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Measuring Productivity in Food SME Using The APC Method

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ABSTRACT

Objective: *This research was conducted due to the condition of the company which was only founded in June, so that in July the company received few orders and in the following month, namely August, the company received quite a lot of orders and so this research uses a base period in September because the company received 500 orders. pcs and in October the company received a decrease in orders so it experienced a decrease in profits. Therefore this research aims to measure the company's productivity and profitability based on changes in labor, material, energy, capital and total input at UD. Lontong Irfan.* ***Method:*** *The method used involves calculating productivity and profitability indices as well as evaluating price improvement indices to evaluate the impact of changes in input costs.* ***Results:*** *The analysis results show that labor productivity remains stable despite an increase in wages, while material profitability has increased but productivity has decreased. Energy and capital productivity remained stable with no decline in profitability. Although total input productivity decreased, profitability increased, highlighting the complexity of the influence of input variables on a company's overall performance.* ***Novelty:*** *This study provides an in-depth view of how variations in different input factors such as labor, material, energy, and capital simultaneously affect productivity and profitability within a newly established company context, emphasizing the nuanced relationship between cost efficiency and performance outcomes.*

INTRODUCTION

Productivity is the main pillar for a company's sustainability, meaning that increasing productivity refers to efforts to improve efficiency and outcomes in an activity or process, which reflects the company's success in carrying out its production process. The level of productivity indicates the extent to which a company is effective in utilizing its resources and funds to produce products. In a highly competitive business environment, productivity becomes a key factor for a company's success. Productivity is closely related to the company's ability to efficiently and effectively utilize its resources (inputs) to generate outputs [1].

Productivity measurement plays a crucial managerial role at various economic levels. In general, productivity measurement can be categorized into three types of comparisons: first, a comparison between current performance and past performance; second, a comparison of performance between different units, such as labor, materials, energy, and capital, which reflects relative achievement; and third, a comparison between current performance and predetermined targets [2]. Measuring productivity is the first step in the productivity cycle, aimed at assessing the company's current productivity level. The next step is productivity evaluation, which is the process of assessing the results of productivity measurement. At this stage, comparisons are often made between the company's productivity levels from one period to another, or among the factors that

influence productivity values. The goal is to identify the root causes of any decrease or increase in the company's productivity level. Through this productivity evaluation, an analysis of the company's productivity development from one period to the next can be obtained [3].

Total productivity represents the results of all elements used in creating the final output, including raw materials, labor, energy, capital, and other factors involved in the process [4].

A micro-enterprise refers to an entity owned by an individual or a sole proprietorship that meets the requirements stipulated by law [5]. One of the food-related MSMEs is UD. Lontong Irfan, which produces *lontong* (rice cakes) and is located in Durung Bedug Village, RT 9 RW 2, Candi, Sidoarjo. This *lontong* is quite popular among both local and non-local consumers, particularly among *lontong kupang* (clam rice cake) vendors. One of the problems faced by this MSME is the suspected lack of total productivity, which includes labor, materials, capital, and energy. This business employs 10 workers, producing 500 pieces of *lontong* daily, with 26 working days per month. In the previous two months, the partner experienced a 50% decline in profit. In October 2023, the profit was IDR 7,466,000, while the normal monthly profit standard is around IDR 14,849,000. Based on this issue, an analysis of the problem is necessary.

Several previous studies have been used to support this research, including Setiawan's [6] study on the implementation of the Objective Matrix (OMAX) method for productivity measurement at PT. ABC; Novrigent's [7] research on the application of the American Productivity Center (APC) model as a determinant of productivity improvement focus; and Kusumanto's [8] study on the productivity analysis of PT. Perkebunan Nusantara V (PKS) Sei Galuh using the American Productivity Center (APC) method. The results of the productivity measurement indicated a decline in the company's productivity index, caused by the amount of inputs used in the production process being significantly higher than the output produced. Therefore, the company needs to optimize its production process so that the increase in fresh fruit bunches (FFB) processed is positively correlated with production output.

The OMAX method itself is only used to calculate partial productivity; therefore, this research does not apply the OMAX method but instead uses the APC method, as this study focuses on total productivity, including labor, capital, energy, and raw materials.

RESEARCH METHOD

This research was conducted at UD. Lontong Irfan, located in Durung Bedug Village, RT 9 RW 2, Candi, Sidoarjo. The study was carried out over a period of six months. In this research, data were collected using a quantitative method to solve the case study conducted at UD. Lontong Irfan, through which information related to the research problems was obtained.

Observation was conducted by paying attention to every activity carried out in the field section, recording data from these observations, and identifying the main focus of the study to obtain the required data, including productivity data and opportunity

analysis. Through this observation, the objective was to measure productivity in micro, small, and medium enterprises (MSMEs).

