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The Effect of Intangible Assets, Research and Development Costs, and Modern Technology Investment on the Relationship between Profitability and Firm Value

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Abstract
This study investigates the influence of profitability on firm value and further examines the moderating roles of intangible assets, research and development (R&D) expenditures, and technology investments in Indonesian manufacturing companies. The issue of how firms translate profitability into long-term value remains an important topic in financial and strategic management, particularly in emerging markets where resource allocation and investment strategies vary considerably. The research population comprises manufacturing firms listed on the Indonesia Stock Exchange during the period 2019–2023. Using purposive sampling, 105 firms were selected, resulting in 525 firm-year observations. Data were obtained from annual reports and financial statements, while the analytical methods employed include panel data regression, simple regression, and moderated regression analysis using EViews 12 software. The empirical results confirm that profitability exerts a positive and significant impact on firm value, highlighting its role as a primary driver of shareholder wealth. Nevertheless, the moderating tests indicate that intangible assets and technology investments weaken this relationship, suggesting that excessive or misaligned allocations in these areas may reduce the incremental benefits of profitability. Conversely, R&D expenditures were found not to significantly moderate the profitability–value link, implying that research activities alone do not automatically enhance firm value unless effectively commercialized. Overall, the findings enrich the literature on the resource-based view by emphasizing the conditional effects of intangible and technological resources. For practitioners, the study provides strategic insights into how managers should align resource investments with profitability objectives to optimize value creation in the manufacturing sector.

1. Introduction

Studies on the capital market have devoted considerable time and effort to examining the relationship between financial statements and firm value (Almujamed & Alfraih, 2019). One of the main focuses of accounting studies is to assess whether, when the capital market becomes aware of financial statement information, stock prices respond to the reported book value and earnings (Lim & Park, 2011). However, according to Lev and Gu (2016), in recent decades, the financial information of companies, as conveyed by increasingly numerous and complex quarterly and annual financial statements, has declined in relevance and has lost much of its usefulness for investors the primary intended users who are in great need of revitalization and restructuring. Lev and Gu (2016) further elaborate that the usefulness of financial statement information is diminishing, and only about five percent of investors actually utilize it. Investors are now more focused on market sentiment, political issues, and forecasts of future trends, rather than the historical information presented by companies in their financial statements.

The issue of declining relevance and the loss of much of the usefulness of financial statements for investors arises because the majority of investors have increasingly begun to doubt the utility or benefits of the accounting information presented in the financial statements published by companies (Barth, Li, & McClure, 2023). In addition, institutional and macroeconomic factors such as the global trend toward increased regulation and harmonization of financial reporting, the expanded use of fair value instead of historical cost, market bubbles, accounting scandals, and recurring financial crises have altered the role of financial reporting

in company valuation(Hail, 2013).

The development of issues related to the declining relevance of value has also occurred following the disclosure of several accounting fraud cases committed by some public companies in Indonesia, such as Indo Farma, Great River Indonesia, Kimia Farma, Garuda Indonesia, Hanson International, Envy Technologies Indonesia, and by several major global companies such as Enron, Xerox, Worldcom, and Global Crossing (United States), Vivendi (France), Independent Insurance and Equitable Life (United Kingdom), Parmalat Group (Italy), HIH Insurance (Australia), Royal Ahold (Netherlands), and SK Group (South Korea). These cases have further strengthened some investors' suspicions that financial statements no longer provide adequate information (Lako, 2007).

Furthermore, research findings on value relevance in Indonesia by Wulandari and Adiati (2015), and Sahlan (2020), state that financial statements still maintain their value relevance in the capital market and have not experienced a decline. However, other studies, such as those conducted by Lako and Hartono (2019) and Suwardi (2020), indicate that there has been a decrease in value relevance over the past few years.

Acaranupong (2021) and Diab et al. (2021) state that earnings values can be applied to test value relevance by identifying their impact on changes in firm value. Therefore, in its development, earnings (profitability) are often used as an indicator to assess value relevance (Sahlan, 2020). Furthermore, in response to the issue of declining value relevance, this decline is suspected to occur because investors consider that information such as profitability alone is not sufficient to guide them in making economic decisions, as stated by Lev and Gu, (2016). Therefore, investors require additional information beyond profitability. In this study, the researcher assumes that there are several variables that can enhance value relevance, including intangible assets (Al Ani & Tawfik, 2021), research and development costs (Kalantonis, Schoina, Missiakoulis, & Zopounidis, 2020), and investment in modern technology (Sahlan, 2020), Thus, in this research, intangible assets, research and development costs, and investment in modern technology are used as moderating variables in the relationship between profitability and firm value (value relevance).

Based on the background explanation provided earlier, this study focuses on the question of value relevance, specifically the relationship between profitability and firm value during the period 2019–2023, and examines the effect of intangible assets, research and development costs, and investment in modern technology in moderating the influence of profitability on firm value.

2. Literature Review

2.1 Signaling Theory

Signaling theory refers to the actions taken by company management to provide indications to investors regarding management's outlook on the company's prospects. Signaling theory explains why companies feel compelled to provide information in the form of financial statements to external parties. Companies are driven to present financial statements as a means of addressing information asymmetry between external parties and the company. This information asymmetry arises because companies possess much more detailed knowledge about their future prospects compared to external parties such as creditors, investors, and the government (Brigham & Houston, 2019).

2.2 Financial Statement

Financial statements are the most crucial instrument for assessing a company's performance and economic condition. These financial statements are used as tools by management analysts and market participants in making economic decisions. A financial statement can illustrate a company's financial condition and performance, the results of its operations over a specific period, and the company's cash flows within a certain timeframe (Harahap, 2018).

Statement of Financial Accounting Standards (PSAK) No. 1 (2018) defines financial

statements as a structured presentation that includes a company's financial performance, financial position, and cash flows. Comprehensive financial statements generally include an income statement, a statement of financial position, a statement of changes in financial condition (which can be presented in various forms, such as a funds flow statement or a cash flow statement), other reports and notes, as well as additional explanatory information that is an integral part of the financial statements. In addition, financial statements may also include supplementary diagrams and related information, such as financial information regarding industry segments, geographic segments, and disclosures about the impact of changes in policy.

Financial statements must be presented in accordance with accounting standards and financial reporting regulations to meet certain characteristics. The characteristics of financial statements are the qualities that make the information in financial statements useful to most users in making economic decisions. According to PSAK No. 1 (2018), there are at least four main characteristics of financial statements: reliability, understandability, comparability, and relevance.

2.3 Value Relevance

Value relevance is defined as the relationship between the content of accounting information and stock prices (Odoemelam, Okafor, & Ofoegbu, 2019). Value relevance is also a general term used to refer to the extent to which investors consider accounting figures in financial statements when making equity investment decisions (Bankole, 2020; Imhanzenobe, 2022). Value relevance can be measured as the statistical relationship between the information content of financial statements and stock market value (Acaranupong, 2021; Odoemelam et al., 2019). From these definitions, it is evident that for accounting figures to be relevant to value, they must have a significant relationship with the company's market value (Odoemelam et al., 2019). Therefore, the term value relevance is often used to evaluate the information contained in accounting figures (Perveen, 2019).

