**SKRIPSI**

# METODE FUZZY C-MEANS DAN PARTICLE SWARM OPTIMIZATION PADA PEMBENTUKAN PORTOFOLIO SAHAM INDEKS LQ45

***FUZZY C-MEANS AND PARTICLE SWARM OPTIMIZATION METHODS IN THE FORMATION OF THE LQ45 INDEX STOCK PORTFOLIO***

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Diajukan untuk memenuhi salah satu syarat memperoleh derajat
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# ABSTRAK

## METODE FUZZY C-MEANS DAN PARTICLE SWARM OPTIMIZATION PADA PEMBENTUKAN PORTOFOLIO SAHAM INDEKS LQ45

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Meningkatnya dinamika pasar keuangan dan tingginya tingkat ketidakpastian ekonomi global memerlukan metode analisis yang mampu membantu investor dalam memilih saham secara lebih tepat. Metode *Fuzzy C-Means* (FCM) digunakan untuk mengelompokkan saham indeks LQ45 berdasarkan rasio profitabilitas, seperti *Return on Equity* (ROE), *Net Profit Margin* (NPM), dan *Price to Earnings Ratio* (PER). Penentuan jumlah *cluster* optimal divalidasi menggunakan *Davies-Bouldin Index* (DBI). Setiap *cluster* dipilih saham dengan *expected return* tertinggi, kemudian bobot portofolio dioptimalkan menggunakan *Particle Swarm Optimization* (PSO) dengan tujuan memaksimalkan *Sharpe Ratio*. Hasil penelitian menunjukkan bahwa portofolio optimal terdiri dari tiga saham dengan proporsi bobot BRIS (60.11%), BRPT (20.59%), dan ANTM (19.29%). Risiko portofolio diukur menggunakan *Value at Risk* (VaR) dan *Expected Shortfall* (ES) pada tingkat kepercayaan 95% selama satu bulan, dengan potensi kerugian maksimum sebesar 11,18% serta kemungkinan kerugian terburuk mencapai 14.62%.



**Kata Kunci:** Investasi, Portofolio Saham, Indeks LQ45, Rasio Profitabilitas, *Fuzzy C-Means*, *Davies-Bouldin Index*, *Particle Swarm Optimization*, *Sharpe Ratio*, *Value at Risk*, *Expected Shortfall*.

**ABSTRACT**

**FUZZY C-MEANS AND PARTICLE SWARM OPTIMIZATION METHODS IN THE FORMATION OF THE LQ45 INDEX STOCK PORTOFOLIO**

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The increasing dynamics of the financial market and the high level of global economic uncertainty require analysis methods that can help investors choose stocks more accurately. The Fuzzy C-Means (FCM) method is used to cluster LQ45 index stocks based on profitability ratios, such as Return on Equity (ROE), Net Profit Margin (NPM), and Price to Earnings Ratio (PER). The determination of the optimal number of clusters is validated using the Davies-Bouldin Index (DBI). Each cluster selected stocks with the highest expected return, then the portfolio weight was optimized using Particle Swarm Optimization (PSO) with the aim of maximizing the Sharpe Ratio. The results showed that the optimal portfolio consisted of three stocks with weight proportions of BRIS (60.11%), BRPT (20.59%), and ANTM (19.29%). Portfolio risk is measured using Value at Risk (VaR) and Expected Shortfall (ES) at a 95% confidence level for one month, with a maximum potential loss of 11.18% and a worst-case loss of 14.62%.

**Keywords:** Investment, Stock Portfolio, LQ45 Index, Profitability Ratio, Fuzzy C-Means, Davies-Bouldin Index, Particle Swarm Optimization, Sharpe Ratio, Value at Risk, Expected Shortfall.