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PRODUCTION COSTS AND COST OF GOODS SOLD AS DETERMINANTS OF NET PROFIT: EMPIRICAL EVIDENCE FROM PULP AND PAPER MANUFACTURING COMPANIES ON THE IDX

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Abstract

Indonesia became the first ASEAN country to become an official partner of Hannover Messe three times, confirming its position as an emerging economic power and a major player in the global manufacturing industry. One of the strategic sectors that supports this position is the pulp and paper industry, where Indonesia ranks eighth in the world in pulp production and sixth in paper production. This study aims to determine Production Costs, Cost of Goods Sold (COGS), and Net Profit, and analyze the effect of Production Costs and COGS on Net Profit, both partially and simultaneously, in pulp and paper subsector manufacturing companies listed on the Indonesia Stock Exchange (IDX) for the period 2016–2024. The research method uses a quantitative approach with panel data processed through the EViews 13 application. From a population of 180 manufacturing companies on the IDX, 4 companies were selected by purposive sampling, namely PT Alkindo Naratama Tbk (ALDO), PT Indah Kiat Pulp & Paper Tbk (INKP), PT Suparma Tbk (SPMA), and PT Pabrik Kertas Tjiwi Kimia Tbk (TKIM), resulting in 36 observations. The Random Effect Model (REM) was selected as the best model. The results of the study indicate that Production Costs and COGS significantly influence Net Profit, both partially and simultaneously. The coefficient of determination shows an influence of 22.31%, while 77.69% is influenced by other variables outside the model.

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Introduction

The manufacturing industry is a key driver of the Indonesian economy, contributing significantly to GDP, employment, and global competitiveness. This sector even received international recognition when Indonesia was selected three consecutive times as an official partner of the Hannover Messe, signifying Indonesia's strategic position in the global supply chain. One crucial subsector is the pulp and paper industry, ranking Indonesia eighth in the world in pulp production and sixth in paper production. This achievement not only demonstrates the pulp and paper subsector's significant potential in supporting the national economy but also confirms its role in the international market. However, global industry dynamics, fluctuating raw material prices, changes in consumer consumption due to digitalization, and high production costs pose real challenges that can impact the stability of corporate profits in this subsector (Indonesia, 2022).

Net profit, as a key indicator of corporate performance, reflects a company's ability to manage revenue and costs. According to Kasmir, net profit is obtained after all costs and expenses are deducted from total revenue (Kasmir, 2018). Thus, achieving net profit is determined not only by sales volume, but also by the company's ability to control costs, particularly production costs and the cost of goods sold (COGS). Production costs include raw materials, direct labor, and factory overhead required in the product manufacturing process. Meanwhile, COGS reflects the total costs a company must bear to produce goods that are successfully sold. Increases in production costs and COGS without a balanced efficiency strategy will reduce net profit margins, making effective cost management key to the success of manufacturing companies, particularly in the pulp and paper subsector.

Financial report data from pulp and paper companies listed on the Indonesia Stock Exchange (IDX) for the 2016–2024 period shows significant fluctuations. For example, PT Indah Kiat Pulp & Paper Tbk recorded a net profit of IDR 202 billion in 2016, which increased rapidly to IDR 857 billion in 2022, but declined again to IDR 424 billion in 2024. Conversely, PT Alkindo Naratama Tbk experienced a sharp decline in net profit in 2023, reaching only IDR 2.4 billion from over IDR 100 billion in 2021, despite a significant increase in production costs from IDR 337 billion in 2016 to IDR 1.47 trillion in 2024. This pattern indicates an imbalance between production costs, COGS, and net profit, which are crucial for companies to improve efficiency and competitiveness.

