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Investment Efficiency in Indonesia's Construction Sub-Sector: An Optimal Portfolio Approach Using the Markowitz Model

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ABSTRACT

Investment is an activity aimed at generating future profits but is inherently accompanied by uncertainty risks. To minimize such risks, investors need to construct an optimal portfolio. This study uses the Markowitz Model approach to analyze the allocation of returns and risks in forming an optimal portfolio of construction sub-sector stocks listed on the Indonesia Stock Exchange (IDX) from January to December 2021 as well as identifies the stocks selected as part of the optimal portfolio. The research employs a descriptive quantitative approach, with a population of 29 stocks and a sample of 18 stocks meeting the selection criteria. The results reveal that applying the Markowitz Model results in an optimal portfolio with a risk level of 0.47% and an expected return of 4.12%. The four stocks selected for the optimal portfolio include DGIK (44.4%), IDPR (2.2%), PPRE (30.9%), and RONY (18%). This study contributes new insights by highlighting investment efficiency in the construction sub-sector in Indonesia, which plays a vital role in national development. Moreover, it compares various portfolio scenarios to identify the best efficiency point, a method rarely applied in the context of the construction sector within the Indonesian market. This research is expected to serve as a reference for investors and scholars in understanding the formation of optimal portfolios and to encourage further.

Keywords : Investment Efficiency; Optimal Portfolio; Markowitz Model; Return and Risk; Construction Sub-Sector

ABSTRAK

Investasi adalah kegiatan yang bertujuan untuk menghasilkan keuntungan di masa depan, namun pada dasarnya memiliki risiko ketidakpastian. Untuk meminimalkan risiko tersebut, investor perlu membentuk portofolio yang optimal. Penelitian ini menggunakan pendekatan Model Markowitz untuk menganalisis alokasi return dan risiko dalam membentuk portofolio optimal pada saham-saham sub sektor konstruksi yang terdaftar di Bursa Efek Indonesia (BEI) pada periode Januari sampai dengan Desember 2021 serta mengidentifikasi saham-saham yang terpilih menjadi bagian dari portofolio optimal tersebut. Penelitian ini menggunakan pendekatan kuantitatif deskriptif, dengan populasi sebanyak 29 saham dan sampel sebanyak 18 saham yang memenuhi kriteria pemilihan. Hasil penelitian menunjukkan bahwa penerapan Model Markowitz menghasilkan portofolio optimal dengan tingkat risiko 0,47% dan tingkat pengembalian yang diharapkan sebesar 4,12%. Empat

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saham yang terpilih sebagai portofolio optimal adalah DGIK (44,4%), IDPR (2,2%), PPRE (30,9%), dan RONY (18%). Studi ini memberikan kontribusi wawasan baru dengan menyoroti efisiensi investasi di subsektor konstruksi di Indonesia, yang memainkan peran penting dalam pembangunan nasional. Selain itu, penelitian ini membandingkan berbagai Scenario portofolio untuk mengidentifikasi titik efisiensi terbaik, sebuah metode yang jarang diterapkan dalam konteks sektor konstruksi di pasar Indonesia. Penelitian ini diharapkan dapat menjadi referensi bagi para investor dan akademisi dalam memahami pembentukan portofolio yang optimal dan mendorong penelitian lebih lanjut.

Kata Kunci : Efisiensi Investasi; Portofolio Optimal; Model Markowitz; Return dan Risiko; Sub-Sektor Konstruksi

INTRODUCTION

The progress of globalization has had a significant impact on global economic growth, including in Indonesia. One of the key sectors that plays a strategic role in national development is the construction sector, particularly the building construction subsector. According to data from the Central Statistics Agency (BPS), building construction projects saw an increase of 8.42% in 2022 compared to the previous year. This growth includes various aspects, such as the number of projects, investment value, and the expansion of the construction sector covering infrastructure and property development. This reflects the significant potential of this subsector in driving the economy, as more projects are being undertaken and higher investment values are flowing into this sector. This indicates a great potential of this subsector in boosting the economy.