Accounting information plays an important role in evaluating all forms of economic entities for various stakeholders, especially investors. Accounting information should assist in assessing an entity's economic resources and the claims against those resources, as well as their changes. Accounting information also provides important signals for investors to make efficient investment decisions (Acaranupong, 2021).

To test value relevance, researchers have used price models and return models. The price model and the return model are popular valuation models in value relevance research. In both models, stock price and stock return are the dependent variables, while accounting figures are the independent variables (Nguyen & Dang, 2023). Studies measure value relevance through significant regression correlations. Both models the return model and the price model use earnings values, which are a form of profitability ratio, to test value relevance.

2.4 Profitability

Profitability is a company's ability to generate profit over a certain period by utilizing all the resources it possesses in managing its operational activities. Information related to a company's profitability ratios is crucial in running a business, as these ratios can measure the effectiveness of management in managing the resources entrusted to them. These ratios can also be used to monitor and evaluate the company's profit development over time, which will impact the company's sustainability (Zam-Zam, Haliah, & Andi Kusumawati, 2023). One of the profitability variables often used in value relevance studies is earnings (Sahlan, 2020).

Earnings are one of the most frequently used forms of information from financial statements as indicators to assess changes in stock prices or returns (Sahlan, 2020). Literature studies show that elements in the income statement, such as earnings, are correlated with stock prices or returns (Ball & Brown, 1968; Francis & Schipper, 1999). Many

studies on value relevance have also used earnings as a variable because it is considered capable of influencing changes in stock prices or returns as an indicator of firm value when compared to other models (Sahlan, 2020). Therefore, in this study, the profitability variable namely, earnings is used as a proxy for financial statements in examining value relevance, specifically the relationship between profitability and firm value.

2.5 Efficient Market Hypothesis

A capital market can be considered efficient if the value of listed securities reflects all types of accurate information from the company, is not influenced by other information, and has been adjusted for the risks and strategies implemented by the company. If, when an event occurs, the value of securities changes, then the event contains important information for market participants. Conversely, if there is no change in the value of securities when an event occurs, it means the event does not contain sufficient information, thus it can be concluded that the capital market is not efficient (Lako, 2007). The information described in the efficient market theory consists of three types: historical stock price information from the past, information accessible to the public, and confidential information or information originating from within the market.

Fama classifies the efficient market hypothesis into three forms based on the type of information used: weak form, semi-strong form, and strong form. The weak form hypothesis states that current stock prices reflect all financial market information, including historical stock prices, trading volume data, rates of return, and other data released by the financial markets, so past results and historical market data should not be related to future outcomes. The semi-strong form hypothesis adds that stock prices also reflect all public information, including financial statements and economic, political, and other information, so investors cannot earn excess returns simply by relying on newly announced information. Meanwhile, the strong form hypothesis states that stock prices reflect all information, both public and private, so no investor can achieve higher returns than the market because there is no hidden information that provides an advantage (Reilly & Brown, 2020).

2.6 Event Study

Pandey and Kumari (2021) define an event study as a technique for testing the efficiency of the capital market, as it aims to evaluate the impact, smoothness, and characteristics of the market's response to an event or announcement. An event study analyzes stock price responses over a short period, with a focus on the timing of financial statement announcements, making the announcement date of financial statements a primary focus in such research.

An event study can be utilized in testing value relevance because it can be used to assume that changes in stock prices at the time of financial statement announcements occur due to the event itself, and not because of other factors (Lako, 2018). Therefore, since this study uses the event study approach, it is assumed that the Indonesian stock exchange exhibits semi-strong form efficiency (Kurniawati & Lestari, 2011; Sadikin, 2022).

2.7 Firm Value

Firm value is a reflection of a company's performance that can influence investors' assessments of the company. Firm value can be affected by several factors, including the debt policy adopted by the company, the company's ability to generate profits, its ability to manage finances in meeting all its obligations, company size, stock price, company income, and other factors that have been examined in previous empirical studies (Sari & Sedana, 2020).

Firm value can be measured through the stock price in the market, which is determined by the stock price formation process and reflects the public's assessment of the company's actual performance. It is considered actual because the market price results from the equilibrium between the forces of demand and supply, where real transactions of securities occur in the capital market between sellers (issuers) and investors, commonly referred to

as market equilibrium. Therefore, in capital market financial theory, the market stock price is referred to as the concept of firm value (Harmono, 2017). In this study, firm value is measured using the stock return indicator.

2.8 Stock Return

Stock return is one of the indicators used to assess firm value (Lako, 2007; Sahlan, 2020). Return is the difference either profit or loss earned by individual or institutional investors from prior investments. Returns can be actual profits or losses that have already occurred, or they can be unrealized profits or losses that are expected to occur in the future (Jogiyanto, 2017) Thus, stock return can be defined as the percentage return earned from funds or capital that have been or will be invested in a stock, either at present or in the future.

The use of stock return refers to the views of Easton (1999) and Beaver (2002), who recommend the use of stock returns to test value relevance as being more appropriate than using the price model. The return model is also suitable for testing the hypothesis of the timeliness of reporting changes in information in financial statements, compared to the price model which is assumed to ignore the timing of financial reporting. In addition, stock returns are widely accepted because this approach can evaluate both historical beliefs and current investor beliefs in making decisions (Lako & Hartono, 2019).

2.9 Intangible Assets

According to PSAK No. 19 (2018), intangible assets are recognized as non-monetary assets without physical substance. Non-monetary assets are assets received in the form of cash and held in the form of cash, which have stable or measurable value. PSAK No. 19 explains that entities often expend resources or assume obligations when acquiring, developing, maintaining, or enhancing non-physical resources such as knowledge or technology, the design and implementation of new systems or processes, licenses, intellectual property rights, market knowledge, and trademarks. Furthermore, PSAK No. 19 states that the future economic benefits arising from intangible assets include cost savings, increased sales of products or services, and other benefits resulting from the utilization of intangible assets within a company. The classification of intangible assets includes patents, goodwill, trademarks, copyrights, franchises, and lease rights.

The utilization of intangible assets in this study is based on the resource-based view theory. The resource-based view theory was first pioneered by Wernerfelt (1984), who stated that a company's resources and capabilities play an important role in its success and performance, as they are the primary foundation of the company's competitiveness. According to Ferdaous and Rahman (2019), the resource-based view theory provides a theoretical basis for measuring intangible assets and supports the relationship between intangible assets and company performance. The main prediction of the resource-based view theory is that the more intangible resources a company owns, the greater its competitive advantage and sustainability, assuming the company can properly assess its intangible assets. In addition, the resource-based view always emphasizes the company's ability (such as the ability to commercialize innovation) to generate invisible resources (Barney, 1991).

2.10 Research and Development Costs

Research and development is a series of stages aimed at improving existing products or developing new products that are worth considering. The products in question are not only tangible or hardware but can also be software (Sujadi, 2013). PSAK No. 19 (2018) defines research as an authentic and planned exploration with the expectation of obtaining technical understanding and the latest knowledge about something new.