Previous literature reviews have yielded mixed results regarding the effect of production costs and COGS on net profit. Research by Pinkan Kezia and Endang Wulandari (2024) found that production costs significantly impacted net profit in food and beverage companies listed on the IDX (Kezia & Wulandari, 2024). However, Aditya Ahmad Fathony and Yulianti Wulandari (2020) found a different finding, stating that production costs had no significant effect on net profit at PT Perkebunan Nusantara VIII (Fathony & Wulandari, 2020). Regarding COGS, research by Joko Priyadi et al. (2022) showed that COGS had a positive effect on net profit (Priyadi et al., 2022). However, Angelica Astra et al. (2024) found that COGS had no effect on net profit at PT Makmur Alam Seiwampu (Astra et al., 2024). These discrepancies indicate a research gap, necessitating further research to determine the

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relationship between production costs and COGS on net profit, particularly in the pulp and paper subsector, which is characterized by high capital intensity and high production complexity.

Based on this description, this study was conducted to analyze the effect of production costs and cost of goods sold on net profit in pulp and paper manufacturing companies listed on the Indonesia Stock Exchange for the 2016–2024 period. Explicitly, the objectives of this study are to: describe production costs, COGS, and net profit in pulp and paper sub-sector companies during 2016-2024, analyze the effect of production costs on net profit, analyze the effect of COGS on net profit, and simultaneously test the effect of production costs and COGS on net profit, so that it can provide academic and practical contributions in the development of cost management and financial strategies of companies in this sector.

Literature Review

Production costs are a crucial factor in determining a company's success in achieving profits. Production costs are defined as all expenses incurred to transform raw materials into finished goods ready for sale, including raw material costs, direct labor, and factory overhead (Carter, 2017). If production costs increase and are not offset by adequate revenue, the company's net profit margin will be squeezed. Hansen and Mowen (2015) emphasized that efficient production cost management is a crucial strategy for companies to survive in intense business competition. In other words, controlling production costs not only impacts a company's financial structure but also its competitiveness in the industry.

In addition to production costs, cost of goods sold (COGS) is also a key component influencing net profit. COGS reflects all costs inherent in products sold during an accounting period. Alam (2016) stated that COGS can be calculated using two approaches: subtracting ending inventory from goods available for sale or adding beginning inventory to net purchases and then subtracting ending inventory. The amount of COGS directly impacts gross profit, which ultimately affects net profit. If the selling price of a product is higher than the COGS, the company makes a profit; if it is lower, the company will incur a loss (Widjajanta, Widyaningsih & Tanuatmojo, 2017). Therefore, management is required to be able to control COGS to maintain profit margins.

Furthermore, net profit is the most frequently used benchmark for assessing company performance. Net profit is obtained after all costs, including production costs and COGS, are subtracted from revenue. According to Kasmir (2018), net profit is the primary indicator for assessing a company's operational success over a given period. A decrease in net profit can send a negative signal to business prospects, especially for investors who use profit as an indicator of investment viability. Rohman et al. (2024) added that decreasing profits often impact investor interest because they are perceived as reducing company value. Therefore, net profit not only reflects internal efficiency but also serves as an external factor determining a company's investment attractiveness.

Several previous studies have shown mixed findings regarding the relationship between production costs, COGS, and net profit. Research conducted by Kezia and Wulandari (2024) demonstrated that production costs significantly impact net profit in food and beverage

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companies listed on the Indonesia Stock Exchange. However, Fathony and Wulandari (2020) found different results, stating that production costs had no significant impact on net profit at PT Perkebunan Nusantara VIII. Regarding COGS, research by Priyadi, Michael, and Wardana (2022) showed a positive COGS effect on net profit, while research by Astra, Wijaya Lai, Pane, and Fahmi (2024) concluded that COGS had no significant effect. These differences in research findings suggest room for further research, particularly in the manufacturing sector, which is characterized by complex costs.

Based on theoretical analysis and previous research, it can be concluded that production costs and cost of goods sold are closely related factors in determining a company's net profit. Although some studies show conflicting results, the majority of empirical evidence supports that both variables influence financial performance. Therefore, efficient management of production costs and COGS is key to maintaining sustainable profitability, particularly in capital-intensive manufacturing companies such as the pulp and paper industry.

Research Methods

This study uses a quantitative method with a causal associative approach to analyze the effect of production costs and cost of goods sold on net profit in pulp and paper manufacturing companies listed on the Indonesia Stock Exchange (IDX) for the 2016–2024 period.