For example, the building construction subsector makes a significant contribution through the development of urban infrastructure, such as office buildings and shopping centers, which enhance investment attractiveness. Additionally, the construction of educational and healthcare facilities, such as schools and hospitals, supports equitable access to public services. Subsidized housing development also helps reduce the housing backlog and creates job opportunities for the local community. However, behind the opportunities, the sector also faces high risks due to market volatility and the ever-changing dynamics of economic policies (Chih, Hsiao, Zolghadr, & Naderpajouh, 2022). Therefore, a strategic approach to risk management is needed, one of which is through portfolio optimization.

Stock portfolio optimization becomes relevant to help investors reduce risk without sacrificing the expected returns. One of the models commonly used is the Markowitz Model, first introduced in 1952. This model became the foundation of modern portfolio theory, with its main advantage being the consideration of asset correlations to form efficient portfolio combinations. In the Indonesian stock market, known for its volatility, the Markowitz Model is highly effective in creating an optimal portfolio that maximizes returns for a certain level of risk or minimizes risk for a certain level of return (Zhang, Xiang Li, & Guo, 2018). (Balqis, Subiyanto, & Supian, 2021) states the Markowitz Model is based on the assumption that each asset in the portfolio has an expected return and risk (measured by variance or standard deviation). However, the application of the Markowitz Model to specific subsectors, such as building construction, is still relatively limited.

Previous research provides a strong foundation for this study. (Bandawaty, 2020)

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highlights the high risks in the construction sector caused by fluctuations in raw material prices and economic policy uncertainty. The Markowitz Model is a classical approach in portfolio management aimed at optimizing the relationship between risk and return. This is in line with (Permana, 2020), who states that the Markowitz Model is effective as a basic framework in managing portfolios in the Indonesian stock market. Additionally, the multi-scenario approach in portfolio analysis to improve decision-making accuracy is crucial. One such approach, the multi-scenario method, helps identify hidden risks that may not be detected in a single analysis (Tehrani, Mobin, Beauregard, Rioux, & Kenne, 2021). However, most of these studies focus solely on the sector or stock market in general, without considering the unique characteristics of the building construction subsector. This creates a gap in the literature, which this study aims to address.

This study aims to fill this gap by exploring stock portfolio optimization in the building construction subsector during the period of January–December 2021 using the Markowitz Model. The selection of the period from January to December 2021 in the study on stock portfolio optimization in the building construction subsector was driven by several factors. The year 2021 marked Indonesia's economic recovery phase following the significant impact of the COVID-19 pandemic in the previous year. During this period, the construction sector showed signs of recovery, with higher growth compared to the national economic growth. For instance, in 2018, the construction sector grew by 6.09%, surpassing the economic growth of 5.01%, and in 2019, the sector grew by 5.76%, exceeding the economic growth of 5.02%.

The novelty of this research lies in its specific focus on the building construction subsector, which has unique characteristics such as sensitivity to government policies and macroeconomic dynamics. By integrating the Markowitz Model with a multi-scenario approach, this study can evaluate portfolio efficiency under various market conditions, offering a new contribution to portfolio optimization literature. Another novelty is the use of the latest data from the Indonesia Stock Exchange (IDX), reflecting the current dynamics of the stock market. This research also provides a more in-depth analysis compared to previous studies by exploring optimal investment strategies in the building construction subsector. With this approach, the study is expected to not only provide theoretical contributions but also offer practical guidance to investors in making better decisions, particularly in dealing with high risks in the construction sector.

Thus, this research is expected to identify an optimal stock portfolio that provides maximum returns with controlled risks. In addition to offering practical guidance for investors, this study also enriches the academic literature with a fresh perspective on portfolio optimization in the building construction subsector. The findings of this study are expected to serve as a valuable reference for academics, investment practitioners, and policymakers in efforts to advance the construction sector in Indonesia.

RESEARCH METHOD

This study adopts a descriptive quantitative approach to analyze the formation of an optimal portfolio for stocks in the building construction sub-sector listed on the Indonesia Stock Exchange (IDX). The Markowitz Model is utilized as the primary framework to determine portfolio combinations that provide optimal returns with minimal risk. The Markowitz Model emphasizes the importance of diversification by recognizing that the correlation between assets plays a crucial role in portfolio risk (Lakshmi, Krishna, &

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Mamatha, 2023).