Research and development can be used as the foundation for competitive advantage, long-term economic growth, and technological progress, resulting in improved company performance (Patel, Guedes, Soares, & Gonçalves, 2017). Research and development is

also one of the most important approaches for enhancing company performance through increased productivity and technological innovation (Guo, Wang, & Wei, 2018), making it a key driver of social welfare and economic growth (Alam et al., 2020).

The use of research and development costs in this study is based on the knowledge-based view theory. According to Ferdaous and Rahman (2019), the knowledge-based view theory provides a new perspective that enables stakeholders to see and understand the primary objective of a company, which is to generate, transfer, and apply knowledge.

According to the knowledge-based view theory, a company is regarded as an institution for integrating knowledge, and differences in performance among companies depend on their heterogeneous abilities and knowledge (Ferdaous & Rahman, 2019). In addition, the knowledge-based view theory introduces the creation of unique intangible resources, which are difficult to imitate or substitute but can provide superior business performance for companies. Therefore, research and development are essential for generating knowledge within a company. Research and development can provide significant benefits and tangible advantages for a company through the creation of unique intangible resources.

2.11 Modern Technology Investment

Modern technology investment refers to a company's actions in investing by adopting automated and digital production systems. Modern technology investment is a corporate strategy that leverages the latest technologies to improve quality and efficiency by developing smart factories. It also serves as a strategic plan that signals a company's competitive capability through changes in industry structure (Wiyani, 2008).

In this study, the modern technology investment variable uses capital expenditure as the variable, specifically representing investments in fixed assets. The main purpose of capital expenditure is to replace, expand, or upgrade fixed assets, or to pursue more abstract long-term benefits (Sofiamira & Haryono, 2017).

Moreover, companies that make capital investments tend to attract investors because such investment decisions are expected to generate greater returns in the future (Brealey, Myers, & Marcus., 2007). The use of capital expenditure as an investment decision sends a positive signal about future business growth, which is then well received by investors (Achmad & Amanah, 2014).

2.12 International Financial Reporting Standard (IFRS)

Indonesia officially adopted the IFRS policy for Indonesian companies in 2008 and fully implemented it in 2012 (Carl, Reeve, & Feess, 2014). The implementation of IFRS is expected to have a significant impact on financial statements and company performance. The purpose of adopting IFRS in national accounting standards is to enhance confidence in financial statements, strengthen disclosure requirements to increase firm value, reinforce management's accountability in managing the company, and produce more accurate, timely, and relevant reports, as well as provide valid information about a company's assets, liabilities, equity, revenue, and expenses (Petreski, 2006).

The adoption of IFRS as a principles-based standard is expected to maximize value relevance. This is because fair value measurement is considered more capable of reflecting a company's economic performance and position, thus accommodating investors in making investment decisions (Barth, Landsman, & Lang, 2008). Furthermore, earnings information reported under IFRS is considered more accurate in reflecting the company's economic performance (Ewert & Wagenhofer, 2005). However, the implementation of IFRS is also suspected to potentially reduce value relevance. This is due to the limited managerial flexibility in choosing measurement methods, which may reduce management's ability to explain the company's economic position. In addition, other factors affecting financial statements besides standards themselves may worsen the quality of IFRS accounting information if IFRS enforcement and litigation are inadequate (Barth et al., 2008).

3. Research Methods

3.1 Research Design

This study employs a quantitative research design to examine the influence of independent variables on the dependent variable and to assess the moderating effects of selected variables. Specifically, the study tests whether intangible assets, research and development (R&D) costs, and modern technology investment strengthen the relationship between profitability and firm value.

3.2 Data Sources

The study utilizes secondary panel data, combining time-series and cross-sectional data from companies listed on the Indonesia Stock Exchange (IDX) during the 2019–2023 period. Data were collected through document review from official sources, including the IDX website (www.idx.co.id), company websites, and other reputable online platforms.

3.3 Population and Sample

The population consists of all companies listed on the IDX during 2019–2023. Purposive sampling was applied based on the following criteria:

1. Companies listed on the IDX at least by 2016.
2. Companies not delisted during the 2019–2023 period.
3. Companies that did not change their industry sector during 2019–2023.
4. Companies with stable earnings without extreme outliers during 2019–2023.

Based on these criteria, 105 companies were selected, resulting in 525 observations over the five-year period.

3.4 Variables

- **Dependent Variable:** Firm value, measured using stock return.
- **Independent Variable:** Profitability, proxied by earnings.
- **Moderating Variables:** Intangible assets, R&D costs, and modern technology investment.

3.5 Data Collection Techniques

Quantitative data were obtained through structured document review of financial statements, company disclosures, and official reports. All collected data were verified for accuracy and consistency before analysis.

3.6 Data Analysis Techniques

Data were analyzed using:

1. **Descriptive Statistics** – to summarize the characteristics of the dataset.
2. **Difference Tests** – using the Wilcoxon signed-rank test.
3. **Panel Data Regression Analysis** – to assess the effect of independent variables on firm value.
4. **Simple and Moderated Regression Analysis** – to examine the moderating effects of intangible assets, R&D costs, and modern technology investment.
5. **Classical Assumption Testing** – including multicollinearity, heteroscedasticity, autocorrelation, and normality tests, to ensure the validity of regression results.

4. Results and Discussion

4.1 Research Data

There were 186 manufacturing companies listed until 2023, but only 105 manufacturing companies met the criteria to be included as observations in this study. Of the 105 companies, they are divided into three business sector groups: basic industry and chemicals, consumer goods industry, and miscellaneous industry, as explained in more detail in Table 1 below.

Table 1. Number of Samples and Observations for the 2019–2023 Period

Year	Number of Sample	Business Sector		
		Basic Industry and Chemicals	Consumer Goods Industry	Miscellaneous Industry
2019	105	48	32	25
2020	105	48	32	25
2021	105	48	32	25
2022	105	48	32	25
2023	105	48	32	25
Total Observation	525	240	160	125

Source: processed secondary data, 2024

4.2 Descriptive Statistical Analysis

Descriptive statistical analysis will present an overview of the data from the variables studied in

this research, namely earnings (NL), return on assets (ROA), and return on equity (ROE), intangible assets (ATB), research and development costs (BPDP), modern technology investment (ITM), and firm value (NP). These variables are described in terms of mean, median, maximum, minimum, and standard deviation. The results are shown in Table 2 below.

Table 2. Descriptive Data Results

	Mean	Med.	Max.	Min.	Std. Dev	Obs.
NL	0,096365	0,071447	9,330709	-9,60089	1,848254	525
ATB	7,730500	0,000000	27,75565	0,000000	9,2555706	525
BPDP	0,001970	0,000000	0,141076	0,000000	0,013140	525
ITM	14,08569	13,83293	26,24006	-3.13179	5.991776	525
NP	0,053086	0,000000	0,500938	-0,08504	0.504686	525

Source: Output Eviwes 12 SV, processed 2024

Earnings have a mean value of 0.096365, a median of 0.071447, a maximum of 9.330709, a minimum of -9.600893, and a standard deviation of 1.848254. The minimum and maximum values of profitability indicate that among all observations, there are companies experiencing a profit decrease of 960% and a profit increase of 933%. The mean profitability indicates that, on average, companies experienced a profit increase of 9.63%. The standard deviation value indicates that profitability data in this study is highly varied (standard deviation is greater than the mean). The frequency table is as follows.