Interviews were conducted with employees. The interviewees were selected from individuals directly involved in the issues that became the focus of this research. The interviews consisted of several questions, and the information obtained from the interviews was recorded as relevant data. The interview results included information about productivity and the types of challenges affecting productivity improvement in MSMEs.

The secondary data required involved a literature review, conducted by gathering all information related to the research problem from various theories and references that could serve as supporting materials.

A. American Productivity Center (APC)

The American Productivity Center (APC) model indicates that, to produce a productivity index, the total output and input per period are multiplied by the base period prices. Meanwhile, to create a profitability measure, the total output and input for each period are multiplied by the prices applicable during that period. Furthermore, to generate a price improvement measure, the cost per unit and prices for each year are multiplied by the total output and input in the relevant period [6].

The reason for choosing and using the APC method is that it allows the calculation of three productivity metrics—productivity index, profitability index, and price improvement index—which can provide more detailed information about the sources of a company's profitability growth [9].

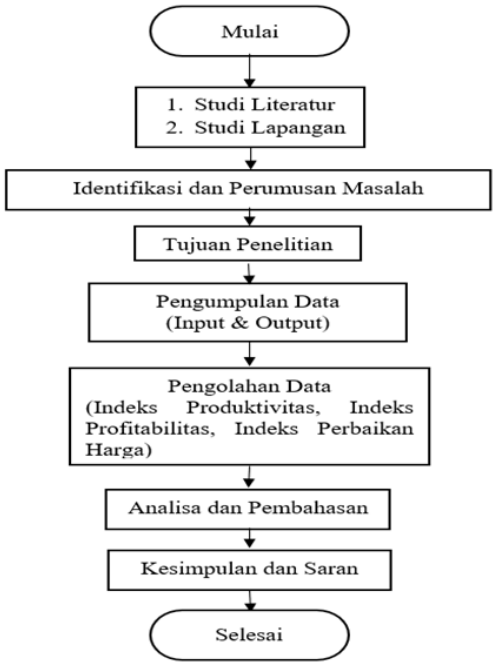

Figure 1. Research Flowchart.

The productivity level is calculated by comparing the total output with the total input. Inputs consist of main raw materials and production inputs, while outputs include

production results measured in monetary value (rupiah). The total productivity level of the company is calculated using the following equation:

$$\text{Total Productivity Index} = \frac{\text{Total Output}}{\text{Total Input}} \text{ x } 100\% \quad (1)$$

Source: [10].

Profitability is calculated using productivity and factors (price improvement) through the following formulas:

$$\text{Profitability} = \frac{\text{Sales Revenue}}{\text{Total Cost}}\% \quad (2)$$

Source: [10]

$$\text{Profitability} = \frac{\text{Total Output x Price per Unit}}{\text{Total Input x Cost per Unit}}\% \quad (3)$$

Source: [10]

$$\text{Profitability} = \frac{\text{Total Output}}{\text{Total Input}} \text{x} \frac{\text{Price}}{\text{Cost}} \quad (4)$$

Source: [10]

In the APC method, several key steps need to be understood, including the following:

1. The total output and input for each year are multiplied by the base-year prices to create the productivity index.
2. The prices and cost per unit for each year are multiplied by the total output and input for that specific year to generate the price improvement index for that year. This price improvement index illustrates the changes in input costs relative to the company's output prices. The relationship between these measures is represented by the following formula:

$$\text{Productivity Index (PI)} = \frac{\text{Profitability Index (PFI)}}{\text{Price Improvemnet Index (PII)}} \quad (5)$$

Source: [11]

$$\text{Profitability Index (PFI)} = \frac{\text{Total Output}}{\text{Total Input}} \text{ x } 100\% \quad (6)$$

Source: [12]

$$\text{Price Improvement Index (PII)} = \frac{\text{Profitability Index}}{\text{Productivity Index}} \quad (7)$$

Source: [13]

3. The cost per unit of labor, raw materials, and energy is calculated directly, while the calculation of capital input involves combining total depreciation and profit relative to total assets (including fixed assets and working capital) used. Thus, the capital input for a given period can be calculated as the result of combining total depreciation and profit relative to the total assets used during that period, as follows:

Capital Input = Depreciation in that period + (Base Return on Asset × Current Assets Used)

The Return on Asset (ROA) in the base period is determined as follows:

$$\text{ROA} = \frac{\text{Profit in Base Period}}{\text{Total Value in Base Period}} \quad (8)$$

Source: [14]

$$\text{ROA} = \frac{Profit\ in\ Base\ Period}{(Fixed\ Assets + Working\ Capital)\ in\ Base\ Period} \quad (9)$$

Source: [15]

RESULTS AND DISCUSSION

A. Output Index, Input Index, and Productivity Index for the September–October Period

To determine the output index, input index, and productivity index for the months of September and October, the calculated data for output, input, and productivity index are used as follows.