The data used in this study are secondary data obtained from several key sources. Monthly closing stock prices for the period of January to December 2021, it is based on Indonesia's economic recovery phase post-COVID-19 pandemic, gathered from the official IDX website and other reliable sources such as Yahoo Finance and Refinitiv, as well as websites like www.idx.com, www.msn.com, www.bps.go.id, and other data providers.

The population of this study includes all companies listed in the building construction sub-sector on the IDX, totaling 29 companies. The sample was selected using a purposive sampling method based on specific criteria, including companies actively traded during the study period, having complete stock price data, not delisted, and demonstrating financial performance stability. Based on these criteria, 18 companies were selected as the study sample.

The primary variables examined in this study include stock returns, expected returns, risk, and inter-stock correlation. Stock returns are calculated as the percentage change in stock prices over a given period. The expected return is determined as the average historical return of each stock, allowing investors to evaluate the potential profitability of an asset relative to its associated risks. This makes the expected return a key indicator in selecting an optimal asset combination within a portfolio, Meanwhile, risk is measured using the standard deviation of stock returns. Additionally, the correlation between stocks is analyzed to determine the relationship between stock price movements, which serves as the basis for constructing an optimal portfolio.

The process of forming an optimal portfolio is carried out through several steps. The first step is to collect stock closing price data and select stock samples based on predetermined criteria, which are calculated using the following formulas: Calculate the stock return using the Formula 1:

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}} \qquad (1)$$

Based on Formula 1, R_{it} is monthly stock return, P_{it} is current month's stock price and P_{it-1} is previous month's stock price. Next, calculate the expected return of each stock using the Formula 2:

$$E(R_i) = \frac{\sum R_i}{N} \qquad (2)$$

Based on Formula 2, $E(R_i)$ is average return of each stock, $\sum R_i$ is the total return of each stock and N is the number of samples. Then, calculate the risk of each stock using Formula 3, with σ_i is standard deviation (Risk) of each stock

$$\sigma_i = \sqrt{\frac{\sum (R_{it} - E(R_i))^2}{N - 1}} \qquad (3)$$

Calculate the correlation coefficients of stock prices using the Formula 4:

$$\rho_{ij} = \frac{\sum (R_{it} - R_{jt}) - n\,E(R_i)E(R_j)}{\sqrt{\left[\sum R_{it}^2 - n\,E(R_i)^2\right]\left[\sum j^2 - n\,E(R_j)^2\right]}} \qquad (4)$$

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Based on Formula 4, ρ_{ij} is correlation between stocks, $E\ (R_i)$ is the average return of the i-th stock and $E\ (R_j)$ is the average return of the j-th stock.

After that, the determination of investment weights, calculation of portfolio returns, and portfolio risk are carried out. The investment weights are calculated using two approaches: the random approach and the efficient set approach (using the highest return and specific risk). The Formula 5 for portfolio return is:

$$\boldsymbol{E(R_p) = \sum X_i\, E(R_i)} \qquad \textbf{(5)}$$

Based on Formula 5, $E(R_p)$ is portopolio return, X_i is proportion for the i-th stock, and $E(R_i)$ is the average of the i-th stock. Meanwhile, the Formula 6 for portfolio risk is:

$$\boldsymbol{\rho_p{}^2 = X_i{}^2\sigma_i{}^2 + X_j{}^2\sigma_j{}^2 + 2X_iX_j\rho_{ij}\sigma_i\sigma_j} \qquad \textbf{(6)}$$

Based on Formula 6, $\rho_p{}^2$ is portfolio variance, ρ_p is portfolio risk, X_i is proportion of stoci and X_j is proportion of stock j. The final step is to compare the return and risk levels of the formed optimal portfolio and identify the stocks that make up the optimal portfolio. By following the stages of the Markowitz model and using Excel, the goal is to obtain the optimal return and risk of the portfolio in the subsector.

RESULTS AND DISCUSSION

This study focuses on companies within the building construction subsector, which will be selected to form an optimal portfolio. The initial step in selecting optimal stocks using the Markowitz technique involves calculating the return, expected return, standard deviation, and variance of each stock. The results are presented in Table 1.

