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Performance measurement design using objective matrix (Case study: an egg-laying chicken farming)

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Abstrak

Increased demand and quality pressures are affecting businesses, as experienced by an Egg Laying Chicken Farming, a small and medium-sized enterprise (SME) Poultry Farm located in Salo Subdistrict, Kampar Regency, Riau Province. Previously, performance evaluations were solely based on monthly egg product sales. Therefore, this research aims to analyze the potential and constraints, and to prioritize strategies for business owners by comprehensively measuring business performance, thus allowing for the provision of suitable strategic recommendations. The measurement model is based on several indicators such as Productivity of Laying Hens, Effective Working Hours, Ratio of defect product, Equipment Productivity, and Productivity of Labor Involved, using the Objective Matrix (OMAX) method. The measurement results are analyzed using the Traffic Light System (TLS) to identify the ratio of indicators that fall below the standards set by the business owner, allowing for further analysis to obtain useful strategic recommendations for future productivity improvement.

1. INTRODUCTION

The livestock industry in Indonesia can greatly contribute to the country's economic growth (Purwadi et al., 2022). Poultry, especially laying hens, is a very important livestock product. It provides a cheap and easy-to-find source of animal protein (Purwadi et al., 2022).

The consumption of chicken meat and its processed products has been known in Indonesia since even before independence and has become an integral part of daily life for the people (Nurcholis et al., 2009). Laying hens, on the other hand, began to be known around World War II. The laying hens raised by Indonesian people at that time differed in terms of productivity compared to those imported from abroad. Previously, domestic chickens or native chickens could only produce around 46 eggs per year, while imported laying hens could produce 180 eggs per year. However, with the increasing market demand and the development of crossbreeding technology, domestic laying hens are now capable of producing over 250-300 eggs per year. Continuous efforts

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are being made to develop technology and productivity to compete with imported laying hens in terms of production capacity (Nurcholis et al., 2009).

According to the data from Badan Pusat Statistik (BPS), Riau Province produced 6,725.20 tons of eggs in 2023. This figure represents an 182% increase compared to the previous year, which was approximately 2,380.91 tons in 2022 (Badan Pusat Statistik, 2024). The high demand for egg products is one of the primary factors driving business owners to develop crossbreeding science and technology to improve the productivity of laying hens. This has also spurred the growth of the poultry business in Kampar Regency. According to statistics from the Riau Provincial Statistics Agency, Kampar Regency itself experienced a 2% increase in the production of poultry and layer eggs, from 41,229.1 tons in 2022 to 42,053.67 tons in 2023 (Badan Pusat Statistik Provinsi Riau, 2024). The number of poultry companies nationwide has also been increasing every year. This data is considered based on the primary activities, namely grandparent stock breeding, parent stock breeding, and cultivation, as shown in Table 1 below.

Table 1 Number of Poultry Farms in Riau Province (Year 2021-2023)

Primary Activity - Poultry Farming	**Number of Poultry Farms by Primary Activity**		
	2021	**2022**	**2023**
Nursery - Grand Parent Stock (GPS)		4	4
Nursery - Parent Stock	49	74	80
Cultivation	132	172	173
Total	182	250	257

[Source: Processed from BPS data for 2024; (Badan Pusat Statistik, 2024)]

Based on the data in Table 1 above, it can be seen that the number of poultry farms has increased every year from 2021 to 2023. This growth and increase in the number of poultry farms indicate that this business is quite promising due to the large potential demand for egg products and its significant market share, especially in Riau Province. The increasing demand for a product such as eggs can serve as a motivation and encourage business owners to always maintain customer satisfaction in terms of product quality and production process optimization.

Product quality is related to the quantity of products produced and the number of defective or damaged products. Meanwhile, production optimization is linked to production targets and timely completion of production (Silalahi et al., 2014). This optimization can be achieved by increasing productivity and product quality through effective and efficient poultry farming management. Additionally, a business or entrepreneur also needs to measure and evaluate the output obtained to determine the level of achievement at a certain time (Jauhari et al., 2019).

