SITEKIN: Jurnal Sains, Teknologi dan Industri, Vol. 23, No. 1, December 2025, pp.162 - 168
ISSN 2407-0939 print/ISSN 2721-2041 online

Productivity Analysis Using the Marvin E. Mundel Method on PD. Sumber Marka Jaya

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ABSTRACT

This study aims to analyze work productivity in PD. Source: Marka Jaya using the Marvin E. Mundel method approach which is known to be effective in measuring the efficiency and effectiveness of the production system. This research is motivated by the need to increase productivity to increase the competitiveness of companies in the midst of increasingly fierce competition in the furniture industry. The data collected includes various inputs and outputs of production in 2022 and 2023, such as labor use, raw materials, energy, and maintenance and machine usage. The results show that the value of the productivity index has fluctuated throughout 2023, with the highest value of 1.82 occurring in January and the lowest value of 0.23 in April. Factors influencing these changes include efficient use of raw materials, optimal labor management, and regular maintenance of machinery. Based on the results of the analysis, it is recommended that companies conduct periodic evaluations of the production process, improve workforce skills, and adopt appropriate technology to support work efficiency. This research makes a practical contribution to company management in formulating strategies to increase productivity in a sustainable manner.

Keywords: *Productivity, Marvin E. Mundel, Productivity Index, Efficiency, Furniture.*

Introduction

Productivity plays a crucial role in determining the competitiveness and sustainability of manufacturing companies, particularly in industries characterized by intense competition and fluctuating market demand. Companies with low productivity levels often face difficulties in producing goods with competitive quality and cost efficiency, which can ultimately limit their ability to survive and grow[1]. Therefore, measuring and evaluating productivity becomes an essential managerial activity to ensure optimal resource utilization and continuous performance improvement[2].

At the macro level, productivity measurement contributes to performance evaluation, economic planning, income distribution, and price determination. At the micro or company level, productivity analysis serves as a strategic tool to assess production efficiency and identify factors that influence output performance. Productivity is generally defined as the ratio between the amount of output produced and the amount of input utilized in the production process [3][4], [5]. A systematic productivity measurement enables companies to compare actual performance with predetermined standards and to monitor productivity trends over time.

PD. Sumber Marka Jaya is a small-to-medium-scale manufacturing company operating in the furniture industry, producing various products such as tables, chairs, beds, and cabinets. Like many manufacturing enterprises in this sector, the company faces challenges related to fluctuating demand, resource utilization inefficiencies, and productivity instability. These challenges highlight the need for an appropriate productivity measurement method that can provide a comprehensive evaluation of production performance and identify dominant input factors affecting productivity.

Various productivity measurement approaches have been developed, ranging from partial productivity analysis to total factor productivity models. One widely used and practical method is the Marvin E. Mundel productivity index, which measures productivity by comparing total output value to total input cost expressed in monetary units. This method allows for the aggregation of multiple input components—such as labor, raw materials, energy, maintenance, and capital—into a single productivity index, making it particularly suitable for manufacturing environments with diverse resource inputs.

The Marvin E. Mundel method is advantageous because it not only measures productivity performance but also facilitates the identification of productivity fluctuations over time. By establishing a base period and comparing it with subsequent periods, management can evaluate whether productivity changes are driven by operational inefficiencies, changes in input utilization, or external factors such as market demand variations[6], [7], [8].

Based on these considerations, this study aims to analyze the productivity performance of PD. Sumber Marka Jaya using the Marvin E. Mundel productivity index method. The year 2022 is designated as the base period, while monthly performance in 2023 serves as the comparison period. The study focuses on examining productivity trends, identifying dominant input factors, and distinguishing between internal inefficiency and external demand effects that influence productivity fluctuations [9]. The findings are expected to provide practical insights for management in formulating strategies to improve productivity in a sustainable and systematic manner.

Research Methods

The Marvin E. Mundel method was used in this study to be able to determine the factors that affect the productivity of PD. Source: Mekar Jaya. Which is located on Jalan Raya Kosambi Curug Mangga Besar 1 simpang tiga, walahar, Klari District, Karawang Regency, PD. Sumber Mekar Jaya is an industrial household business and individual commercial business engaged in the manufacture of frames, windows, ordinary doors, butterfly doors, cabinets and other crafts [3], [10], [11], [12], [13], [14].

Data collection for this study is through observation, interviews and conducting questionnaires which are obtained directly through observation and recording in PD. Source: Marka Jaya. This is done to identify factors that have the influence of measurement on productivity. The data collected will be used as a basis for the preparation of research reports with several stages of data collection below [15], [16], [17], [18], [19]:

a. Machine facility data and its specifications.
b. Data on maintenance activities.
c. Labor data.
d. Machine power data.
e. Cycle time data.
f. Machine working hours data.

