

## Productivity analysis using method Murvin E. Mundel case study PT. Johan Sentosa

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**Abstract**—Productivity is an alternative to evaluating the performance that has been done even one of the most effective ways in assessing the efficiency of using several inputs in producing certain outputs. the study was conducted at PT Johan Sentosa. The company is engaged in processing palm oil into CPO (crude palm oil) and kernels. In this case, the company must replace an important process called the sterilizer system from the horizontal sterilizer to the vertical sterilizer. This change will certainly have an impact on company productivity. In this study, the method used is Marvin E Mundel where partial productivity will be identified in the form of depreciation value index, material, labor, energy, and maintenance, and know the total production value index. The results of this study obtained a partial productivity index on the declining workforce, other partial productivity such as depreciation, material, labor, energy, and maintenance have increased while the index value of total productivity increased after a change in the sterilizer system.

**Keywords:** *Partial productivity, total productivity, productivity index*

### I. INTRODUCTION

PT. Johan Sentosa, the company that engaged in processing palm oil into CPO (crude palm oil) and kernel. Behind a good processing process, of course, good machine maintenance is also carried out. There are times when the machine enters a period of having to be replaced because its lifetime has expired, so it is no longer economical to continue operating. The phase where we change machines will cause an increase in maintenance costs, the swelling affects the company's productivity because one of the inputs to the production value is maintenance costs. This occurred at the company PT Johan prosperous, where they have to replace an important process called system sterilizer of sterilizerhorizontal to sterilizervertical. The sterilizer itself is a combined process of material handling and boiling of palm fruit, where all raw materials that are ready to be processed are brought by the method lorry or conveyor to the boiling either in the form of the old horizontal or the new vertical at PT. This is Johan Sentosa. After the change in the system, the sterilizer author is interested in researching how the company's productivity is.

Application productivity analysis with the method of Marvin E. Mundel. As a tool to analyze the success of the company. The study has the objective to

calculate an index value of the company after the partial productivity system changes sterilizer and the index value of the total productivity of the company after the change sterilizes system.

### II. METHODS

The type of research conducted by the author is descriptive quantitative research, namely processing data in the form of numbers in a company or industry which later data will be collected and processed to provide useful information using mathematical formulations. So, this research includes the process of collecting, presenting, and processing data, as well as analysis and interpretation at PT. John Sentosa.

In productivity, there are input and output variables used for output and input, namely depreciation costs, energy costs, material costs, maintenance costs, labor costs, while the output variables are the amount of production, CPO prices, and kernel prices. The types of data used in this study are primary data and secondary data, namely in the form of what costs are used, and how much profit is obtained.

To perform productivity calculations using the Murvin E.Mundel Method, it is done after the data that can be collected.

1. Deflator Calculation
2. Constant Price Calculation
3. Output Aggregate Calculation
4. Partial Productivity Index Calculation

**III. RESULTS AND DISCUSSION**

The stages in the processing of the Murvin E. Mundel method are as follows:

**A. Partial Costs**

Table 1. Partial cost data

Period	Cost				
	Depreciation	Material	Workforce	Energy	Maintenance
Jan.	26.891.456	17.795.702.206	308.739.297	238.650.879	280.489.792
Feb.	24.766.014	15.429.708.800	321.875.148	156.765.189	200.963.680
Mar.	26.367.796	16.293.136.500	337.713.865	135.608.948	228.956.428
Apr.	37.503.261	17.459.008.000	368.364.008	142.193.069	375.860.437
Mei.	31.173.142	20.505.223.200	329.821.715	190.926.900	277.224.313
Jun.	37.377.583	22.982.365.080	387.276.201	151.822.238	204.969.299
Jul.	34.350.724	25.654.392.510	422.035.165	114.922.147	181.825.713
Aug.	37.583.350	22.763.680.460	408.850.929	106.395.595	148.730.090
Sep.	37.333.842	21.763.680.460	402.664.524	123.836.556	176.107.949
Oct.	41.307.494	22.573.912.000	421.835.658	142.976.071	203.120.179
Nov.	35.732.060	15.884.382.280	400.145.035	213.725.724	209.709.384
Dec.	36.224.916	14.884.382.280	566.770.403	185.808.990	238.310.482