1. Measuring the output index, input index, and productivity index for the September–October period.

Table 1. Output Index, Input Index, and Productivity Index for the September–October Period.

	Description	At Constant Price		Index Number		Change
		Period 1	Period 2	Period 1	Period 2	Period 2 - Period 1
Total Output	Total Output	Rp 20,321,000,-	Rp 21,014,400,-	1.000	1.034	+0.034
	Labor Input	Rp 10,400,000,-	Rp 11,440,000,-	1.000	1.100	+0.100
	Material Input	Rp 9,386,000,-	Rp 9,625,000,-	1.000	1.025	+0.025
	Energy Input	Rp 570,000,-	Rp 694,400,-	1.000	1.218	+0.218
	Capital Input	Rp 45,000,-	Rp 755,000,-	1.000	16.778	+15.778
	Total Input	Rp 20,321,000,-	Rp 21,014,400,-	1.000	1.034	+0.034
Productivity	Labor	1.000	1.000	100.00%	1	0,000
	Material	0.968	0.967	100.00%	1	-0,001
	Energy	1.000	1.000	100.00%	1	0,000
	Capital	1.000	1.000	100.00%	1	0,000
	Total	0.985	0.972	100.00%	1	-0,014

Based on the calculation in Table 1, labor productivity in October did not experience any increase or decrease (0.000), which occurred because labor input increased by (0.100). Material productivity decreased by (0.001) due to an increase in material input by (0.025). Energy productivity showed no increase or decrease, as energy input increased by (0.218). Capital productivity also did not experience any change (0.000), even though capital input significantly increased by (15.778). Meanwhile, total input productivity decreased by (0.014), as the total input reached a value of (0.034).

B. Output Index, Input Index, and Profitability Index for the September–October Period

To determine the output index, input index, and profitability index for the months of September and October, the calculated data for output, input, and profitability index are used as follows.

1. Measuring the output index, input index, and profitability index for the September–October period.

Table 2. Output Index, Input Index, and Profitability Index for the September–October Period.

	Description	At Constant Price		Index Number		Change
		Period 1	Period 2	Period 1	Period 2	Period 2 - Period 1
Total Output	Total Output	Rp 20,321,000,-	Rp 21,014,400,-	1.000	1.034	+0.034
	Labor Input	Rp 10,400,000,-	Rp 11,440,000,-	1.000	1.100	+0.100
	Material Input	Rp 9,386,000,-	Rp 9,625,000,-	1.000	1.025	+0.025
	Energy Input	Rp 570,000,-	Rp 694,400,-	1.000	1.218	+0.218
	Capital Input	Rp 45,000,-	Rp 755,000,-	1.000	16.778	+15.778
	Total Input	Rp 20,321,000,-	Rp 21,014,400,-	1.000	1.034	+0.034
Productivity	Labor			84,996	84,996	0,000
	Material			87,763	87,879	0,115
	Energy			84,996	84,996	0,000
	Capital			85,00	84,996	0,000
	Total			86,247	87,444	1,197

Based on the calculations from Table 2, labor profitability in October did not experience an increase or decrease (0.000), which was due to an increase in labor input of (0.100). The material profitability decreased by (0.015) as a result of an increase in material input of (0.025). Energy profitability did not experience any increase or decrease because energy input increased by (0.218). Similarly, capital profitability did not experience any increase or decrease (0.000) due to a significant increase in capital input of (15.778). Meanwhile, the total input profitability decreased by (1.197), which was caused by a total input value of (0.034)

C. Profitability Index, Productivity Index, and Price Recovery Index for the Period of September–October

To determine the output index, input index, and price recovery index for the period of September and October, the calculated data on output, input, and price recovery index are presented as follows.

1. Measuring the Profitability Index, Productivity Index, and Price Recovery Index for the Period of September and October

Table 3. Profitability Index, Productivity Index, and Price Recovery Index for the Period of September–October.

No (1)	Input Factors (2)	Profitability Index (3)	Productivity Index (4)	Price Improvement Index (5) = (3) / (4)
1	Labor	84,996 (0,000)	100 (0,000)	99,150 -(0,850)
2	Material	87,763 (+0,115)	99,999 (-0,001)	99,094 -(0,906)
3	Energy	84,996 (0,000)	100 (0,000)	99,150 -(0,850)
4	Capital	85,000 (0,000)	100 (0,000)	99,150 -(0,850)
5	Total Input	86,247 (+1,197)	99,986 (-0,014)	99,125 -(0,875)

Based on the calculations in Table 3, it can be seen that the performance of UD. Lontong Irfan did not experience a decrease in productivity in the labor factor. Although labor wages increased in October, the profitability and productivity indices remained the same, resulting in a price recovery index of (0.850).