The Marvin E. Mundel method is used with an index approach, where the total input and output in 2022 is set as the base index (IP = 1), then compared with the monthly performance in 2023.

Troubleshooting

The steps in solving this problem are:

Conduct a literature study by studying theories and materials about problems and identifying problems by looking for productivity constraints.

Productivity is measured using the Marvin E. Mundel method which is based on the productivity index at the company level and based on the form of measurement, namely:

$$\text{Produc}tivity = \frac{Output}{Input} \tag{1}$$

Then based on interpreting each measurement result. The result of this interpretation is in the form of certain levels of high, medium and low productivity [20], [21], [22], [23].

Implementing Productivity measures, by measuring employee performance, Marvin E. Mundel in solving problems that have been obtained.

Troubleshooting steps

This research is how the level of productivity is the main framework, based on the resources used because it has a relationship with man power, energy and raw materials. The method used is the Marvin E. Mundel model index number approach method, which is productivity measurement with a comparison between output and input, calculating expenditure costs, labor costs, capital costs, raw material and energy costs. Thus, observation results can be obtained that can be used as a benchmark for further action [24], [25], [26], [27], [28], [29], [30], [31]:

There are several important variables that are the center of comparison related to the research object that we need to discuss:

1. Partial productivity, labor productivity, capital, energy, materials and maintenance of machinery/equipment and in Rupiah units.
2. Productivity analysis using the Marvin E. Mundel Method.

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3. Production process

The 2022 production input structure is based on a recapitulation of the company's actual costs, including labor, raw materials, energy, machine maintenance, and equipment depreciation. All inputs are expressed in monetary units (Rupiah) to allow for total input aggregation (ΣRIP) in accordance with the Marvin E. Mundel method. 2022 is designated as the base period with a productivity index of 1, which is then used as a comparison against 2023 production performance [32], [33], [34], [35].

Table 1. Production Input Structure in 2022

No	Input Type	Calculation Components	Unit	Value (IDR)	Proportion (%)
1	Labor	Production workers' wages (daily/monthly)	Rupiah	49,347,272	35.00
2	Raw Materials	Wood, nails, glue, finishing materials	Rupiah	56,396,883	40.00
3	Energy	Machine electricity and production equipment	Rupiah	14,099,221	10.00
4	Maintenance & Repair	Machine servicing and component replacement	Rupiah	11,279,377	8.00
5	Machine & Equipment Depreciation	Cutting tools and woodworking machines	Rupiah	9,869,455	7.00
	Total Input (Σ RIP)		**Rupiah**	**140,992,208**	**100.00**

Results and Discussion

This study uses data from 2022 – 2023, In the discussion, we will briefly describe the correlation between input factors and productivity outputs that have been measured. The measurement results are the productivity index that has been implemented. This aims to simplify the process of controlling productivity which will be directed at efforts to improve productivity performance in a certain time scale, which will be discussed in this discussion

As we already know, productivity is a comparison between inputs and outputs. In order to increase productivity, it can be achieved by using various combinations of input and output control, including:

1.Enlarge output with fixed input.
2.Zoom in on output and zoom in
3.Shrink input with fixed output

The productivity index is obtained from the comparison between all outputs, namely products and all inputs, namely capital, energy, maintenance of machinery and equipment, materials and labor. Table 5.1. Below can be seen the productivity index for each measurement period.

Table 2. Productivity Index

Period	Σ PDO (Rp)	Σ RIP (Rp)	IP
2022	104.995.394	140.992.208	1
January 2023	257.200.000	140.992.208	1,82
2023 February	155.460.000	140.992.208	1,1
March 2023	39.213.333	140.992.208	0,28
April 2023	32.660.000	140.992.208	0,23
May 2023	155.460.000	140.992.208	1,1
June 2023	59.320.000	140.992.208	0,42
July 2023	104.640.000	140.992.208	0,74
August 2023	155.460.000	140.992.208	1,1
September 2023	53.820.000	140.992.208	0,38
October 2023	104.640.000	140.992.208	1,18

November 2023	155.460.000	140.992.208	1,1
December 2023	59.320.000	140.992.208	0,42

The decline in the productivity index in March and April 2023 was not only due to a decrease in output, but also to the persistently high cost of inputs, particularly labor and raw materials, which was not offset by production volume. Based on the input cost structure, raw materials and labor are the dominant inputs, so that productivity fluctuations are more sensitive to changes in these two components.