One way to measure part of productivity is by using something called an "objective matrix" (Cici et al., 2024). This method puts together different work group standards into a chart. Each standard has a goal to make things more productive. So, using this method, we can measure overall productivity by looking at key performance indicators.

In this research, the Objective Matrix (OMAX) model was used to measure productivity. OMAX is a comprehensive productivity measurement system for monitoring the performance of each division in a company (Riggs, 1987). OMAX is also used to understand performance measurement results using the Traffic Light System, which serves as an indicator of whether a performance indicator value requires improvement or not (Alda T. , 2013). If the actual value is above the set target, it is given a green color. Conversely, if the actual value is below the target and outside the tolerance limit, it is given a red color. And if the actual value is below the target but still within the company's tolerance limit, it is given a yellow color (Ardianto et al., 2014).

Based on the aforementioned discussion, XYZ Egg Laying Chicken or Poultry Farm, the subject of this study, has never conducted a comprehensive productivity measurement. As a result, the evaluation of the farm has solely relied on monthly production and evaluation results. Therefore, this research aims to provide an overview of XYZ Poultry Farm's productivity and suggest improvements to enhance future productivity. The final output of the productivity measurement using OMAX is a productivity index for each performance indicator, including laying hen productivity, effective working hours, ratio of defective products, equipment productivity, and labor productivity at XYZ Poultry Farm.

2. METHODS

The research methodology encompasses the sequential steps undertaken to quantify the productivity levels and formulate strategies to augment productivity within XYZ Egg Laying Chicken. The researcher adopts a scoring system adapted from the Objective Matrix (OMAX) methodology, complemented by the Traffic Light System that serves as a visual cue to denote whether a performance indicator necessitates rectification. Through a comprehensive analysis of proposed enhancements congruent with the company's context, the objective is to elevate the overall productivity.

The steps or flow of the research can be visualized in Fig. 2 as follows.

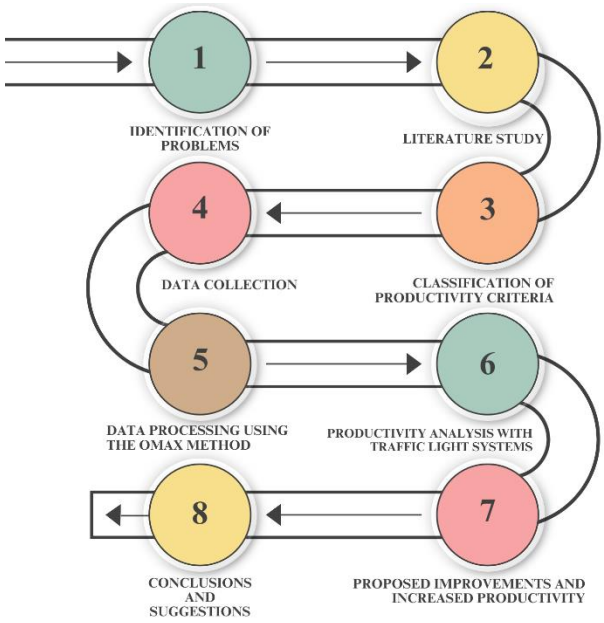

Fig. 1 Research Flow

For a more comprehensive explanation, please refer to the following sub-sections which elaborate on the research steps:

Problem Identification Stage

This research initially focuses on identifying the problems faced by XYZ Farm. XYZ Farm, the case study in this research, has never conducted a comprehensive productivity measurement before, the researcher aims to conduct a more thorough measurement. The objective is to analyze the farm's performance and provide recommendations to improve its productivity.

Literature Study Stage

To achieve this goal, the researcher conducted a literature review by examining various journals and articles related to productivity measurement using the OMAX method. The researcher studied the concept of productivity and the stages involved in improving productivity, namely measurement, evaluation, planning, and improvement (Silalahi et al., 2014).