Table 1. Expected Return and Standard Deviation of Stocks in the Building Construction Sub-Sector

No	Emiten Code	E(Ri)	STDEV	Variance
1	ACST	-3.9%	11.5%	1.3%
2	ADHI	-2.6%	15.8%	2.5%
3	BUKK	4.1%	9.5%	0.9%
4	DGIK	14.8%	20.9%	4.4%
5	FIMP	-4.3%	9.4%	0.9%
6	IDPR	-1.4%	27.7%	7.7%
7	JKON	-7.6%	13.4%	1.8%
8	MTPS	0.1%	7.8%	0.6%
9	MTRA	0.0%	0.0%	0.0%
10	NRCA	-1.3%	3.4%	0.1%
11	PBSA	5.4%	18.7%	3.5%
12	PPRE	-0.4%	13.6%	1.9%
13	PTDU	1.1%	57.8%	33.4%
14	PTPP	-3.8%	12.0%	1.4%
15	PTPW	-2.9%	21.9%	4.8%
16	RONY	22.9%	56.5%	32.0%
17	SSIA	0.9%	7.5%	0.6%
18	TAMA	-0.9%	14.8%	2.2%

Source: Data Processed, 2024

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Based on Table 1, it shows that the highest expected return E(Ri) is found in RONY stock at 22.9%, while the stock with the lowest return is JKON, at -7.6%. Meanwhile, the highest risk (STDEV) is found in PTDU stock at 57.824%, and the stock with the lowest risk is NRCA, at 3.441%.

The researcher created three scenarios: Porto 1, Porto 2, and Porto 3, with random proportions. The company with the highest return, RONY, was allocated the largest portion in each scenario, except in Porto 1, where the researcher used a moderate portion compared to other companies. This was done to observe its impact on portfolio risk and portfolio return. From these three scenarios, the portfolio risk and portfolio return can be seen in Table 2.

Table 2. Random Stock Proportion

No.	Emiten Code	Scenario		
		Porto 1	Porto 2	Porto 3
1	ACST	5%	1.3%	2%
2	ADHI	10%	1.3%	2%
3	BUKK	10%	10.0%	12%
4	DGIK	5%	20.0%	15%
5	FIMP	10%	1.3%	2%
6	IDPR	5%	1.3%	1%
7	JKON	5%	1.3%	2%
8	MTPS	5%	4.0%	4%
9	MTRA	5%	1.3%	2%
10	NRCA	5%	1.3%	2%
11	PBSA	10%	15.0%	11%
12	PPRE	3%	1.3%	2%
13	PTDU	3%	7.0%	12%
14	PTPP	3%	1.3%	2%
15	PTPW	5%	1.3%	2%
16	RONY	5%	25.0%	20%
17	SSIA	3%	5.0%	5%
18	TAMA	3%	1.3%	2%
Total		100%	100%	100%
Portoplio Risk		0.19%	0.53%	0.46%
Portopolio Return		0.70%	3.60%	2.87%

Source: Data Processed, 2024

Based on Tables 1 and 2, the analysis results show differences in the levels of risk and returns generated from various portfolio scenarios. In the first scenario, by allocating a more diversified proportion of stocks, including stocks with the highest returns such as RONY (5%) and DGIK (5%) along with several other stocks, this portfolio produced a relatively low risk of 0.19%, with an expected return of 0.70%. The second scenario, on the other hand, allocated a larger proportion to stocks such as DGIK (20%) and RONY (25%), resulting in a higher risk of 0.53%, but it was balanced with a higher return of 3.60%. The third scenario allocated stocks to RONY (20%) and DGIK (15%), which was smaller than in

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Scenario 2. This scheme resulted in a risk level of 0.46% and an expected return of 2.87%.

Overall, although the three scenarios have varying levels of risk, each provides different returns depending on the stock proportions selected in the portfolio. Ultimately, from the three scenarios with a random approach and based on allocating the largest proportion to stocks with the highest returns under certain risk levels, the portfolio with the highest return is Scenario 2. Therefore, Scenario 2 will be compared to a scenario based on the efficient proportion approach. (See Table 3)