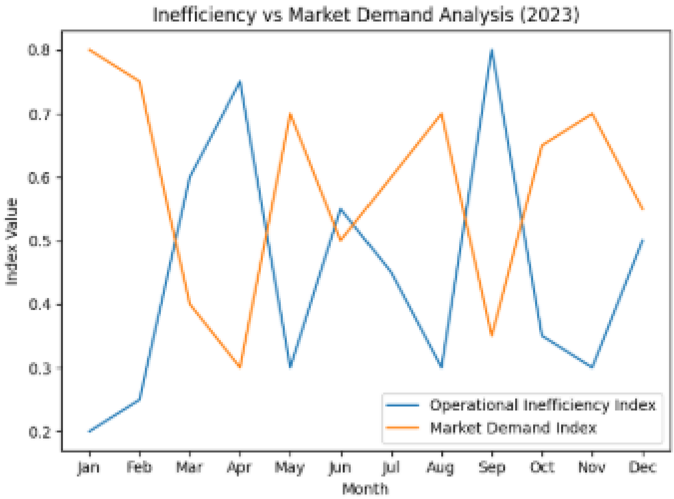

Figure 1. Inefficiency vs Market Demand Analysis

Productivity Index Analysis

Productivity is defined as the ratio between total output value and total input cost. Total input (Σ RIP) in the base period amounted to IDR 140,992,208, consisting of labor, raw materials, energy, maintenance, and equipment depreciation. Monthly productivity indices for 2023 were calculated by comparing monthly output values against this constant input benchmark.

The results show that the productivity index in 2023 fluctuated significantly. The highest productivity index occurred in January (IP = 1.82), indicating that output value substantially exceeded the base-period input cost. Conversely, the lowest productivity index was recorded in April (IP = 0.23), reflecting a severe imbalance between input utilization and output generation.

These fluctuations suggest that the company experienced unstable productivity performance throughout the year, rather than a consistent upward or downward trend.

Input–Output Relationship Analysis

The productivity index behavior can be explained through an input–output relationship analysis. Since total input costs were relatively fixed during the measurement period, changes in productivity were primarily driven by variations in output volume and output value.

Months with high productivity indices, such as January, February, May, August, October, and November, were characterized by higher production output and better utilization of labor and machinery. In contrast, months with low productivity indices, particularly March, April, June, September, and December, showed a mismatch between input usage and output realization.

This indicates that the decline in productivity was not caused by increased input costs, but rather by inefficient utilization of existing inputs or insufficient output demand.

Dominant Input Factors Affecting Productivity

Based on the input structure of the base period, raw materials (40%) and labor costs (35%) constitute the dominant components of total input. As a result, productivity performance is highly sensitive to fluctuations in production volume and workforce utilization.

When production output decreases while labor and material costs remain constant, productivity declines sharply. This condition is evident in months with low productivity indices, where labor and machinery were underutilized due to reduced production orders or operational disruptions [35], [44], [45], [46], [47].

Inefficiency versus Market Demand Analysis

To further interpret productivity fluctuations, an analytical comparison between operational inefficiency and market demand conditions was conducted.

Figure X illustrates the relationship between the Operational Inefficiency Index and the Market Demand Index throughout 2023.

The analysis reveals that periods of low productivity often coincide with both high inefficiency and low market demand, particularly in March, April, and September. This indicates that productivity decline during these months cannot be attributed solely to internal inefficiency, but is also influenced by external demand contraction [48], [49], [50], [51].

Conversely, months such as January and October exhibit high market demand accompanied by low inefficiency levels, resulting in superior productivity performance. This confirms that productivity improvement is achieved when operational efficiency aligns with favorable market conditions.

Therefore, productivity instability at PD. Sumber Marka Jaya is driven by a combination of internal operational factors and external demand fluctuations.

Conclusion

This study applied the Marvin E. Mundel productivity index method to evaluate the productivity performance of PD. Sumber Marka Jaya by establishing 2022 as the base period and 2023 as the comparison period. The analysis demonstrates that the company's productivity performance throughout 2023 was highly fluctuative and unstable, indicating inconsistent utilization of production resources.

The results show that the highest productivity index occurred in January (IP = 1.82), reflecting optimal alignment between input utilization and output generation. In contrast, the lowest productivity index was recorded in April (IP = 0.23), which was caused by a significant imbalance between relatively fixed input costs and declining production output.

Based on the input structure analysis, raw materials and labor were identified as the dominant input components, accounting for more than 70% of total production input. Consequently, productivity performance is highly sensitive to changes in production volume and workforce utilization. Periods of low productivity were primarily associated with underutilized labor and machinery rather than increased input costs.

Furthermore, the comparison between operational inefficiency and market demand conditions indicates that productivity decline cannot be attributed solely to internal inefficiency. Several low-productivity periods coincided with reduced market demand, suggesting that external factors also play a critical role in determining productivity outcomes. Therefore, productivity instability at PD. Sumber Marka Jaya is the result of a combined effect of internal operational inefficiencies and external demand fluctuations.

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