Productivity Criteria Classification

This stage represents the initial step in the corporate performance measurement using the OMAX methodology. The classification of productivity criteria is tailored to the organizational units within Barokah Farm. The outcome of this criteria identification will serve as performance indicators to be evaluated, thereby yielding a measurement of the company's performance and productivity. In this research, the productivity criteria or performance indicators refer to three primary criteria: efficiency, effectiveness, and inferential criteria (Silalahi et al., 2014). Regarding the criteria in this research, they are summarized into the following criteria:

1. *Productivity of Laying Hens*

$$\text{Productivity of Laying Hen} = \frac{\text{Total produk Total products produced (item)}}{\text{Production yield standards (item)}} \times 100\%$$

2. Effective Working Hours

$$\text{Effective Working Hours} = \frac{\text{Actual Working Hours (hour)}}{\text{Total Working Hours (hour)}} \times 100\%$$

3. Ratio of Defect Product

$$\text{Ratio of Defect Product} = \frac{\text{Actual Number of Defective Products (items)}}{\text{Total Production Amount (items)}} \times 100\%$$

4. Equipment productivity

$$\text{Equipment productivity} = \frac{\text{Actual Downtime (hours)}}{\text{Tools and Machine Working Hours (hours)}} \times 100\%$$

5. Productivity of Labor Involved

$$\text{Productivity of Labor Involved} = \frac{\text{Total Production Amount (items)}}{\text{Number of Direct Labor (people)}} \times 100\%$$

Data Collection Stage

At this stage, data was collected through observation and interviews with company management. The data collected includes total production output (both good and defective products), the number of employees, energy consumption, machine operating hours, and production planning data.

Data Processing Stage Using the OMAX Method

Data processing using this method involves the calculation of productivity ratios, the determination of targets and weights for each criterion as discussed and determined by the company management, the establishment of performance standards and scales, and finally, the measurement of performance indicators (productivity index). A general outline of performance measurement using OMAX consists of the following steps:

1. Preparation *measurement performance record sheet*.
2. Calculation of class/level for each indicator.
3. Calculation of actual scores and performance values with OMAX.
4. Scoring system using *Traffic Light System*.

Measurements with OMAX consist of three groups (Setiowati, 2018). The groups consist of productivity criteria, performance levels, and scores, weights, and values. These are arranged in a matrix called a measurement performance record sheet. The structure of the matrix can be seen in the following Fig. 2.

Fig. 2 Measurement Record Sheet

Productivity Analysis Using Traffic Light System

The Traffic Light System (TLS) analysis is employed to determine whether an indicator or criterion has achieved a realistic target or if performance improvement is necessary. The TLS serves as a signal, indicating whether the value of a performance indicator or Key Performance Indicator requires improvement (Alda T. K., 2013). If the actual value exceeds the set target, it is marked green; conversely, if the actual value falls below the target and is outside the tolerance limit, it is marked red; and if the actual value is below the target but still within the company's tolerance limit, it is marked yellow.

3. RESULT AND DISCUSSION

Data Collection

This sub-chapter presents the data collection conducted at XYZ Layer Chicken Farm, a micro, small, and medium-sized enterprise (MSME). After conducting in-depth interviews with the company's management, raw data was obtained for the research period of October-November 2024. The collected data was then processed according to the productivity criteria classification presented in the previous sub-chapter. Furthermore, the company owner determined the performance targets, optimistic values, and pessimistic values. The results of the data collection can be seen in the following Table 2.

Table 2 Data Collection

Indicator	Performance	Target (level 3)	Optimistic Values (level 10)	Pessimistic Value (level 0)
Productivity of Laying Hens	83%	85%	90%	75%
Effective Working Hours	67%	65%	80%	60%
Ratio of defect product	98%	95%	100%	97%
Equipment productivity	98%	97%	100%	80%
Productivity of Labor Involved	58%	50%	65%	55%

Source: Processed from data obtained at the company

The weighting for each indicator was calculated based on a questionnaire distributed to the owner and all employees. The weighting results can be seen in the following table.

Table 3 Weighting of Each Indicator

	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5	Total
Owner	5	4	4	3	3	19

Staff 1	4	3	3	3	3	16
Staff 2	4	3	3	3	3	16
Total	**13**	**10**	**10**	**9**	**9**	**51**
Weight (Indicator/Total*100%)	0,2549	0,1960	0,1960	0,1764	0,1764	1

Performance Measurement Using OMAX

In this sub-chapter, the Measurement Performance Record Sheet is constructed, and the class or level of each indicator is calculated based on the data presented in the table. Additionally, the interval between the Optimistic Value and the Target, and the interval between the Target and the Pessimistic Value are calculated. A summary of the data processing using OMAX can be seen in Table 4.