Table 3. Portfolio Efficient Set Proportion

No	Kode Emiten	Scenario					
		Efisient 47%	Efficient 50%	Efficient 55%	Efficient 57%	Efficien60%	Efficien 65%
1	ACST	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2	ADHI	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3	BUKK	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4	DGIK	44.4%	46.4%	49.4%	50.5%	52.3%	0.0%
5	FIMP	0.0%	0.0%	0.0%	0.0%	0.0%	55.0%
6	IDPR	2.2%	1.2%	0.0%	0.0%	0.0%	0.0%
7	JKON	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8	MTPS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
9	MTRA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10	NRCA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
11	PBSA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12	PPRE	30.9%	29.1%	25.8%	24.1%	21.5%	0.0%
13	PTDU	4.5%	4.2%	3.5%	3.2%	2.9%	17.4%
14	PTPP	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%
15	PTPW	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
16	RONY	18.0%	19.2%	21.3%	22.1%	23.4%	0.0%
17	SSIA	0.0%	0.0%	0.0%	0.0%	0.0%	25.4%
18	TAMA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		100%	100%	100%	100%	100%	100%
Portoplio Risk		0.47%	0.50%	0.55%	0.57%	0.60%	0.65%
Portopolio Return		4,12%	4,32%	4.64%	4.77%	4.95%	5.26%

Source: Data Processed, 2024

The formation of the efficient frontier portfolio is a collection of efficient portfolios with a specified risk value. The formation of the efficient portfolio considers the smallest portfolio risk without considering riskless lending and borrowing, assuming the investor is a risk-averse individual. Based on the results above, the combination of assets will provide an optimal portfolio with the smallest risk. The decision-making suggested by Markowitz is to refer to the formation of a portfolio with the lowest risk level. Investors can choose the portfolio with the lowest risk by selecting the 47% Efficiency Portfolio, which only incurs a risk of 0.47%.

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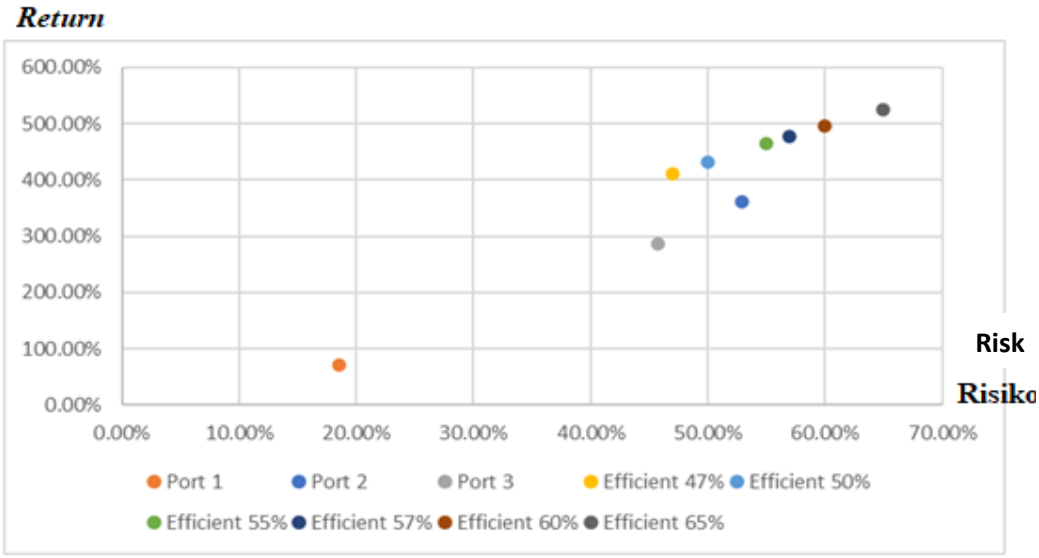
The researcher compared the returns and risks based on both the random scenarios (Porto 1, Porto 2, and Porto 3) and the Efficient portfolio proportion. This comparison can be observed in Figure 1.



Source: Data Processed, 2024

Figure 1. Optimal Portfolios of Building Construction Sub-Sector Stocks

Based on Figure 1, it shows that point porto-1 results in a risk of 0.19% with an expected return of 0.70%, porto-2 results in a risk of 0.53% with an expected return of 3.60%, and porto-3 results in a risk of 0.46% with an expected return of 2.87%. The efficient portfolio points are determined using the efficient set method. These points include the 47% efficient portfolio, which achieves a risk of 0.47% with an expected return of 4.12%, the 50% efficient portfolio, which achieves a risk of 0.50% with an expected return of 4.32%, the 55% efficient portfolio, which achieves a risk of 0.55% with an expected return of 4.64%, the 57% efficient portfolio, which achieves a risk of 0.57% with an expected return of 4.77%, the 60% efficient portfolio, which achieves a risk of 0.60% with an expected return of 4.95%, and the 65% efficient portfolio, which achieves a risk of 0.65% with an expected return of 5.26%.