The data used are secondary data in the form of annual financial reports obtained from the official IDX website (www.idx.co.id) and company websites. The study population comprised all pulp and paper manufacturing companies listed on the IDX. Using a purposive sampling technique, four sample companies were selected: PT Alkindo Naratama Tbk (ALDO), PT Indah Kiat Pulp & Paper Tbk (INKP), PT Suparma Tbk (SPMA), and PT Pabrik Kertas Tjiwi Kimia Tbk (TKIM). A total of 36 observations were obtained (four companies × nine years).

The study variables consist of production costs (X1) and cost of goods sold (X2) as independent variables, and net profit (Y) as the dependent variable. Data analysis used panel data regression with EViews 13, as the data combined time series and cross-sectional dimensions.

The estimation model was selected using the Chow test, the Hausman test, and the Lagrange Multiplier test, with the results indicating that the Random Effects Model (REM) was the best model. Prior to the regression, hypothesis testing included a partial t-test, a simultaneous F-test, and the coefficient of determination (R^2) to measure the contribution of the independent variables to the dependent variable.

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Result and Discussion

Panel Data Model Estimation

Chow Test

Redundant Fixed Effects Tests
Equation: FEM
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	6.131595	(3,30)	0.0022
Cross-section Chi-square	17.215008	3	0.0006

Source: Eviews 13 output, processed by researcher, 2025.

Based on the results of the Chow test above, the cross-section probability value is 0.0006 < 0.05, so H1 means that the estimation with fixed effects is more appropriate than the common effect.

Hausman Test

Correlated Random Effects - Hausman Test
Equation: REM
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.080637	2	0.9605

Source: Eviews 13 output, processed by researcher, 2025.

From the table above, it can be seen that the cross-section probability value is 0.9605 > 0.05, meaning that the suitable model is an estimate with a random effect model rather than a fixed effect model.

Lagrange Multiplier Test

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	12.73249 (0.0004)	0.147678 (0.7008)	12.88017 (0.0003)
Honda	3.568261 (0.0002)	-0.384289 (0.6496)	2.251408 (0.0122)
King-Wu	3.568261 (0.0002)	-0.384289 (0.6496)	2.842335 (0.0022)
Standardized Honda	7.623385 (0.0000)	-0.248192 (0.5980)	0.241728 (0.4045)
Standardized King-Wu	7.623385 (0.0000)	-0.248192 (0.5980)	1.628727 (0.0517)
Gourieroux, et al.	--	--	12.73249 (0.0006)

Source: Eviews 13 output, processed by researcher, 2025.

From the table above, it can be seen that the Breusch-Pagan p-value in the cross section is 0.0004 < 0.05, meaning that the suitable model is an estimate with a random effect model rather than a fixed effect model.

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REM Panel Data Regression Test

Dependent Variable: Y
Method: Panel EGLS (Cross-section random effects)
Date: 05/09/25 Time: 19:45
Sample: 2016 2024
Periods included: 9
Cross-sections included: 4
Total panel (balanced) observations: 36
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.83E+13	7.55E+12	2.426562	0.0209
X1	0.631612	0.209136	3.020100	0.0048
X2	-6.81E+11	2.81E+11	-2.427432	0.0208

Effects Specification				
			S.D.	Rho
Cross-section random			1.13E+11	0.4687
Idiosyncratic random			1.20E+11	0.5313

Weighted Statistics			
R-squared	0.267526	Mean dependent var	7.11E+10
Adjusted R-squared	0.223133	S.D. dependent var	1.34E+11
S.E. of regression	1.18E+11	Sum squared resid	4.60E+23
F-statistic	6.026384	Durbin-Watson stat	1.467646
Prob(F-statistic)	0.005876		

Unweighted Statistics			
R-squared	0.470310	Mean dependent var	2.13E+11
Sum squared resid	6.87E+23	Durbin-Watson stat	0.982825

Source: Eviews 13 output, processed by researcher, 2025.

