

A SYSTEMATIC REVIEW: AN ANALYSIS OF STOCK MARKET PREDICTION

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ABSTRACT

Stock market prediction is a complex and dynamic field that has attracted significant attention from researchers and practitioners seeking to enhance investment decision-making and maximize returns. The goal of this systematic literature review is to give a thorough examination of existing studies on stock market prediction strategies. By synthesizing a wide range of research articles, this review examines the methodologies employed, data sources utilized, predictive models developed, and evaluation metrics applied in the context of stock market prediction. The findings highlight the strengths and limitations of different approaches, such as statistical models, machine learning algorithms, and hybrid techniques. Furthermore, this review identifies research gaps and suggests future directions for improving stock market prediction accuracy. The insights gained from this systematic literature review contribute to understanding the current state of stock market prediction research, facilitate knowledge exchange among researchers, and offer valuable guidance for further advancements in this field.

Keywords: Fuzzy Classifier, Machine Learning, Stock Market Prediction, Technical and Fundamental Analysis, Technical Indicators

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1. Introduction

A systematic review offers various advantages, such as less biased study results from a well-defined approach (Li et al., 2020). Systematic reviews have been widely used in medical science to systematically, transparently, and reproducibly synthesize study findings. Despite its potential, this technique has yet to be widely used in business research, although it is becoming more popular daily (Bhowmik et al., 2020). This study aims to conduct a comprehensive review, critical analysis, and systematic categorization of the literature about an analysis on stock market predictions. This systematic literature review analyses research patterns and ascertains commonalities regarding research objectives, methodology used in the area of the topic, the primary market studied, and the analysis type. Table 1 displays the themes that were identified in the course of this study.



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Table 1: Themes of the Study

No.	Themes of the Study
1.	Objectives
2.	Methodology
3.	Primary Market Studied and Period
4.	Analysis Type

Forecasting the stock market is one of the most challenging tasks in the financial market due to the complex, noisy, chaotic, dynamic, volatile, and non-parametric nature of its time series. However, due to advancements in computation, an intelligent model can assist investors and professional analysts in mitigating investment risk (Li et al., 2020). The studies of stock market forecasting are mainly anyaleses the most suitable and highly accurate prediction methods used. However, according to Zhang et al. (2022), given a response variable, various forecasts can typically be generated if the prediction models have different structures or the same structure but random initialization. In such situations, combining multiple forecasts is frequently more accurate than using a single model alone. This method of "combining the wisdom of the crowds" is known as ensemble learning, and it entails training several separate base learners and combining their predictions.

2. Literature Review

Stock market prediction has been an active area of research for decades, with numerous studies focusing on developing effective models and techniques to forecast market trends. Various methodologies have been explored, from traditional statistical methods to advanced machine learning, statistical means, soft computing and deep learning algorithms (Nti et al., 2020). Early studies predominantly employed statistical models such as autoregressive models to capture temporal dependencies in stock prices. These models relied on historical price data and assumed that past trends would continue. While these models provided valuable insights, they often needed help to capture complex patterns and non-linear relationships in stock market data (Jiang & Abdeldayem, 2022).

In recent years, machine learning algorithms have gained prominence in stock market prediction due to their ability to capture intricate patterns and adapt to changing market conditions (Henrique et al., 2019). Techniques such as support vector machines, random forests, and gradient boosting have been extensively used to predict stock prices based on a wide range of input features, including technical indicators, financial ratios, and news sentiment (Ji, 2022; Ijegwa, 2020; Nguyen, 2019; Rustam, 2018; Mailinda, 2021; Shahvaroughi Farahani, 2021; Nti, 2020; Namdari, 2021; Pang, 2018; Rahul, 2020). These algorithms leverage the power of pattern recognition and feature extraction to uncover hidden relationships and generate accurate predictions. Additionally, deep learning techniques, particularly recurrent neural networks (RNNs) and long short-term memory (LSTM) networks have demonstrated promising results in capturing temporal dependencies and modeling complex sequential data (Mailinda et al., 2021 & Nguyen et al., 2019).

The articles reviewed present various approaches to incorporating technical indicators into stock market prediction models. Some studies employ single indicators as standalone predictors, while others combine multiple indicators to capture different aspects of market behavior (Ijegwa et al., 2014). Researchers often use these indicators

as input features for machine learning algorithms or as decision rules for trading strategies (Ji et al., 2022; Ijegwa et al., 2014; Escobar et al., 2013; Taş & Gürsoy, 2016). The choice of indicators and their combinations depends on the research objectives, data availability, and the specific characteristics of the market being analyzed.