Table 4. Comparison of Portfolio Return and Risk

Return dan Resiko Portfolio	Port 2	Portfolio Efficient 47%
Resiko	0.53%	0.47%
Return	3.60%	4.14%

Source: Data Processed, 2024

Based on Table 4, it can be seen that the comparison between portfolio 2 and the efficient portfolio 47% shows noticeable differences in terms of the risk levels and

expected return generated. The highest return produced by Portfolio 2 is 3.60%, while the highest return produced by the efficient portfolio 47% is 4.12%. Portfolio 2 achieves the lowest risk of 0.53%, whereas the efficient portfolio 47% achieves the lowest risk of 0.47%. The efficient portfolio is able to generate the same return but with a lower risk. Assuming that the investor is a rational individual who tends to avoid risk (risk-averse), the efficient portfolio 47% represents the optimal portfolio with the lowest risk, thus making it the Minimal Variance Portfolio (MVP). Investors are advised to choose the efficient portfolio 47%, as it generates the same return but with a lower risk compared to portfolio 2. This is in line with Markowitz's portfolio theory, which suggests forming a portfolio with the lowest risk while maintaining the same level of return (Mittal, Bhattacharya, & Mandal, 2021). Investors can choose the efficient portfolio 47% with only a 0.47% risk and an expected return of 4.12%. Therefore, the efficient portfolio 47% can be considered the optimal portfolio. The efficient portfolio 47% consists of four selected stocks. Investors can allocate the proportion of investments to DGIK (44.4%), IDPR (2.2%), PPRE (30.9%), and RONY (18%).

This research produces an optimal portfolio using the Markowitz Model for construction sub-sector stocks listed on the Indonesia Stock Exchange (BEI) during the period from January to December 2021. With this approach, the portfolio risk is minimized to 0.47% with an expected return of 4.12%. The selected stocks in the optimal portfolio are DGIK (44.4%), RONY (18%), PPRE (30.9%), and IDPR (2.2%). These results provide practical guidance for investors in managing risk while maximizing returns. The selection of these stocks is based on an in-depth analysis of the historical performance and volatility of each stock within the construction subsector. By considering the correlations between stocks, the Markowitz Model enables the creation of a more efficient portfolio, which not only optimizes returns but also reduces the potential losses caused by stock price fluctuations (Radovic, Radukic, & Njegomir, 2018).

The findings of this research are in line with the study by (Giharta, Sedana, & Bagus , 2017), which also used the Markowitz Model to form an optimal portfolio in the construction sector. However, this research demonstrates a higher level of efficiency due to the use of more up-to-date data and consideration of current market dynamics. In comparison, (Ridwanudin & Sari, 2023) showed that the Markowitz Model is superior to the Single Index Model in terms of risk diversification, further supporting the relevance of this research in the context of the Indonesian stock market. Additionally, the significant time difference in data selection and the methods used provides a more accurate picture of the potential optimal portfolio (Putra & Dana, 2020), especially in dealing with the ever-evolving market uncertainties. This demonstrates that the Markowitz Model remains relevant and effective as a tool for managing risk and enhancing returns in dynamic market conditions.

DGIK stock is dominant in the portfolio, with an allocation of 44.4%. This can be explained by its combination of a high return rate and relatively controlled risk. Fundamentally, DGIK has shown solid financial performance during the research period, supported by large-scale construction project growth in Indonesia. From a technical perspective, the stock price volatility of DGIK remained within acceptable limits, making it an attractive option for the portfolio. RONY stock, with an allocation of 18%, also shows significant potential in the optimal portfolio. Although it carries a higher risk compared to other stocks, its expected return is among the highest in the construction sub-sector. Technical factors such as a consistent upward price trend during the research period

support this stock's dominance in the portfolio (Lin, 2018). PPRE and IDPR stocks, although having smaller allocations, still contribute positively to the portfolio's risk diversification. Fundamentally, both of these stocks benefited from the massive government infrastructure projects in 2021, strengthening their position as low-risk assets with stable returns.