Intangible assets have a mean value of 7.730500, a median of 0.000000, a maximum of 27.75565, a minimum of 0.000000, and a standard deviation of 9.2555706. The minimum and maximum values of intangible assets show that among all observations, there are companies with no intangible assets and companies with intangible assets amounting to 27.75565. The mean intangible asset value indicates that, on average, companies have intangible assets of 7.730500. The standard deviation value shows that the data in this study is highly varied (standard deviation is greater than the mean).

Research and development costs have a mean value of 0.001970, a median of 0.000000, a maximum of 0.141076, a minimum of 0.000000, and a standard deviation of 0.013140. The minimum and maximum values of research and development costs indicate that among all observations, there are companies with no research and development costs and companies with research and development costs of 0.141076. The mean intangible asset value indicates that, on average, companies have intangible assets of 0.001970. The standard deviation value shows that the data in this study is highly varied (standard deviation is greater than the mean).

Modern technology investment has a mean value of 0.027344, a median of 0.016776, a maximum of 0.663606, a minimum of 0.000000, and a standard deviation of 0.045173. The minimum and maximum values of modern technology investment show that among all observations, there are companies with no modern technology investment and companies with modern technology investment of 0.663606. The mean value shows that, on average, companies made modern technology investments of 0.027344. The standard deviation value indicates high variability in the data (standard deviation is greater than the mean).

Firm value has a mean of 0.053086, a median of 0.000000, a maximum of 0.500938, a minimum of -0.08504, and a standard deviation of 0.504686.

4.3 Description of Difference Test Results

The difference test in this study was conducted to determine whether there are differences in the performance of profitability, intangible assets, research and development costs, modern technology investment, and stock returns between the periods 2019–2021 and 2022–2023. The use of these two periods aims to identify whether the COVID-19 pandemic, which occurred in early 2020, affected all the variables used in this study. The decision rule for the Wilcoxon signed rank test is that if the probability value is < 0.05, there is a significant difference, and vice versa. The results of the difference test are presented in the table below.

Table 3. Difference Test Results

	NL	ATB	BPDP	ITM	NP
Wilcoxon/ Mann-whitney	0.0259	0.9107	0.7394	0.0340	0.0254

Source: Output Eviwes 12 SV, processed 2024

Based on Table 3 above, it is found that the probability value for earnings is 0.0259 < 0.05, the probability value for intangible assets is 0.9107 > 0.05, the probability value for research and development costs is 0.7394 > 0.05, the probability value for modern technology

investment is 0.0340 < 0.05, and the probability value for firm value is 0.0254 < 0.05. Thus, this shows that there are significant differences in the variables of earnings, modern technology investment, and firm value, while the variables of intangible assets and research and development costs do not show significant differences. These results also indicate that the COVID-19 pandemic that occurred at the beginning of 2020 affected the performance of earnings, modern technology investment, and firm value.

4.4 Description of Regression Analysis Results

To test the hypotheses proposed in this study, three types of regression analyses were conducted: panel data regression analysis for H1a (Model 1), simple regression analysis for H1b (Model 2), and moderated regression analysis for H2 (Model 3), H3a (Model 4), and H4 (Model 5).

4.4.1 Model Selection Tests

1. Chow Test

The Chow test is used to determine which is better between the common effect model and the fixed effect model. If the probability value of the chi-square is > 0.05, then the selected model is the common effect model and can be continued with the Lagrange multiplier test. However, if the probability value of the chi-square is < 0.05, then the selected model is the fixed effect model, and the Hausman test should be conducted next. The results of the Chow test for models 1, 3, 4, and 5 are presented in Table 4 below.

Table 4. Chow Test Results

	Model 1	Model 3	Model 4	Model 5
Effects Test	Prob.	Prob.	Prob.	Prob.
Cross-section F	0,2797	0,2459	0,2928	0,1938
Cross-section Chi-square	0,0736	0,0559	0,0746	0,0380

Source: Output Eviwes 12 SV, processed 2024

Table 4 above shows that the probability value of the chi-square for Model 1 is 0.0736 > 0.05, for Model 3 is 0.0559 > 0.05, for Model 4 is 0.0746 > 0.05, and for Model 5 is 0.0380 < 0.05. Thus, for Model 5, the selected model is the fixed effect model, and since the fixed effect model is selected, the Hausman test will be conducted. Meanwhile, for models 1, 3, and 4, the selected model is the common effect model, so the Lagrange multiplier test will be continued.

2. Hausman Test

The Hausman test is used to determine which model is better, between the fixed effect model and the random effect model. If the probability value of the cross-section random < 0.05, then the selected model is the fixed effect model. However, if the probability value of the cross-section random > 0.05, then the selected model is the random effect model, and the Lagrange multiplier test will be conducted. The results of the Hausman test for model 5 are presented in Table 5 below.

Table 5. Hausman Test Results

	Model 5
Test Summary	Prob.
Cross-section Random	0,4167

Source: Output Eviwes 12 SV, processed 2024

Based on the table above, the probability value of the cross-section random for Model 5 is 0.4167 > 0.05. Thus, the selected model for Model 5 is the random effect model, and since the random effect model is selected, the Lagrange multiplier test will be conducted.

3. Lagrange Multiplier Test

The Lagrange multiplier test is used to determine which model is better, between the random effect model and the common effect model. If the Breusch-Pagan value < 0.05, then the selected model is the random effect model. However, if the Breusch-Pagan value > 0.05, then the selected model is the common effect model. The results of the Lagrange multiplier test for models 1, 3, 4, and 5 are presented in Table 6 below.

Table 6. Lagrange Multiplier Test Results

	Model 1	Model 3	Model 4	C
	Cross- section	Cross- section	Cross- section	
Breusch-Pagan	0,25266	0,404821	0,247060	
	(0,6141)	(0,5246)	(0,6192)	

Source: Output Eviwes 12 SV, processed 2024

Based on the table above, the Breusch-Pagan value for Model 1 is 0.6141 > 0.05, for Model 3 is 0.5246 > 0.05, for Model 4 is 0.6192 > 0.05, and for Model 5 is 0.4582 > 0.05. Thus, the selected model for models 1, 3, 4, and 5 is the common effect model.

4.4.2 Classical Assumption Tests

1. Heteroscedasticity Test

This study uses the Glejser test for heteroscedasticity. The decision rule is that if the probability value is > 0.05, there is no heteroscedasticity, and vice versa. The summary of heteroscedasticity test results for models 1, 3, 4, and 5 is presented in the table below.