Source: Mill Manager Report PT. Johan Sentosa 2018

**B. Price index data**

Table 2. BPS Riau 2018 Price Index Data

Period	The price index				
	Material	Workforce	Depreciation	Energy	Maintenance
18-Jan.	440.2	513.8	304.4	170.9	357.3
18-Feb.	435.7	514.1	320.6	171	357.3
18-Mar.	440.9	520	321.6	171.4	362.9
18-Apr.	440.8	520	321.7	170.7	362.9
18-Mei.	449.1	522.2	323.8	171.1	362.9
18-Jun.	464.6	533.3	325.7	172.3	380.5
18-Jul.	462.6	534.6	326.7	172.4	374.3
18-Aug.	465.6	546.5	327.6	173	376.8
18-Sep.	474.7	547.1	327.6	173.8	376.8
18-Oct.	477.9	547.8	331.7	174	376.8
18-Nov.	485.3	547.8	331.8	175.1	376.8
18-Dec.	497.3	560.2	334.4	176.5	376.8

Source: BPJS Riau in figures for the 2018 period

**C. Production data**

Table 3. Production Data of PT Johan Sentosa 2018

Period	CPO (kg)	Kernel (kg)
Jan.	2.559.943	442.816
Feb.	2.276.677	408.984
Mar.	2.466.249	540.850
Apr.	2.523.943	573.120
May.	3.154.600	683.550
Jun.	3.631.275	745.146
Jul.	4.454.243	932.226
Aug.	4.163.402	547.640
Sep.	3.902.599	648.792
Oct.	4.601.788	827.978
Nov.	3.691.841	745.066
Dec.	3.580.739	809.532

Source: Mill Manager Report PT Johan Sentosa 2018

**D. Average price of CPO and palm kernel oil**

Table 4. Average Price of CPO and Kernel Oil 2018

Period	CPO	Kernel
Jan.	7.779	7.204
Feb.	7.843	6.840
Mar.	7.925	5.748
Apr.	8.056	5.973
Jun.	7.733	5.821
Jul.	7.534	5.344
Aug.	7.004	5.056
Sep.	6.690	5.384
Oct.	6.822	5.725
Nov.	6.545	5.190
Dec.	6.014	4.116
Jan.	5.950	4.108

Source: Mill Manager Report PT. Johan Sentosa 2018

**E. Deflator calculation**

$$\text{Research month deflator} = \frac{\text{I. H Research month} - \text{I. H Base month}}{\text{I. H Base month}}$$

January depreciation example:

$$\text{January deflator} = \frac{\text{I. H Month January} - \text{I. H Month January}}{\text{I. H January}}$$

$$\text{January deflator} = \frac{304,4 - 304,4}{304,4} = 0$$

Table 5. Deflator value

Period	Depreciation	Material	Workforce	Energy	Maintenance
Jan.	0	0	0	0	0
Feb.	0.053	0.01	0.001	0.001	0
Mar.	0.057	0.002	0.012	0.003	0.016
Apr.	0.057	0.001	0.012	0.001	0.016
Mei.	0.064	0.02	0.016	0.001	0.016
Jun.	0.07	0.055	0.038	0.008	0.065
Jul.	0.073	0.051	0.04	0.009	0.065
Aug.	0.076	0.058	0.064	0.012	0.048
Sep.	0.076	0.078	0.065	0.017	0.055
Oct.	0.09	0.086	0.066	0.018	0.055
Nov.	0.09	0.102	0.066	0.25	0.055
Dec.	0.009	0.13	0.09	0.033	0.055