Based on the table above, the coefficient value is a constant of 18,300,000,000,000. In variable X^1, production costs are 0.631612, and in variable X^2, operational costs are -681,000,000,000. Therefore, the panel data regression coefficient equation can be formulated as follows:

Regression Equation Analysis

$Y = 18{,}300{,}000{,}000{,}000 + 0.631612\ X^1 - 681{,}000{,}000{,}000\ X^2$

Hypothesis Testing

- T-test

  Based on the table, it is known that the coefficient value of variable X1 (production costs) is 0.631612, and its probability value is 0.0048, which is smaller than the significance level of 0.05 (0.0048 < 0.05). This means that production costs have a significant effect on net profit in pulp and paper sub-sector companies listed on the IDX for the 2016-2024 period.

- F-Test

  Based on the table, the probability value (Prob F-statistic) is 0.005876, which is smaller than the significance level of 0.05 (0.005876 < 0.05). This means that production costs and cost of goods sold simultaneously have a significant effect on net profit in pulp and paper sub-sector companies listed on the IDX for the 2016-2024 period.

- Analysis of the Coefficient of Determination (R^2 Test)

  Based on the results of the coefficient of determination test in the Table, it is known that the Adjusted R-squared value is 0.223133 or 22.31%. Thus, it can be concluded that the independent variables, namely production costs and cost of goods sold, are able to explain

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the dependent variable, namely net profit in pulp and paper sub-sector companies listed on the IDX by 22.31% during the 2016–2024 period. Meanwhile, the remaining 77.69% is explained by other variables not included in this research model. This relatively low coefficient of determination value indicates that the company's net profit is a complex variable and is influenced by many other factors outside of production costs and cost of goods sold.

Production Costs in Pulp and Paper Manufacturing Companies on the IDX 2016–2024

Production costs include direct raw materials, direct labor, and factory overhead. Data from four companies (ALDO, INKP, SPMA, and TKIM) for the 2016–2024 period shows a significant upward trend, particularly in 2022 due to the post-pandemic surge in raw material, energy, and distribution prices. INKP consistently recorded the highest production costs, from IDR 2.14 trillion (2016) to IDR 2.43 trillion (2022). ALDO saw a sharp increase from IDR 337 billion (2016) to IDR 1.47 trillion (2024), but this was not accompanied by an increase in net profit. SPMA also rose to IDR 2.29 trillion (2024), while TKIM remained relatively stable at below IDR 1 trillion and declined after 2022. This situation confirms that uncontrolled increases in production costs have the potential to depress company profitability.

Cost of Goods Sold (COGS) of Pulp and Paper Manufacturing Companies on the IDX 2016–2024

COGS includes the cost of goods sold, calculated as beginning inventory + net purchases – ending inventory. Data from 2016–2024 shows an increasing trend, peaking in 2022. INKP recorded the highest COGS of IDR 2.41 trillion (2022), which decreased to IDR 2.17 trillion (2024). ALDO jumped from IDR 554 billion (2016) to IDR 1.61 trillion (2024), but without an increase in net profit, indicating low efficiency. SPMA rose from IDR 1.62 trillion (2016) to IDR 2.31 trillion (2024) with significant fluctuations, while TKIM remained relatively stable and managed to reduce COGS from IDR 985 billion (2022) to IDR 837 billion (2024). These findings underscore the importance of COGS control to maintain profit margins amidst pressures on raw material and logistics costs.

Net Profit of Pulp and Paper Manufacturing Companies on the IDX 2016–2024

Net profit, the result of profit before tax minus income tax, exhibits fluctuations influenced by production costs and COGS. INKP consistently recorded the highest profit, at IDR 857 billion (2022), falling to IDR 424 billion (2024). ALDO declined sharply from IDR 100 billion (2021) to IDR 2.4 billion (2023), then slightly increased to IDR 8.9 billion (2024). SPMA reached IDR 336 billion (2022) but declined to IDR 104 billion (2024). TKIM fluctuated, recovering from IDR 172 billion (2023) to IDR 297 billion (2024). The decline in profit at the end of the period was driven by high production costs and COGS, which were disproportionate to revenue. Panel data regression tests (Random Effect) prove that production costs and COGS have a significant effect on net profit, both partially and simultaneously, so that strategic cost management is the key to maintaining profitability.