Feature selection is a critical step in stock market prediction to identify the most relevant and informative features for modeling. Researchers have employed various approaches, including correlation analysis, principal component analysis (PCA), and genetic algorithms, to select optimal features (Ji et al., 2022). Additionally, new features derived from technical indicators, statistical measures, and sentiment analysis have been created to capture market trends and investor sentiment. However, feature selection remains challenging, as including irrelevant or noisy features can lead to overfitting and deteriorate prediction performance.

A literature review is an important component of all types of research efforts. Literature reviews serve as a foundation for knowledge advancement, provide recommendations for planning and practice, provide evidence of an effect, and, if correctly guided, have the potential to provide new ideas and directions for a specific research area. (Snyder, 2019). Similarly, a systematic literature review is the basis for future research and theory work.

3. Research Methodology

A systematic literature review (SLR) is a methodical and organised way of looking at and evaluating prior research on a particular subject. It entails using a methodical and predetermined technique to find, choose out, assess, and synthesise pertinent studies from multiple sources. An SLR aims to present an objective and thorough assessment of the current state of knowledge on a particular issue (Bhowmik & Wang, 2020).

A SLR methodology is obtained and adapted from Bhowmik & Wang (2020). This manuscript was led by a systematic database search, surveyed by cross-reference snowballing, as demonstrated in Figure 1, which was originally adapted from Geissdoerfer et al. (2017). Firstly, a systematic literature search is managed. The keywords that were too broad or likely to be recognized in literature-related keywords with other research areas. The search strings used to search for reviews of articles in English from three scientific databases, namely, IEEE Xplore, Science Direct, Web of Science: “stock market”, “prediction”, “forecasting”, “feature selection”, “feature study”, “feature analysis”, “technical indicators”, “mathematical model”, “machine learning”, “forecasting stock return”, “financial market volatility”, “fuzzy logic”, “fuzzy inference system”.

Next, suitable cross-references in this primary sample were discovered by examining the publications' titles in the reference section and their context and cited content in the text. The abstracts of the recognised additional publications were reviewed to evaluate whether or not the work was appropriate. As a result, relevant references were added to the sample and scanned for suitable cross-references. This procedure was repeated until no more suitable cross-references could be discovered. Lastly, the final sample was combined, synthesised, and assembled in the third stage to create the literature review that is resulted in Table 2.