Table 7. Heteroscedasticity Test Results for Models 1, 3, 4, and 5

Variable	Model 1	Model 3	Model 4	Model 5
	Prob.	Prob.	Prob.	Prob.
C	0.0000	0.0000	0.0000	0.0002
Earnings	0.1711	0.5311	0.1681	0.0946
Intangible Assets		0.3948		
R&D Costs			0.7088	
Modern Tech Inv.				0.1008
Earnings * Intangible Assets		0.8058		
Earnings * R&D Costs			0.9825	
Earnings * Modern Tech Inv.				0.3454
Modern Tech Inv.				

Source: Output Eviwes 12 SV, processed 2024

The table above shows that for Model 1, the probability value for earnings is 0.1711 > 0.05. Next, for Model 3, the probability value for earnings is 0.5311 > 0.05, the probability value for intangible assets is 0.3948 > 0.05, and the probability value for earningsintangible assets is 0.8058 > 0.05. For Model 4, the probability value for earnings is 0.1681 > 0.05, the probability value for research and development costs is 0.7088 > 0.05, and the probability value for earningsresearch and development costs is 0.9825 > 0.05. For Model 5, the probability value for earnings is 0.0946 > 0.05, the probability value for modern technology investment is 0.1008 > 0.05, and the probability value for earnings*modern technology investment is 0.3454 > 0.05. Thus, these results indicate that there is no heteroscedasticity in models 1, 3, 4, and 5.

Furthermore, since H1c of this study investigates the extent of value relevance each year during the study period, as measured using the coefficient of determination (R^2), a simple regression analysis was conducted on the independent and dependent variables for each year of the study: 2019, 2020, 2021, 2022, and 2023. Therefore, the heteroscedasticity test using the Glejser test was performed for each regression analysis in Model 2. The summary of the heteroscedasticity test results for Model 2 for the years 2019, 2020, 2021, 2022, and 2023 is presented in Table 8 below.

Table 8 Heteroscedasticity Test Results for Model 2

Variable	2019	2020	2021	2022	2023
	Prob.	Prob.	Prob.	Prob.	Prob.
C	0,0000	0,0000	0,0000	0,0000	0,0000
Earnings	0,2092	0,4611	0,8159	0,9055	0,4360

Source: Output Eviwes 12 SV, processed 2024

Based on Table 8 above, the probability value for earnings in 2019 is 0.2092 > 0.05, for 2020 it is 0.4611 > 0.05, for 2021 it is 0.8159 > 0.05, for 2022 it is 0.9055 > 0.05, and for 2023 it is 0.4360 > 0.05. Thus, these results indicate that there is no heteroscedasticity in Model 2 for the years 2019, 2020, 2021, 2022, and 2023.

2. Multicollinearity Test

The multicollinearity test in this study was conducted on all models. The decision rule for the multicollinearity test is that if the correlation value between variables is < 0.80, then there is no multicollinearity, and vice versa. The results of the multicollinearity test are presented in Table 9 below.

Table 9. Multicollinearity Test Results

	Earnings	Intangible Assets	Research & Development Costs	Modern Technology Investment
Earnings	1.000000	-0.03790	-0.00731	-0.08835
Intangible Assets	-0.03790	1.000000	0.112645	0.159999
Research & Dev. Costs	-0.00731	0.112645	1.000000	-0.005001
Modern Tech Investment	-0.08835	0.159999	-0.005001	1.000000

Source: Output Eviwes 12 SV, processed 2024

The table above shows that the correlation between earnings and intangible assets is -0.03790 < 0.80, the correlation between earnings and research and development costs is -0.00731 < 0.80, the correlation between earnings and modern technology investment is -0.08835 < 0.80, the correlation between intangible assets and research and development costs is 0.112645 < 0.80, the correlation between intangible assets and modern technology investment is 0.159999 < 0.80, and the correlation between research and development costs and modern technology investment is -0.005001 < 0.80. Thus, these results indicate that there is no multicollinearity.

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4.4.3 Regression Equations

1. Regression Analysis Model 1

To test H1a, this study conducts panel data regression analysis on the independent variable (profitability) and the dependent variable (firm value). The results of the regression analysis for Model 1 using the common effect model are presented in Table 10 below.

Tablel 10. Regression Analysis Model 1

Variable	Coeffisient	Std. Errors	t-Statistic	Prob.
C	0,041250	0,019718	2,092027	0,0369
Earnings	0,122831	0,010664	11,51843	0,0000
R-squared				0.202350
Prob (F-statistic)				0.000000

Source: Output Eviwes 12 SV, processed 2024

Based on Table 10 above, the panel data regression equation between the profitability variable (earnings) and firm value is as follows:

Y_{it} = 0,041250 + 0,122831 X1 + ε_{it} (1)

Furthermore, based on Table 10, it can also be seen that the probability value for earnings is 0.0000 < 0.05 and the R^2 value is 0.202350.

2. Regression Analysis Model 2

To test H1b, this study investigates the extent of value relevance in each year of the study period as measured by the R^2 value. Therefore, a simple regression analysis was conducted on the independent and dependent variables for each year: 2019, 2020, 2021, 2022, and 2023. The results of the regression analysis are presented in Table 11 below.

Table 11. Regression Analysis Model 2

Year	N	Coefisient C	Coefisient Profitabilitas	Prob. C	Prob. Profitabilitas	R-squared	Δ
2019	105	0,002243	0,031784	0,3332	0,0000	0,673397	-0,3523
2020	105	0,011064	0,240465	0,8764	0,0000	0,321059	0.2116
2021	105	0,017642	0,036772	0,0061	0,0000	0,532624	0.0236
2022	105	0,014965	0,026521	0,0036	0,0000	0,556272	-0.2314
2023	105	-0,065657	0,234435	0,3201	0,0000	0,324846	
Panel	525	0,041250	0,122831	0,0369	0,0000	0.202350	

Source: Output Eviwes 12 SV, processed 2024

Based on Table 11, it can be seen that the R^2 value in 2019 is 0.673397. In 2020, the R^2 value is 0.321059, a decrease of -0.3523 from the previous year. In 2021, the R^2 value is 0.532624, an increase of 0.2116 from the previous year. In 2022, the R^2 value is 0.556272, an increase of 0.0236 from the previous year. Then, in 2023, the R^2 value is 0.324846, a decrease of -0.2314 from the previous year. These results indicate that from 2021 to 2023, the R^2 value experienced a decline; although in 2021 and 2022 the R^2 increased, in 2023 it declined again.

3. Regression Analysis Model 3

To test H2, this study conducted a panel data regression analysis using the moderated regression analysis approach, with intangible assets as the moderating variable. The results of the regression analysis for Model 3 using the common effect model are presented in the table below.

Table 12. Regression Analysis Model 3

Variable	Coeffisient	Std. Errors	t-Sstatistic	Prob.
C	0,057664	0,025301	2,279137	0,0231
Earnings	0,151421	0,012497	12,11632	0,0000
Intengible Assts	-0,002417	0,002097	-1,152750	0,2495
Earnings*Intengible Assets	-0,004967	0,001161	-4,279310	0,0000
R-squared				0,231079
Ajusted R2				0,226652
Prob (F-statistic)				0,000000

Source: Output Eviwes 12 SV, processed 2024

Based on Table 12 above, the regression equation between the earnings variable, the intangible assets variable, the interaction variable of earnings and intangible assets, and the interaction variable of return on assets and intangible assets with firm value is as follows:

Y_{it} = 0,057664 + 0,151421 X1 - 0,002417 Z1 - 0,004967 X1*Z1 + εit (2)

Furthermore, based on Table 12, it can also be seen that the probability value for the interaction variable of earnings and intangible assets is 0.0000 < 0.05, and the Adjusted R^2 is 0.226652.