The Effect of Production Costs on Net Profit in Pulp and Paper Manufacturing Companies on the IDX

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The results of the Random Effects Model regression show that production costs (X1) significantly influence net profit (Y) with a coefficient of 0.631612 and a probability of 0.0048 <0.05. This means that increasing production costs can increase net profit if other variables remain constant. Production costs, which include raw materials, labor, and factory overhead, are the main components determining profitability. In line with Mulyadi's theory, increased costs due to higher production volumes can reduce unit costs, and when accompanied by selling price adjustments, can boost profits.

For example, PT Suparma Tbk (SPMA) experienced an 18.19% increase in production costs (from IDR 2.16 trillion in 2021 to IDR 2.55 trillion in 2022), followed by a 14.21% increase in net profit (from IDR 294.32 billion to IDR 336.14 billion). This demonstrates efficient cost management. This finding aligns with research by Pinkan Kezia & Endang Wulandari (2022), which demonstrated that production costs significantly impact net profit in the food and beverage sector listed on the IDX.

Thus, production costs are proven to be a major factor influencing net profit, necessitating cost control, efficient production planning, and appropriate pricing strategies to ensure cost increases drive profitability.

The Effect of Cost of Goods Sold (COGS) on Net Profit in Pulp and Paper Manufacturing Companies on the Indonesia Stock Exchange

The results of the Random Effects Model regression show that COGS has a significant negative effect on net profit, with a coefficient of -681,000,000,000 and a probability of 0.0208 (<0.05). This means that any increase in COGS will significantly reduce net profit. As a direct cost component (beginning inventory + production costs - ending inventory), an increase in COGS automatically narrows profit margins.

For example, at PT Alkindo Naratama Tbk (ALDO), COGS increased 24.3% from IDR 1.15 trillion (2022) to IDR 1.42 trillion (2023), resulting in a 96.3% decline in net profit, from IDR 65.76 billion to IDR 2.43 billion. This indicates that an increase in COGS without efficient production and pricing strategies will depress financial performance. This finding is consistent with research by Wahyuni & Christine (2021) and Riani & Satria (2022), which both demonstrated a significant negative effect of COGS on net profit.

Thus, COGS has been shown to depress net profit, necessitating companies to control it through production efficiency, inventory management, and distribution and pricing strategies to maintain profit margins and sustain financial performance.

The Effect of Production Costs and Cost of Goods Sold on Net Profit in Pulp and Paper Manufacturing Companies on the Indonesia Stock Exchange

The F-test results show a probability of 0.005876 < 0.05, indicating that production costs and COGS simultaneously have a significant effect on net profit. Efficient production costs (raw materials, labor, overhead) and COGS control play a crucial role in maintaining profitability. The higher the COGS, the more pressure there is on profit margins, while sound production cost management can reduce COGS and increase net profit.

This finding aligns with cost accounting theory and Dian Nofiana's research, which demonstrates that production costs and COGS significantly influence net profit, with a significance value of 0.000 and an F-count of 37.471 > F-table of 2.49. Therefore, increasing production costs will impact COGS and depress profits if not offset by efficiency, production process optimization, or selling price adjustments. Therefore, an appropriate cost management strategy is key to maintaining price competitiveness and sustainable company profitability.

CONCLUSION

Based on the data analysis and discussion, six key findings emerged. First, production costs in pulp and paper companies tend to increase due to pressures on raw materials, energy, and logistics, making production efficiency key to sustainable profits. Second, cost of goods sold (COGS) also increased, indicating a high cost of sales burden, necessitating effective cost and inventory management to maintain margins. Third, the company's net profit fluctuated, reflecting operational dynamics that are heavily influenced by production efficiency and cost control. Fourth, production costs significantly impacted net profit; increases were not always negative, as when accompanied by increased production volume and adjusted selling prices, profits could actually increase. Fifth, COGS significantly negatively impacted net profit, making its increase potentially depressing profitability and underscoring the importance of COGS control. Sixth, production costs and COGS simultaneously significantly impacted net profit, demonstrating that an efficient cost management strategy in accordance with cost accounting principles is crucial for increasing profitability and supporting optimal company financial performance.

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