The portfolio efficiency graph illustrates the relationship between risk and return across various portfolio scenarios. The efficient portfolio point at 47% provides the lowest risk of 0.47% with an expected return of 4.12%. Compared to other scenarios, such as the 50% or 55% efficient portfolios, the risk at this point is lower while maintaining a competitive return rate. This interpretation suggests that risk-averse investors can select the 47% efficient portfolio to maximize their utility. In line with Markowitz's theory, the asset combination at this point offers optimal diversification, where the overall portfolio risk is minimized through the correlation among the stocks (Koumou, 2020). (Jones & Trevillion, 2022) states that by carefully selecting assets with different correlations—some positively correlated, some negatively correlated—the portfolio can achieve a balance that reduces the impact of individual asset volatility.

This study reaffirms a fundamental principle of investing—the trade-off between risk and return. Stocks such as DGIK and RONY, despite having relatively high individual risks, can significantly contribute to the portfolio's return when combined with low-risk stocks like PPRE and IDPR. This diversification enables the portfolio to achieve an optimal combination that is difficult to attain by relying solely on one stock. (Ma, Ahmad, Liu, & Wang, 2020) explain that diversification allows a portfolio to reduce overall risk without sacrificing the potential for higher returns. Moreover, the results show that the Markowitz Model provides a practical solution for navigating market volatility, particularly in the construction sector, which is often influenced by government policy dynamics and macroeconomic factors.

This research provides empirical evidence that the Markowitz Model is effective in forming optimal portfolios for construction sub-sector stocks in Indonesia. The dominance of specific stocks in the portfolio is supported by a combination of fundamental and technical factors, while the graphical interpretation highlights the portfolio's efficiency in minimizing risk while maximizing return. This study is expected to serve as an important reference for investors and researchers in understanding portfolio optimization strategies in other strategic sectors.

CONCLUSION

The conclusion of this study confirms that the Markowitz Model is effective in constructing an optimal portfolio for construction subsector stocks on the Indonesia Stock Exchange. The effectiveness of this model is supported by its ability to quantitatively measure risk and return, as well as optimize their combination to achieve an efficient portfolio. The findings show that the resulting optimal portfolio has a low risk of 0.47% with an expected return of 4.12%. This reinforces that the Markowitz Model provides a good balance between risk and return, making it relevant for various types of investors.

The four stocks dominating this optimal portfolio are DGIK, RONY, PPRE, and IDPR,

each contributing significantly to risk diversification and return optimization. The dominance of these stocks is due to several key characteristics, such as stable historical performance, controlled risk, and low correlation between stocks, allowing for more effective diversification. With these characteristics, these four stocks become ideal choices for reducing risk and enhancing return potential within the portfolio. This study provides practical guidance for investors, both individual and institutional, in managing their investment portfolios efficiently. Investors can use these findings to select stocks with the optimal combination of maximum return and measured risk, aligning with their risk profile. Therefore, this study not only contributes theoretically to portfolio optimization literature but also offers practical benefits that can be applied in real-world investment decision-making.

RECOMMENDATION

Based on the research findings, it is recommended that investors use the Markowitz Model approach in building investment portfolios, particularly in the construction sector, which has high growth potential. Portfolio diversification can help investors manage risk more efficiently without sacrificing expected returns. For beginner investors, this research can serve as an initial guide to understanding the importance of risk and return analysis before making investment decisions. For institutions, this recommendation can serve as the foundation for more complex asset allocation strategies, especially in facing market volatility. Additionally, regulators and the government are expected to support the development of the capital market by increasing stock data transparency and implementing policies that support market liquidity, such as providing incentives for construction companies to list their shares on the Indonesia Stock Exchange (IDX) or supporting sustainable infrastructure projects. These steps are expected to attract more investors and enhance the competitiveness of Indonesia's construction sector. Future research may explore hybrid models, such as integrating the Markowitz Model with the Value at Risk (VaR) approach or machine learning-based models, to achieve more adaptive portfolio optimization. Cross-sector and cross-country research is also important to understand investment dynamics in a global context, offering new insights for future portfolio management strategies. The limitations of this study relate to the sample size and the limited time period, so future research could expand the sample scope and observation period to obtain more representative results.

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