**F. Constant price calculation**

$$\text{Constant price} = \frac{\text{Research period value} \times 100}{100 + \text{Deflator}}$$

Example constant price depreciation Januari

$$\text{Constant price depreciation January} = \frac{\text{Score depreciation January} \times 100}{100 + \text{January}}$$

$$\begin{aligned} \text{Constant price depreciation January} &= \frac{26.891.456 \times 100}{100 + 0} \\ &= 26.891.456 \end{aligned}$$

Table 6. Constant price values

Period	Depreciation	Material	Workforce	Energy	Maintenance
Jan.	26.891.456	17.695.702.260	308.739.297	238.650.879	280.489.792
Feb.	24.766.014	15.429.708.800	321.875.148	156.765.189	200.963.680
Mar.	26.367.796	16.293.136.500	337.713.865	135.608.984	228.965.428
Apr.	37.503.261	17.459.008.000	368.364.088	142.193.069	375.860.437
Mei.	31.173.142	20.505.223.200	329.821.715	190.926.900	277.224.313
Jun.	37.377.583	22.982.365.080	387.276.201	151.822.238	204.969.299
Jul.	34.530.724	25.654.392.510	422.035.165	114.922.147	181.825.713
Aug.	37.583.350	22.837.440.360	408.850.929	106.359.595	148.730.090
Sep.	37.333.842	21.763.680.460	402.664.524	123.836.556	176.107.949
Oct.	41.307.494	22.573.912.000	421.835.658	142.976.071	203.120.179
Nov.	35.732.060	15.891.331.280	400.145.035	213.725.724	209.709.384
Dec.	36.224.916	14.884.382.280	566.770.403	185.805.990	238.310.482

**G. Calculation of total Resources Input Partial (RIP)**

RIP January Total = January Depreciation Constant Price + January Constant Material Price + January Constant Price of Labor + January Energy Constant Price + Maintenance Constant Price

$$\begin{aligned}
 \text{RIP Total January} &= \text{Rp } 26.891.456 + \\
 &\quad \text{Rp } 17.695.702.260 + \text{Rp } 308.739.297 + \text{Rp } 238.650.879 \\
 &\quad + \text{Rp } 280.489.792 \\
 &= \text{Rp } 18.550.473.684
 \end{aligned}$$

Tabel 7. Value Total Resources Input Partial (RIP)

Period	Price (Rp)
Jan.	18.550.473.684
Feb.	16.134.078.831
Mar.	17.021.783.537
Apr.	18.382.928.855
Mei.	21.334.369.270
Jun.	23.763.810.401
Jul.	26.407.706.259
Aug.	23.538.964.325
Sep.	22.503.623.331
Oct.	23.383.151.402
Nov.	16.750.643.483
Dec.	15.911.494.071

**H. Calculation of aggregate output**

Aggregate Output = (Amount of palm oil production in the month of research x selling price of CPO oil per kilogram) + (Number of kernel production in the month of research x selling price of kernel per kilogram)

$$\begin{aligned}
 \text{Agregat Output January} &= (2.559.943 \text{ kg} \times \text{Rp } 7.779 / \text{kg}) + (442.816 \text{ kg} \times \text{Rp } 7.204 / \text{kg}) \\
 &= \text{Rp } 23.103.843.061
 \end{aligned}$$

Table 8. Score output agregat

Period	Price (Rp)
Jan.	23.103.843.061
Feb.	20.653.428.271
Mar.	22.653.829.125
Apr.	23.756.130.568
Mei.	28.373.466.350
Jun.	31.340.086.074
Jul.	35.910.852.628
Aug.	30.801.653.140
Sep.	30.337.864.578
Oct.	34.415.908.280
Nov.	25.269.423.430
Dec.	24.630.954.506

**I. Partial productivity index calculation**

Example of depreciation productivity index January:

