G. E. Battese, *An introduction to efficiency and productivity analysis*, 2nd ed. New York: Springer New York, 2005. doi: https://doi.org/10.1007/b136381.

[4] P. Fithri and R. Yulinda Sari, "Analisis pengukuran produktivitas perusahaan alsintan CV. Cherry Sarana Agro," *Jurnal Optimasi Sistem Industri*, vol. 14, no. 1, pp. 138–155, 2015, doi: https://doi.org/10.25077/josi.v14.n1.p138-155.2015.

[5] Adianto, A. Saryatmo, and A. Gunawan, "Analisis pengukuran kinerja perusahaan dengan metode performance prism dan scoring objective matrix (OMAX) pada PT. BPAS," *SINERGI*, vol. 18, no. 2, pp. 61–70, 2014, doi: https://dx.doi.org/10.22441/sinergi.

[6] D. Fajar and A. Nugroho, "Pengukuran produktivitas lantai produksi menggunakan metode objective matrix (OMAX) dan fault tree analisis (FTA)," *Jurnal Ilmiah Teknik Mesin, Elektro dan Komputer*, vol. 3, no. 2, pp. 165–179, Jul. 2023, doi: 10.51903/juritek.v3i2.1674.

[7] N. Damariandini, B. A. Harsojuwono, and I. K. Satriawan, "Analisis produktivitas produksi keripik tempe 'sagu' UD. Arya Putra Surabaya dengan menggunakan metode objective matrix (OMAX)," *Jurnal Rekayasa dan Manajemen Agroindustri* , vol. 11, no. 3, pp. 443–455, 2023, doi: https://doi.org/10.24843/JRMA.2023.v11.i03.p12.

[8] Eric Louis Kohler, *Kohler's Dictionary for Accountants*. 1983.

[9] W. Minto, *Produktivitas untuk teknik industri*. Sidoarjp: Dian Samudra, 2008.

[10] D. Avianda and Y. Yuniati, "Strategi peningkatan produktivitas di lantai produksi menggunakan metode objective matrix (OMAX)," *Reka Integra*, vol. 1, no. 4, pp. 202–213, 2014.

[11] T. L. Saaty, "The modern science of multicriteria decision making and its practical applications: The AHP/ANP approach," *Oper Res*, vol. 61, no. 5, pp. 1101–1118, Sep. 2013, doi: 10.1287/opre.2013.1197.

[12] N. A. Wessiani and F. Yoshio, "Failure mode effect analysis and fault tree analysis as a combined methodology in risk management," in *IOP Conference Series: Materials Science and Engineering*, Institute of Physics Publishing, Apr. 2018. doi: 10.1088/1757-899X/337/1/012033.

[13] K. F. Kodrat, "Hubungan kelelahan dengan produktivitas tenaga kerja pabrik kelapa sawit PT. X Medan," *Jurnal Intelektualita: Keislaman, Sosial dan Sains*, vol. 11, no. 2, pp. 181–186, Sep. 2022, doi: 10.19109/intelektualita.v11i2.13689.

[14] S. R. Ningsih, "Pengaruh teknologi terhadap produktivitas tenaga kerja di Indonesia," *Benefit: Journal of Bussiness, Economics, and Finance*, vol. 2, no. 1, pp. 1–9, Feb. 2024, doi: 10.37985/benefit.v2i1.341.

[15] G. Gumilar, "Pengaruh pelatihan terhadap peningkatan produktivitas kerja karyawan pada PT. Raya Sugarindo Inti Tasikmalaya," *Jurnal Ilmiah Manajemen dan Bisnis*, vol. 19, no. 1, pp. 55–63, Apr. 2018, doi: 10.30596/jimb.v19i1.1804.

[16] A. G. Abri and M. Mahmoudzadeh, "Impact of information technology on productivity and efficiency in Iranian manufacturing industries," *Journal of Industrial Engineering International*, vol. 11, no. 1, pp. 143–157, Mar. 2015, doi: 10.1007/s40092-014-0095-1.

AUTHORS BIOGRAPHY

First Author – Gde Agung Ramanda Pinangguh is a final year student of Agroindustrial Technology, Faculty of Agricultural Technology, Udayana University, Bali, Indonesia.

Second Author – I Wayan Gede Sedana Yoga, S.TP., M.Agb. ia a lecturer of Department of Agroindustrial Technology, Faculty of Agricultural Technology, Udayana University, Bali, Indonesia.

Third Author – Dr. Ir. Lutfi Suhendra, M.P. is a lecturer of Department of Agroindustrial Technology, Faculty of Agricultural Technology, Udayana University, Bali, Indonesia.