4. Regression Analysis Model 4

To test H3, this study conducted a panel data regression analysis using the moderated regression analysis approach, with research and development costs as the moderating variable. The results of the regression analysis for Model 4 using the common effect model are presented in the table below.

Table 13. Regression Analysis Model 4

Variable	Coeffisient	Std. Errors	t-Sstatistic	Prob.
C	0,042501	0,019976	2,127604	0,0338
Earnings	0,123340	0,010728	11,49673	0,0000
Research & Development Costs	-0,635320	1,523980	-0.416882	0,6769
Earnings*Research & Development Costs	-3,909555	7,381737	-0,529625	0,5966
R-squared				0,202946
Ajusted R2				0,198357
Prob(F-statistic)				0,000000

Source: Output Eviwes 12 SV, processed 2024

Based on Table 13 above, the regression equation between the earnings variable, the research and development costs variable, the interaction variable of earnings and research and development costs, and the interaction variable of return on assets and research and development costs with firm value is as follows:

$$Y_{it} = 0{,}042501 + 0{,}123340\ X_1 - 0{,}635320\ Z_2 - 3{,}909555\ X_1{*}Z_2 + \varepsilon_{it} \quad (3)$$

Furthermore, based on Table 13, it can also be seen that the probability value for the interaction variable of earnings and research and development costs is 0.5966 > 0.05, and the Adjusted R^2 is 0.198357.

4. Regression Analysis Model 5

To test H4, this study conducted a panel data regression analysis using the moderated regression analysis approach, with modern technology investment as the moderating variable. The results of the regression analysis for Model 5 using the common effect model are presented in the table below.

Table 14. Regression Analysis Model 5

Variable	Coeffisient	Std. Errors	t-Sstatistic	Prob.
C	0,015359	0,050487	0,304241	0,7611
Earnings	0,221711	0,027880	7,952456	0,0000
Modern Technology Investmen	0,001352	0,003884	0,411805	0,6807
Earnings*Modern Tech. Investment	-0,007052	0,001839	-3,833978	0,0001
R-squared			0,224236	
Ajusted R2			0,219769	
Prob(F-statistic)			0,000000	

Source: Output Eviwes 12 SV, processed 2024

Based on Table 14 above, the regression equation between the earnings variable, modern technology investment variable, the interaction variable of earnings and modern technology investment, and the interaction variable of return on assets and modern technology investment with firm value is as follows:

$$Y_{it} = 0{,}015359 + 0{,}221711\ X_1 + 0{,}001352\ Z_3 - 0{,}007052\ X_1{*}Z_3 + \varepsilon_{it} \quad (14)$$

Furthermore, based on Table 14, it can also be seen that the probability value for the interaction variable of earnings and modern technology investment is 0.0001 < 0.05, and the Adjusted R^2 is 0.219769.

4.4.5 Hypothesis Testing

1. H_{1a}: Earnings have a positive effect on firm value for the period 2019–2023

The results of the panel data regression analysis shown in equation 1 indicate that the regression coefficient for profitability is 0.122831, meaning that earnings (X_1) have a positive value of 0.122831. This implies that if earnings increase by one unit, firm value will increase by 0.122831. Furthermore, based on Table 10, it can be seen that the probability value for earnings is 0.0000 < 0.05, which means earnings have a significant effect on stock returns.

Therefore, this indicates that from 2019–2023, earnings had a positive and significant effect on firm value for manufacturing companies listed on the Indonesia Stock Exchange during 2019–2023. This result supports the proposed H1a, namely that earnings have a positive effect on firm value for the period 2019–2023. Thus, H1a is accepted.

Furthermore, based on Table 10, the R^2 value is 0.202350, or rounded to 0.20. This means that 20% of the dependent variable can be explained by the variation of a single independent variable. Thus, it is known that 20% of firm value

is influenced by profitability (earnings), while the remaining 80% is influenced by other variables not examined in this study.

2. H_{1b}: The effect of profitability on firm value (value relevance) has increased from 2019–2023

Based on Table 11, it can also be seen that the R^2 value in 2019 was 0.673397, then in 2020, the R^2 value was 0.321059, a decrease from the previous year. In 2021, the R^2 value was 0.532624, an increase from the previous year. In 2022, the R^2 value was 0.556272, another increase from the previous year. In 2023, the R^2 value was 0.324846, a decrease from the previous year. These results indicate that from 2019 to 2023, the adjusted R^2 experienced a decline.

Therefore, this shows that the effect of profitability on firm value in manufacturing companies listed on the Indonesia Stock Exchange has decreased during the 2019–2023 period. These results do not support H1b, which hypothesized that the effect of profitability on firm value (value relevance) has increased from 2019–2023. Thus, H1b is rejected.

3. H_2: Intangible assets strengthen the effect of profitability (earnings) on firm value for the period 2019–2023

The results of the moderated regression analysis, as shown in equation 2, indicate that the regression coefficient for the interaction between earnings and intangible assets is -0.004967. This means that the interaction between earnings and intangible assets (X_1*Z_1) has a negative value of -0.004967; in other words, if the interaction increases by one unit, firm value will decrease by 0.004967. Furthermore, based on Table 12, the probability value for the interaction between earnings and intangible assets is 0.0000 < 0.05, which means that the interaction has a significant effect on firm value.

Thus, this indicates that from 2019 to 2023, intangible assets act as a moderator that actually weakens the effect of earnings on firm value in manufacturing companies listed on the Indonesia Stock Exchange for the period 2019–2023. This result does not support H2, which hypothesized that intangible assets strengthen the effect of earnings on firm value for the period 2019–2023. Therefore, H2 is rejected.

4. H_3: Research and development costs strengthen the effect of profitability (earnings) on firm value for the period 2019–2023

The results of the moderated regression analysis, as shown in equation 3, indicate that the regression coefficient for the interaction between earnings and research and development costs is -3.909555. This means that the interaction between earnings and research and development costs (X_1*Z_2) has a negative value of -3.909555; in other words, if the interaction increases by one unit, firm value will decrease by 3.909555. Furthermore, based on Table 13, the probability value for the interaction between earnings and research and development costs is 0.5966 > 0.05, which means that the interaction does not have a significant effect on firm value.

Thus, this indicates that from 2019 to 2023, research and development costs cannot act as a moderator, meaning they cannot strengthen or weaken the effect of earnings on firm value in manufacturing companies listed on the Indonesia Stock Exchange for the period 2019–2023. This result does not support H3, which hypothesized that research and development costs strengthen the effect of earnings on firm value for the period 2019–2023. Therefore, H3 is rejected.

