CHAPTER I
INTRODUCTION

1.1. Background

The rise of information technology has pulled Financial Technology into everyday financial life, changing how people access and use financial systems [1]. Beyond making digital transactions easier, FinTech has created new space for investment activity. Better computing and data analysis tools now allow market participants to make decisions more quickly and with greater accuracy [2]. This reflects a move away from intuition toward more systematic decision-making.

Algorithmic trading is one of the more common applications of technology in modern investing. It automates transaction analysis based on predefined rules, and according to [2], technical analysis is the dominant method it uses to read price movements. This makes it a relevant tool for cryptocurrency markets, where supply and demand shift quickly enough to keep volatility persistently high [3].

Crypto markets never close, which puts pressure on traders to monitor prices continuously to catch opportunities to buy low and sell high [4]. High volatility makes that harder price prediction becomes genuinely difficult, and trading on intuition alone carries real risk. There is a clear need for analytical methods that produce more reliable signals and can adapt as market conditions change.

Technical analysis addresses this by reading trends and price patterns from historical data [5]. Trend indicators like SMA and EMA help identify where the market is heading, while momentum indicators like MACD and RSI detect shifts in trend strength and flag overbought or oversold conditions [2]. Bollinger Bands map price pressure through standard deviation bands, while Parabolic SAR and Stochastic Oscillator can signal trend reversals and momentum shifts earlier than many other tools in fast-moving markets [6]. Stochastic RSI offers higher sensitivity because it derives momentum from RSI values rather than price directly, making it quicker to respond to rapid changes [7]. Together, these eight indicators cover trend, momentum, and volatility each bringing a different angle to the analysis, which is the case for using all of them.

That said, individual indicators have real limits. They are prone to false signals, and no single indicator can give a complete view of market conditions. Research [8] confirms that relying on just one tends to produce limited information and, in turn, weaker signals.

This problem shows up on two of Indonesia's more popular trading platforms, Pintu and Indodax. Both display indicators SMA, EMA, MACD, RSI separately, with no built-in way to combine them. That leaves interpretation largely up to the user, introducing significant subjectivity into the signal.

Combining multiple indicators can improve accuracy, since each one captures something the others miss [2]. But no existing study has specifically integrated multi-indicator technical analysis into a web-based decision support system with indicator weighting and real-time backtesting. Research [2] evaluates how well multiple indicators work together it does not build a system that translates that combined analysis into trading guidance.

Given this gap, this study aims to develop a cryptocurrency trading DSS based on multi-indicator technical analysis, implemented as a website. By combining eight technical indicators, this system is expected to help users make more optimal trading decisions in the highly volatile cryptocurrency market.

1.2. Problem Statement

Based on the background described above, the research questions in this study are as follows.

1. How can a cryptocurrency trading decision support system be designed and implemented to generate buy, sell, or neutral signals through multi-indicator technical analysis?
2. How can combining SMA, EMA, RSI, MACD, Bollinger Bands, Stochastic Oscillator, Stochastic RSI, and Parabolic SAR with optimized indicator weights produce better trading signals than using any single indicator alone, as measured by ROI, Win Rate, Maximum Drawdown, and Sharpe Ratio?
3. How can the system evaluate trading strategy performance through backtesting, using ROI, Win Rate, Maximum Drawdown, and Sharpe Ratio to support user decision-making?

1.3. Research Objectives

This study aims to develop a cryptocurrency trading decision support system grounded in multi-indicator technical analysis, with the goal of producing trading recommendations that are more objective, consistent, and less dependent on user intuition.

1.4. Research Benefits

This study is expected to offer both theoretical and practical contributions to relevant parties, as outlined below:

1. Theoretical Benefits

   This study contributes to the body of knowledge in technical analysis and decision support systems, particularly in applying multi-indicator technical analysis to cryptocurrency markets. The findings can serve as a reference for future research focused on multi-indicator approaches in similar contexts.

2. Practical Benefits

   For market participants, this study offers a decision support system that generates buy and sell signals automatically reducing reliance on subjective judgment and producing more consistent results. It can also serve as a reference for developers of digital trading systems looking to build technical analysis models that are more responsive to the dynamics of crypto markets.

1.5. Scope of the Problem

The following limitations define the scope of this study and the boundaries of the decision support system developed:

1. The system generates trading signal recommendations (Buy, Sell, or Neutral) only and does not execute transactions automatically.
2. The analysis is based on eight technical indicators: Simple Moving Average (SMA), Exponential Moving Average (EMA), Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), Bollinger Bands, Stochastic Oscillator, Stochastic RSI, and Parabolic SAR.

3. The dataset covers seven cryptocurrency assets with the largest market capitalizations according to CoinMarketCap, limited to those with historical data available on Coinbase prior to January 1, 2025.
4. Indicator weight optimization is conducted using historical data from January 1, 2020 to December 31, 2024. Assets listed after January 1, 2025 are excluded due to insufficient historical data. This range was chosen to ensure a stable optimization period before the strategy is evaluated on separate test data.
5. The system uses a rule-based algorithm grounded in the mathematical calculations of each technical indicator. No Machine Learning or Artificial Intelligence predictive models are involved.
6. Backtesting excludes external market factors such as news sentiment, transaction costs, and slippage. This is intentional the system is designed as a proof of concept to measure the accuracy and integrity of the multi-indicator algorithm's signals without distortion from third-party variable costs.
7. System implemented as a web application only and doesn’t include mobile or iOS development.