For material profitability, there was an increase of (0.115) due to the rise in raw material costs. However, in the material factor, there was a decrease in the productivity index value by (0.001). This decline in productivity is indicated by the price recovery index of material input, which is (0.906), showing a productivity decrease of 0.001%.

Energy productivity did not experience a decline in October, and the profitability index for energy also did not decrease, resulting in a price recovery index value of (0.850).

The capital factor also did not experience any increase or decrease in its profitability or productivity indices, resulting in a price recovery index of (0.850).

For the last factor, total input experienced a productivity decrease of (0.014), while the profitability index increased by (1.114), as indicated by a price recovery index value of (0.875).

D. Fishbone Diagram

To identify the factors causing fluctuations in productivity achievement within a company, a fishbone diagram—also known as a cause-and-effect diagram—is created as follows.

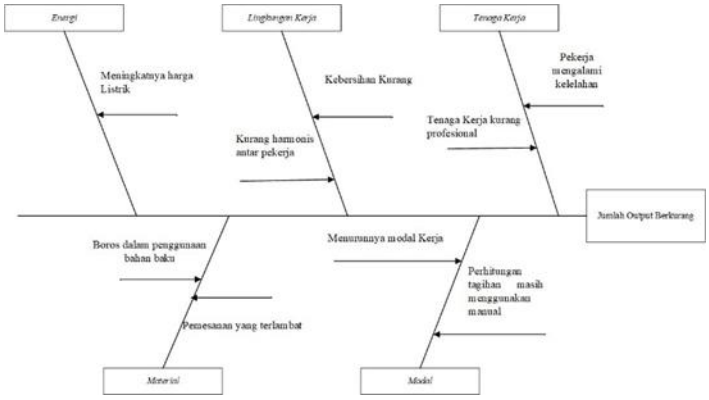

Figure 2. Fishbone Diagram.

Based on the diagram above, it can be concluded that the factors that need to be improved to increase productivity are that workers often tend to overlook work

discipline, and the company is expected to plan its working capital expenditures properly. Therefore, the company's productivity can improve over time.

E. Suggestions for Productivity Improvement

The following are proposed suggestions to enhance productivity within the company:

1. Provide guidance to workers to pay more attention to work discipline.
2. The company is advised to plan its working capital expenditures to prevent a decline in capital.

CONCLUSION

Fundamental Finding : Based on the calculation of labor productivity in October, there was no increase or decrease (0.000), which occurred because the labor input increased by (0.100) due to several workers requesting a salary raise. Material productivity experienced a decrease of (0.001) caused by an increase in material input of (0.025) due to rising material prices. Energy productivity also showed no increase or decrease, as energy input rose by (0.218) due to higher electricity costs. Capital productivity likewise did not experience any change (0.000), even though capital input significantly increased by (15.778), which was caused by higher raw material prices and a decline in orders. Meanwhile, the total input productivity decreased by (0.014), as total input reached a value of (0.034). Based on the calculation in Table 3, it can be seen that UD. Lontong Irfan did not experience a decline in productivity in the labor factor. Although labor wages increased during October, both the profitability index and productivity index remained the same, resulting in a price improvement index of (0.850). Material profitability increased by (0.115) due to the rise in raw material costs, while the productivity index for material decreased by (0.001). This decline in productivity is shown by the price improvement index of the material input, which was (0.906), resulting in a 0.001% drop in productivity. Energy productivity did not decrease during the October period, and the profitability index for energy also remained unchanged, resulting in a price improvement index of (0.850). For the capital factor, there was also no increase or decrease in either the profitability or productivity indices, yielding a price improvement index of (0.850). Finally, for the total input factor, productivity decreased by (0.014), while the profitability index increased by (1.114), as indicated by the price improvement index of (0.875). **Implication :** These results indicate that fluctuations in input costs—especially materials and capital—can significantly impact company profitability and productivity. Although labor productivity remained stable, increases in wages and material prices affected overall efficiency. Therefore, maintaining productivity stability requires balanced management between cost control and operational efficiency. **Limitation :** The research focuses only on one observation period (October) and one company, UD. Lontong Irfan, which limits the generalization of findings to other periods or companies. External economic factors, such as inflation or market demand fluctuations, were not analyzed in depth and may influence the results. **Future Research :** Based on the fishbone diagram, it can be concluded that the factors that

need to be improved to enhance productivity include workers often neglecting work discipline, and the company is expected to plan its working capital expenditures properly. It is recommended to provide guidance to workers to pay more attention to work discipline and for the company to plan its working capital expenditures carefully to prevent capital reduction. Future research may extend to multi-period productivity assessments or comparative studies across industries to identify broader productivity determinants and sustainability strategies.

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