5. H_4: Modern technology investment strengthens the effect of profitability (earnings) on firm value for the period 2019–2023

The results of the moderated regression analysis, as shown in equation 4, indicate that the regression coefficient for the interaction between earnings and modern technology investment is -0.007052. This means that the interaction between earnings and modern technology investment (X_1*Z_3) has a negative value of -0.007052; in other words, if the interaction increases by one unit, firm value will decrease by 0.007052. Furthermore, based on Table 14, the probability value for the interaction between earnings and modern technology investment is 0.0001 < 0.05, which means that the interaction has a significant effect on firm value.

Thus, this indicates that from 2019 to 2023, modern technology investment acts as a moderator that actually weakens the effect of earnings on firm value in manufacturing companies listed on the Indonesia Stock Exchange for the period 2019–2023. This result does not support H4, which hypothesized that modern technology investment strengthens the effect of earnings on firm value for the period 2019–2023. Therefore, H4 is rejected.

4.5 Discussion

4.5.1 The Effect of Profitability on Firm Value for the Period 2019–2023

Based on hypothesis testing, the results show that profitability has a positive and significant effect on firm value, so the statement that profitability has a positive effect on firm value for the period 2019–2023 has been empirically proven. This result also indicates that profitability remains a benchmark for investors in determining firm value. Companies with high profitability, empirically, can increase their firm value in the eyes of investors. This can be seen from the results of H1a testing, which show that as profitability increases, firm value also increases.

The influence of profitability on firm value occurs because profitability, especially earnings, is an important figure in financial statements. This is due to several reasons, including: profitability (earnings) serves as a guideline for investment policy and decision-making, a basis for forecasting future profitability and economic events of the company, a basis for calculating and assessing company efficiency, and a basis for evaluating company performance and achievements. Therefore, profitability (earnings) is generally viewed by investors as a guideline in making investment decisions and as an indicator for assessing the company (Harahap, 2018). It is not surprising, then, that profitability (earnings) is one of the most frequently used pieces of information from financial statements to indicate changes in firm value (stock price or return) (Sahlan, 2020). Furthermore, several literature studies show that profitability (earnings) is correlated with firm value (stock price or return) (Ball & Brown, 1968; Francis & Schipper, 1999).

The findings of this study are consistent with value relevance, which refers to the capability of financial statement information to convey firm value concisely. Value relevance can be seen from the significant correlation between financial statement information and firm value (stock price or return), illustrating that the financial information published by companies is considered relevant by investors in the capital market (Barth, Beaver, & Landsman, 2001). Therefore, research results showing that profitability influences firm value indicate that financial statements still possess value relevance, at least among manufacturing companies listed on the Indonesia Stock Exchange for the period 2019–2023.

These findings are also consistent with signaling theory, which states how crucial the information provided by a company is in the investment decision-making process, since information is a key factor for investors and entrepreneurs as it provides records and descriptions of the past, present, and future for both companies and the capital market. Therefore, the announcement of released information will signal to investors in making decisions (Jogiyanto, 2017). One form of information disclosed by companies is financial statements containing profitability (earnings) information, which is used as an indicator by investors in making investment decisions. Thus, when companies announce profitability (earnings) information through financial statements to investors and investors receive the information, they will analyze and interpret it as a favorable signal, which in turn affects stock prices and trading volume. Consequently, companies with positive profitability (earnings) will provide a favorable signal to investors, resulting in profitability having a positive effect on firm value.

The results of this study are consistent with the research conducted by Pascayanti et al. (2017) which stated that profitability (earnings) has an effect on stock prices and stock returns (firm value). This is also consistent with the research conducted by Sahlan (2020) which also found that profitability (earnings) has a significant effect on firm value (stock returns).
Furthermore, based on hypothesis testing, it was also found that the effect of profitability on firm value for manufacturing companies listed on the Indonesia Stock Exchange has decreased over the 2019–2023 period. This result shows that while profitability remains a benchmark for investors in determining firm value, also referred to as value relevance, there has been a decline. This is evident from the results of the H1b test, which indicate that from 2019 to 2023, there has been a decrease in the effect of profitability on firm value. This decline suggests that the use of profitability by investors in making investment decisions has diminished, and the results also show that the value relevance of financial statement information, particularly profitability, has decreased.

These findings are inconsistent with the hypothesis which stated that the effect of profitability on firm value (value relevance) would increase from 2019–2023. The assumption that the value relevance of financial statements would increase, based on the implementation of IFRS in Indonesia—since IFRS uses fair value

methods that are even applied to biological assets (such as plants or animals), intangible assets, property investments, and securities, and is considered a better approach compared to the historical cost method (Syagata & Daljono, 2014), as well as the fact that IFRS requires more comprehensive reporting so that users of financial statements can obtain more complete information for decision making—apparently is not perceived by investors as something that adds value to the published financial statements.

This result may occur for reasons outlined by Barth et al. (2008), who argue that the implementation of IFRS may also reduce value relevance. This occurs due to the limited managerial flexibility in choosing measurement methods, which can reduce management's ability to explain the company's economic position. Additionally, other factors affecting financial statements, aside from the standards themselves, can worsen the quality of IFRS accounting information if IFRS enforcement and litigation are inadequate (Barth et al., 2008). This is further compounded by several fraud cases, such as those involving Garuda Indonesia, Hanson International, and Envy Technologies Indonesia, which reinforce some investors' suspicions that financial statement information no longer provides adequate information (Lako, 2007).

This finding is also in line with research by Lako (2007) which states that value relevance has declined. However, on the other hand, it is not in line with the findings of Sahlan (2020), who found that value relevance increased, and also not in line with the studies by Wulandari and Adiati (2015) and by Romadhoni and Purwanti (2017), which stated that there was an increase in value relevance after the implementation of IFRS in Indonesia.

4.5.2 Intangible Assets as a Moderator of the Effect of Profitability on Firm Value for the Period 2019–2023

Based on hypothesis testing, the results show that the interaction between profitability and intangible assets is negative and significant with respect to firm value, indicating that intangible assets weaken the effect of profitability on firm value. Thus, the statement that intangible assets strengthen the effect of profitability on firm value for the period 2019–2023 is not empirically supported. This result also shows that intangible assets contribute to weakening profitability, which is empirically used as a benchmark by investors in determining firm value. Therefore, it can be said that if a company has intangible assets, it may reduce the value of profitability information in the eyes of investors. As a result, this study does not succeed in proving that intangible assets strengthen the effect of profitability on firm value for the period 2019–2023.

The statement that intangible assets can strengthen the effect of profitability on firm value because investments in intangible assets are considered important by business actors in generating firm value (Ocak & Fındık, 2019) was not proven in this study. The notion that companies can obtain future economic benefits such as cost savings, increased sales of products or services, and other benefits generated from the utilization of intangible assets also does not mean that the existence of intangible assets can strengthen the effect of profitability on firm value.

Thus, these results indicate that investors do not view a company's intangible assets as a favorable signal, but rather the opposite.