IP Depreciation

$$\begin{aligned}
 &= \frac{\text{AOMP}}{\frac{\text{AOBP}}{\frac{\text{RIMP}}{\text{RIBP}}}} \times 100
 \end{aligned}$$

$$\text{IP Depreciation} = \frac{\frac{\text{Output aggregate depreciation month January}}{\text{Output agregat depreciation month January}}}{\frac{\text{Input depreciation period month January}}{\text{Input depreciation period month January}}} \times 100$$

IP Depreciation

$$\begin{aligned}
 &\frac{23.103.843.061}{\frac{23.103.843.061}{26.891.456}} \times 100 = 100
 \end{aligned}$$

Table 9. Partial Productivity Index Value

Period	Depreciation	Material	Workforce	Energy	Maintenance
Jan.	100	100	100	100	100
Feb.	97.07	102.52	85.75	136.09	124.77
Mar.	100	106.49	89.64	172.56	120.12
Apr.	73.73	104.22	86.18	172.57	76.73
Mei.	105.94	105.98	114.96	153.51	124.26
Jun.	97.59	104.45	108.14	213.23	185.63
Jul.	121.05	107.21	113.71	322.78	239.77
Aug.	95.39	103.3	100.67	299.14	251.42
Sep.	94.58	106.77	100.68	253.06	209.14
Oct.	96.98	116.77	109.02	248.64	205.7
Nov.	82.31	121.79	84.39	122.13	146.29
Dec.	79.14	126.75	58.07	136.93	125.48

**J. Total productivity index calculation**

Table 10. Index Value Total Productivity

Period	Nilai
January	100,00
February	102,78
March	106,86
April	103,76
May	106,78
June	105,89
July	109,19
Agust	105,06
September	108,24
October	118,18
November	121,13

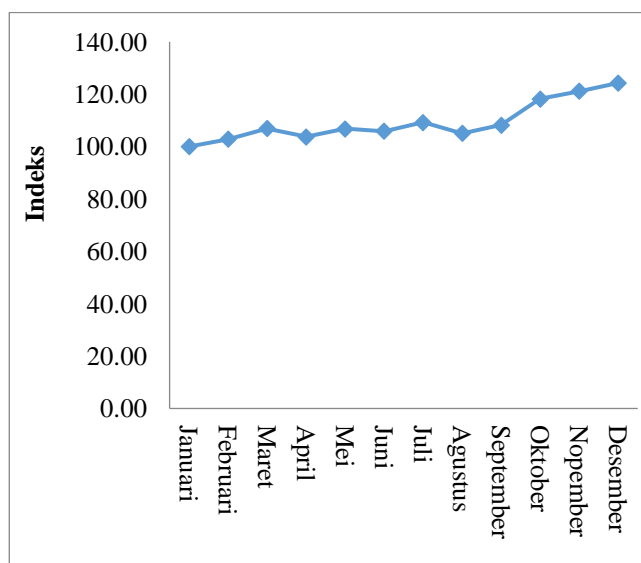


Figure 1. Total Productivity Indeks

**IV. CONCLUSION**

Based on data processing and analysis, the following conclusions can be drawn:

1. The company's partial productivity index after the sterilizer system change can be seen a decrease in labor productivity By setting January as the base

period, the index value for February is 85.75% and then March by 89.64% followed by April with 86.18% the highest productivity index was achieved in May at 114.9%, then June at 108.14% and July at 113.71%, continuing to August with a figure of 100.68% further to October at 109.02% and then November with 84.39% the lowest index occurred in December at 58.07%. due to the adjustment of the new system. While the index of parial productivity values such as depreciation, By setting January as the base period, February got the lowest index of 102.5%, March of 106.49%, then April with a value of 104.22%, followed by May at 105.98% and then June at 104, 45% then July at 107.21% continued to August at 103.30% then September 106.77% October at 116.77% November 121.79% The highest productivity index was achieved in December at 125.7%. materials, energy, and maintenance have increased.

2. The index of the company's total productivity value after the sterilizer system change has increased. This is in line with the company's goal of increasing productivity.

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