Table 4 Performance Measurement Using OMAX

KPI	**Indicator 1**	**Indicator 2**	**Indicator 3**	**Indicator 4**	**Indicator 5**
Performance	**83%**	**67%**	**98%**	**98%**	**58%**
10	**90%**	**80%**	**99%**	100%	**65%**
9	89,2857%	77,8571%	98,5714%	99,5714%	62,8571%
8	88,5714%	75,7143%	**97,8571%**	99,1429%	60,7143%
7	87,8571%	73,5714%	97,1429%	**98,7143%**	**58,5714%**
6	87,1429%	71,4286%	96,4286%	98,2857%	56,4286%
5	86,4286%	69,2857%	95,7143%	97,8571%	54,2857%
4	85,7143%	**67,1429%**	95,0000%	97,4286%	52,1429%
3	85%	65%	95%	97%	50%
2	**81,6667%**	63,3333%	95,6667%	91,3333%	51,6667%
1	78,3333%	61,6667%	96,3333%	85,6667%	53,3333%
0	75%	60%	97%	80%	55%
Level (score)	2	4	8	3	7
Weight	0,254902	0,1960784	0,1960784	0,176470588	0,1764706
Value	**0,5098039**	**0,7843137**	**1,5686275**	0,529411765	**1,2352941**

Scoring System Using Traffic Light System

The level of each indicator is obtained from the final calculation compared to the performance of each indicator. Using the Traffic Light System, indicators can be categorized to determine whether an indicator or criterion has achieved a realistic target or if performance improvement is necessary. A green color is given if the actual value exceeds the set target, a yellow color is given if the actual value is below the target but still within the company's tolerance limit, and a red color is given if the actual value is below the target and outside the tolerance limit. The results of the scoring system can be seen in Table 5.

Table 5 Tabel Scoring System Using Traffic Light System

KPI	**Indicator**	**Value**	**Level**	**Category based on TLS**
I-1	Productivity of Laying Hens	0,509803922	2	Red
I-2	Effective Working Hours	0,784313725	4	Yellow
I-3	Ratio of defect product	1,568627451	8	Green
I-4	Equipment productivity	0,529411765	5	Yellow
I-5	Productivity of Labor Involved	0,529411765	7	Yellow

Productivity Analysis

The results of the recapitulation of performance values have been obtained as in the table above. The overall company performance graph can be seen in Fig. 3 below.

Fig. 3 Overall Performance

From the OMAX value scoring of each indicator, it was found that the Productivity of Laying Hens (I-1) indicator had the lowest performance value. I-2 was at level 2 with a red indicator, meaning the indicator's performance currently does not meet the standards and productivity targets desired by the company owner. Meanwhile, the Effective Working Hours (I-2), Equipment Productivity (I-4), and Productivity of Labor Involved (I-5) were at levels 4, 5, and 7, respectively. This level indicates that these three indicators fall into the yellow category, meaning the indicators have not yet met the set performance targets but are still tolerable for the company. For the Ratio of Defect Product indicator (I-3), it obtained the best performance value and was at level 8. I-3 is the only indicator that falls into the green category, meaning the performance of I-3 has met the company's expectations.

4. CONCLUSION

The overall performance measurement of XYZ Egg Laying Chicken Farm is sufficient to meet the company's operational needs, although only the Ratio of Defect Product (I-3) indicator surpassed the company's performance target. The Productivity of Laying Hens (I-1) indicator, however, remains below the company's standard, necessitating improvements to enhance its performance. A suggested solution is to improve egg production by implementing a cutting-edge system that monitors cage cleanliness using integrated sensors and IoT technology. For future research, the same methodology can be applied to different case studies. Moreover, for data processing such as weighting each indicator, software can be utilized to obtain more accurate results faster compared to manual calculations, especially when dealing with a large number of indicators.

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