The failure of this study to prove that intangible assets strengthen the effect of profitability on firm value for the period 2019–2023 may be due to the fact that the value of intangible assets, whether book value or market value, is difficult to capture (Eisfeldt & Papanikolaou, 2013), especially goodwill, as the goodwill acquired by companies in Indonesia often results from mergers or acquisitions and is therefore not considered by investors to represent the company's true value (Setijawan, 2011). PSAK 19 (2018) also provides discretion for evaluating the amortization (impairment) of intangible assets whose useful life cannot be identified or is indefinite, and this broad discretion often leads management to manipulate the amortization value of intangible assets for personal gain, resulting in deviations of the intangible asset value from its actual value (Wijaya & Suganda, 2020). In addition, there are some intangible assets whose useful lives cannot be determined and are considered to have an indefinite useful life, requiring regular reviews (such as goodwill and trademarks), so companies must continually incur replacement costs to maintain and preserve their intangible assets (Wijaya & Suganda, 2020). This causes investors to perceive intangible assets as providing no additional value to profitability, thus having a moderating (weakening) effect on firm value.

These findings are inconsistent with the research by Lako (2007), who stated that financial statements containing intangible assets have significantly greater value relevance than

financial statements without intangible assets. They are also inconsistent with the findings of Trisnajuna and Sisdyani (2015), and Gamayuni (2015) who found that the value of intangible assets has a positive and significant effect on market value.

4.5.3 Research and Development Costs as a Moderator of the Effect of Profitability on Firm Value for the Period 2019–2023

Based on hypothesis testing, the results show that the interaction between profitability and research and development (R&D) costs is negative but not significant with respect to firm value, indicating that R&D costs cannot strengthen the effect of profitability on firm value. Thus, the statement that R&D costs strengthen the effect of profitability on firm value for the period 2019–2023 is not empirically supported. This result also shows that R&D costs do not have a contribution in either strengthening or weakening profitability, which is empirically used as a benchmark by investors in determining firm value. Therefore, it can be said that if a company has R&D costs, it does not enhance the value of profitability information in the eyes of investors. As a result, this study does not succeed in proving that R&D costs strengthen the effect of profitability on firm value for the period 2019–2023.

The statement that R&D costs strengthen the effect of profitability on firm value occurs because R&D costs are a key factor in innovation development. Investors are attracted to innovative investments and expect greater benefits in the future (Kalantonis et al., 2020), but this was not proven in this study. The assumption that R&D costs will result in increased technological and design efficiency, as well as the use of innovative products and services, thereby encouraging companies to enter dynamic and competitive business markets and ultimately positively impacting company performance especially in the manufacturing sector (Ehie & Olibe, 2010), did not lead to R&D costs strengthening the effect of profitability on firm value. Therefore, these results indicate that investors do not view R&D costs in a company as a favorable signal.

The failure of this study to prove that R&D costs strengthen the effect of profitability on firm value for the period 2019–2023 may be due to the perception that R&D costs are inefficient, especially since they require advanced technology and originality of ideas (not copying from other companies to avoid plagiarism). Investors may still view these costs as a drag on earnings, which could impact dividend distribution. Furthermore, in the manufacturing sector, the R&D costs for further development cannot be too large due to other operational expenditures such as salaries, wages and welfare, distribution costs, rental costs, depreciation, transportation, and other expenses (Trisnajuna & Sisdyani, 2015). Thus, investors seem not to see R&D costs as adding value to profitability and therefore do not view them as having a moderating effect on firm value.

This result is consistent with the research conducted by Subaida and Sari (2021) which found that R&D costs do not have a positive and significant effect on firm value. However, it is inconsistent with the research by Ferida (2019) who found that R&D has a positive and significant effect on firm value.

4.5.4 Modern Technology Investment as a Moderator of the Effect of Profitability on Firm Value for the Period 2019–2023

Based on hypothesis testing, the results show that the interaction between profitability and modern technology investment is negative and significant with respect to firm value, indicating that modern technology investment weakens the effect of profitability on firm value. Thus, the statement that modern technology investment strengthens the effect of profitability on firm value for the period 2019–2023 is not empirically supported. This result also shows that modern technology investment contributes to weakening profitability, which is empirically used as a benchmark by investors in determining firm value. Therefore, it can be said that if a company invests in modern technology, it may reduce the value of profitability information in the eyes of investors. As a result, this study does not succeed in proving that modern technology investment strengthens the effect of profitability on firm value for the period 2019–2023.

The statement that modern technology investment strengthens the effect of profitability on firm value is based on the idea that modern technology investment is a strategic corporate plan indicating competitive capability through changes in industry structure (Wiyani, 2008) but this was not supported in the findings. The assumption that modern technology investment plays a key role as a facilitator of company business activities and greatly contributes to fundamental changes in management structure, operations, and strategy (Kadir, 2014), as well as having a crucial role in business activities such as

increasing efficiency, effectiveness, communication, collaboration, and competitiveness (Sahlan, 2020), and other benefits generated from modern technology investment in a company, was not sufficient to ensure that modern technology investment could strengthen the effect of profitability on firm value. Thus, these results indicate that investors do not view a company's modern technology investments as a favorable signal.

The failure of this study to prove that modern technology investment strengthens the effect of profitability on firm value for the period 2019–2023 may be due to several factors, such as the fact that the impact of modern technology investment cannot be felt in the short term, and investors tend not to pay attention to the amount of a company's modern technology investment. Expenditures on modern technology investment are considered long-term investments, so their effects are only felt several years later. As a result, market participants are still waiting to see the impact of modern technology investment policies on the company's cash flows, leading them to refrain from trading company shares. Moreover, company profits are generally still safe at present, so investors can still expect returns from dividends, resulting in only a small impact of modern technology investment on increasing firm value (Sudiyatno, 2010).

Additionally, effective modern technology investment is not measured by the amount of money spent, but by the company's management control in maximizing the use of the fixed assets purchased. Modern technology investment is a long-term policy, so the returns from such investments are future income. Therefore, investors tend to make short-term investments on the stock exchange, focusing more on a company's short-term financial ratios (Fitriani, 2023). This causes investors to see modern technology investment as something that does not add value to profitability, thereby having a moderating (weakening) effect on firm value.

This result is inconsistent with the findings of Wiyani (2008), who stated that modern technology investment has a significant effect on firm value, as well as with Sahlan (2020), who stated that modern technology investment strengthens the effect of financial reporting on firm value.

5. Conclusion

5.1 Conclusion

The analysis shows that profitability positively affects firm value, although its relevance for investors has declined. Intangible assets and modern technology investment weaken the relationship between profitability and firm value, suggesting that these factors have not yet enhanced the informativeness of earnings. Research and development costs do not significantly affect this relationship. Overall, while profitability remains important for investors, its role as a reliable indicator in financial statements appears increasingly limited.

5.2 Suggestions

1. Future research should investigate additional variables that may moderate the relationship between profitability and firm value, such as alternative profitability measures (ROE, ROA) or other accounting information variables.
2. Researchers are encouraged to refine indicators for measuring modern technology investment.
3. Expanding the sample to include companies from diverse sectors and extending the observation period could provide more comprehensive insights.
4. Comparative analyses across industries or periods, including both normal and pandemic-affected years, may help clarify how intangible assets, research and development costs, and technology investments influence the profitability–firm value relationship.

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