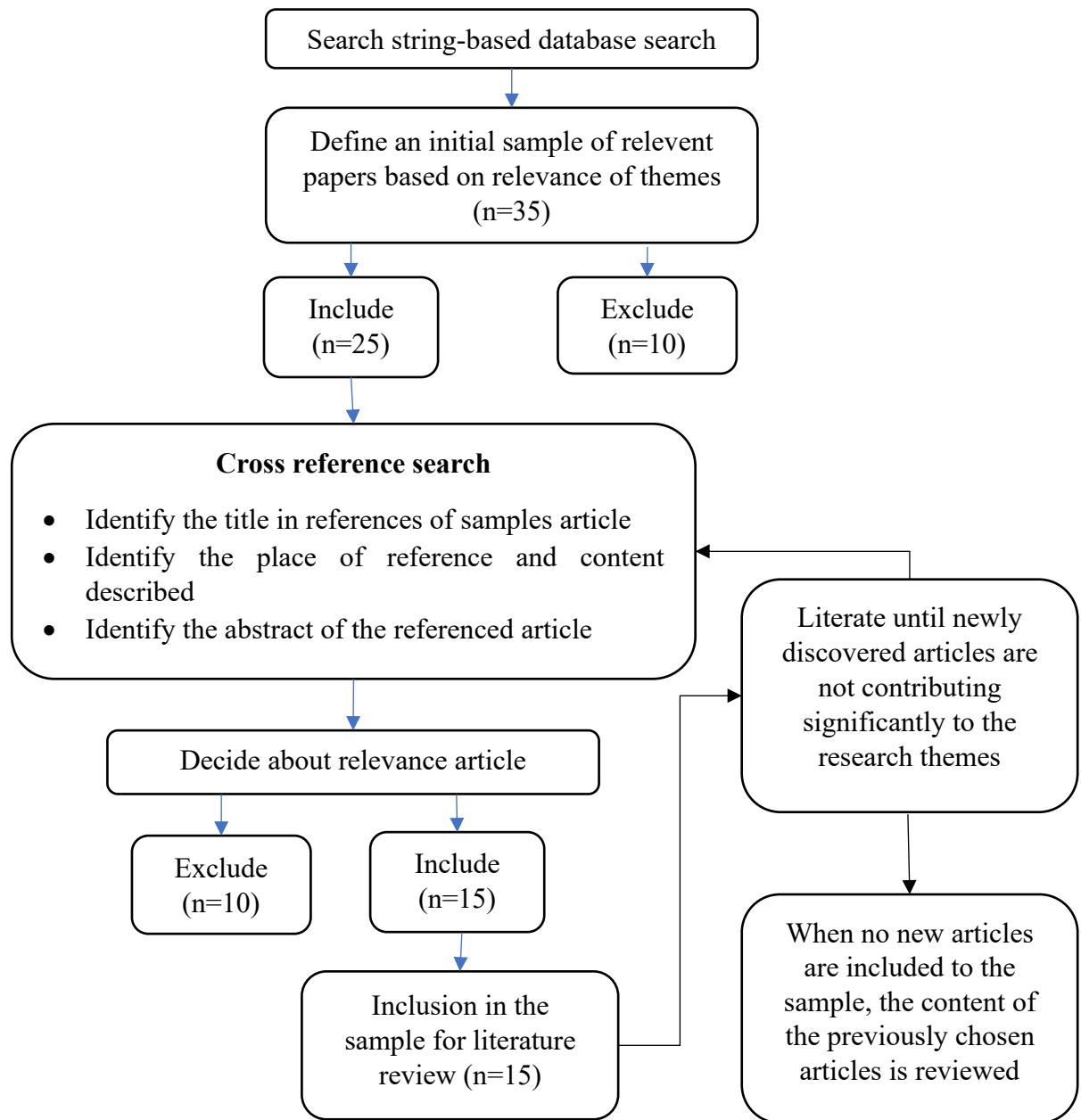


Figure 1: Research Data Search of Literature Review Flow using Cross-Reference Snowballing.

Table 2: Identity of the articles to be analyzed further.

No.	Article Title	Year	Author's Name	Journal Name
1)	SutteARIMA: Short-term forecasting method, a case: Covid-19 and stock market in Spain	2020	Ahmar, Ahsan Shahid; del Val, Elena B.	Science of The Total Environment
2)	An adaptive feature selection schema using improved technical indicators for predicting stock price movements	2022	Ji, Guoliang; Yu, Jingwen; Hu, Kening; Xie, Jun; Ji, Xiang	Expert Systems with Applications
3)	A Predictive Stock Market Technical Analysis Using Fuzzy Logic	2014	Ijegwa, Amaka D.; Rebecca, Victor O.; Olusegun, Folorunso; Isaac, Oluwafemi O.	Computer and Information Science
4)	A Technical Analysis Indicator Based On Fuzzy Logic	2013	Escobar, Andrés; Moreno, José; Múnera, Samuel	Electronic Notes in Theoretical Computer Science
5)	An Intensive Empirical Study of Machine Learning Algorithms for Predicting Vietnamese Stock Prices	2019	Nguyen, Thanh-Phong; Van, Thanh-Do; Le, Nguyen-Thi; Mai, Thanh-Thai; Nguyen-An, Khoi	Advanced Computational Methods for Knowledge Engineering
6)	A Fuzzy Logic Based Technical Indicator for BIST 30 Index and Islamic Index	2016	Taş, Onur; Gürsoy, Özgür Zeki	Procedia Economics and Finance
7)	Prediction and Analysis of ChiNext Stock Price Based on Linear and Non-linear Composite Model	2022	Jiang, Yinye; Abdeldayem, Mohammed M.	Applied Mathematics and Nonlinear Sciences
8)	Predicting the Direction of Indonesian Stock Price Movement Using Support Vector Machines and Fuzzy Kernel C-Means	2018	Rustam, Zainul; Vibranti, Dwi Fajar; Widya, Diah	AIP Conference Proceedings
9)	Investment Decision Support Based on Interval Type-2 Fuzzy Expert System	2021	Janková, Zuzana; Jana, Dipak Kumar; Dostál, Petr	Engineering Economics
10)	Stock Price Prediction During the Pandemic Period with the SVM, BPNN, and LSTM Algorithm	2021	Mailinda, Indah; Ruldeviyani, Yanti; Tanjung, Febi; Mikoriza T, Ruri; Putra, Riza; Fauziah A, Tyas	2021 4th International Seminar on Research of Information Technology and Intelligent Systems (ISRITI)
11)	Forecasting stock price using integrated artificial neural network and metaheuristic algorithms compared to time series models	2021	Shahvaroughi Farahani, Mohamad; Razavi Hajiagha, Saeed H.	Soft Computing
12)	Efficient Stock-Market Prediction Using Ensemble Support Vector Machine	2020	Nti, Isaac Kwesi; Adekoya, Adesina Festus; Weyori, Ben A.	Open Computer Science
13)	A Multilayer Feedforward Perceptron Model in Neural Networks for Predicting Stock Market Short-term Trends	2021	Namdari, Amin; Durrani, Tariq Shah	Operations Research Forum

14)	An innovative neural network approach for stock market prediction	2018	Pang, Xiaoming; Zhou, Yilin; Wang, Pingfeng; Lin, Wenxue; Chang, Victor	The Journal of Supercomputing
15)	Analysis of various approaches for stock market prediction	2020	Rahul; Sarangi, Sasmita; Kedia, Pradeep; Monika.	Journal of Statistics and Management Systems

The process of collecting data is performed by searching the related strings and keywords with potential alternatives to ensure that the selected literature will be relevant to the study. This paper only use articles that have writing in English language. There are two main scientific databases used to search for the articles namely, IEEE Xplore and Web of Science. The keywords used are “stock market”, “prediction”, “forecasting”, “feature selection”, “feature study”, “feature analysis”, “technical indicators”, “mathematical model”, “machine learning”, “forecasting stock return”, “financial market volatility”, “fuzzy logic”, “fuzzy inference system”. The articles searched are published in the last 9 years, from 2013 until 2022. Table 2 illustrates the 15 articles obtained after filtering the best requirement for this paper.

4. Data Collection And Analysis

Search for data sources in this research was accessed through various electronic databases such as Google Scholar, IEEE Explore, Web of Science, Science Direct, and others. These databases were chosen because they contain key research depositories and are commonly utilised in literature reviews for mathematics and finance research. There are several keywords used in data search, namely mathematics, stock market forecasting, technical indicators, fuzzy and mathematical model. In addition, the researchers also used several criteria in analysing data. This manuscript was led by a systematic database search, surveyed by cross-reference snowballing, as demonstrated in Figure 1, which was adapted from Geissdoerfer et al. (2017). Table 3 shows the data collected from the articles included in this study.

Table 3: Data collected from the articles.

No.	Article Title	Objectives	Methodology	Primary Market Studied and period	Analysis Type
1)	SutteARIMA: Short-term forecasting method, a case: Covid-19 and stock market in Spain	-to predict the short-term of confirmed cases of covid-19 and IBEX in Spain by using SutteARIMA method. -To evaluate the effectiveness of Suttearima in predicting stock market volatility during the Covid-19 pandemic in Spain. -To analyse the relationship between the pandemic and stock market performance.	The authors created a new forecasting method called "SutteARIMA" by combining three different models and applied it, along with two other methods, to predict the stock market index during the pandemic.	Spanish stock market, specifically the Ibex 35 stock market index. The period covered in the article is from January 1, 2020, to May 31, 2020.	Technical analysis
2)	An adaptive feature selection schema using improved technical indicators for predicting stock price movements	-To propose an adaptive feature selection schema that can effectively predict stock price movements by incorporating improved technical indicators. -To evaluate the performance of the proposed schema and compare it with existing methods.	Three machine learning algorithms, SVM, KNN, and RF, were used to develop a predictive model. The authors compared the performance of the models using metrics such as accuracy, precision, recall, and F1-score.	Shanghai Stock Exchange, a primary stock market located in China. Daily stock price data and a period of 5 years.	Technical analysis

3)	A Predictive Stock Market Technical Analysis Using Fuzzy Logic	This study proposes to address the coming investment problem by employing a basic inference indicators model with few variables to simplify the complicated market environment and provide reliable recommendations to investors, thus providing a valuable decision-support tool. The technique makes use of fuzzy logic to make decisions based on inputs from technical analysis indicators.	Fuzzy data was used to generate fuzzy rules using the Mamdani fuzzy inference system. The accuracy and reliability of the fuzzy logic model calculated statically and compared to the four technical indicators, the Moving Average Convergence/Divergence (MACD), Relative Strength Index (RSI), Stochastic Oscillator (SO) and On-Balance Volume (OBV).	Nigerian Stock Exchange (NSE) for a period of five years, from 2008 to 2012.	Technical analysis
4)	A Technical Analysis Indicator Based On Fuzzy Logic	-To evaluate the performance of the fuzzy logic-based indicator in predicting market trends and making investment decisions, and to compare its performance to traditional technical analysis indicators. -to identify the potential benefits of using the former in financial markets, such as improved accuracy and more reliable predictions.	The study compares the fuzzy logic-based indicator with traditional technical analysis indicators such as MA, RSI and MACD, are compared against those obtained by agents that use the fuzzy indicator for the decision making process.	The Standard & Poor's 500 index, which was used as the primary dataset, US Stock Market	Technical analysis

5)	An Intensive Empirical Study of Machine Learning Algorithms for Predicting Vietnamese Stock Prices	-To implement machine learning and hybrid methods such as ARIMA+ANN on Vietnamese stock market. -to identify the factors that influenced the dynamic of stock price in market.	Machine learning and hybrid methods implemented. A hybrid model of ARIMA and ANN were implemented.	Vietnamese stock market. The study covers several years prior to 2019.	Mixed Fundamental and Technical analysis
6)	A Fuzzy Logic Based Technical Indicator for BIST 30 Index and Islamic Index	-To propose a new technical indicator for the BIST 30 index and the Islamic index using fuzzy logic. -To compare the performance of the fuzzy logic-based indicator with traditional indicators.	The study uses traditional technical analysis tools such as Moving-Average-Convergence-Divergence (MACD), Relative-Strength-Index (RSI), Stochastic-Oscillator (SO), On-Balance-Volume (OBV) and a new fuzzy logic-based indicator to generate trading signals for two indices. The fuzzy logic-based indicator was developed based on the authors' technical analysis expertise, and its linguistic terms were determined using the membership functions.	Turkish stock market, specifically the BIST 30 index and the BIST Islamic index. The date period covered in the study is from January 2010 to December 2014.	Technical Analysis

7)	Prediction and Analysis of ChiNext Stock Price Based on Linear and Non-linear Composite Model	-To develop a composite model that combines the strengths of linear and non-linear models to predict the ChiNext stock price accurately. -To evaluate the performance of the composite model and compare it with the individual linear and non-linear models. - to establish a stock price forecasting model that integrates GARCH and regression methods.	A linear ARIMA model, a nonlinear GARCH model, and a composite model combining the outputs of the linear and nonlinear models were developed to capture the linear and nonlinear trends and seasonality in the data. The performance of the composite model was evaluated using various statistical measures.	Chinese stock market index (ChiNext) that comprises mainly of high-growth firms. Daily stock prices of the ChiNext index from January 2015 to December 2019, period studied 5 years (2015-2019).	Technical analysis
8)	Predicting the Direction of Indonesian Stock Price Movement Using Support Vector Machines and Fuzzy Kernel C-Means	-To implement Support Vector Machines (SVM) and Fuzzy Kernel C-Means (FKCM) in predicting the direction of stock price movement of Indonesian stock market.	Appropriate machine learning which is SVM, technical indicators such as Momentum, Simple Moving Average, EMA & MACD, RSI, Stochastic and William %R also FKCM, were chosen.	Daily stock price of PT Bursa Efek Indonesia. Bank Rakyat Indonesia, Tbk (BBRI) is used. 1 year period, from 1 Jan 2016 to 30 Dec 2016, with a total of 254 trading days.	Technical Analysis

9)	Investment Decision Support Based on Interval Type-2 Fuzzy Expert System	-To develop an interval type-2 fuzzy expert system (IT2FLS) for investment decision support. -To demonstrate the effectiveness of the proposed system in handling uncertainty and imprecision in investment decision-making.	The results of the IT2 FLS were compared to traditional expert systems based on type-1 fuzzy logic system (IT1 FLS) to demonstrate the superiority of the proposed system in terms of accuracy and robustness.	37 real estate investment projects from the Czech Republic, selecting the most profitable project from a set of investment alternatives based on various criteria. The article was published in 2021, and the period of data is not explicitly mentioned in the article.	Technical analysis
10)	Stock Price Prediction During the Pandemic Period with the SVM, BPNN, and LSTM Algorithm	-to explore the performance of three machine learning algorithms, SVM, BPNN, and LSTM, in predicting stock prices during the pandemic period. -to compare the predictive accuracy of these algorithms in terms of their Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) values. -to identify the algorithm that provides the best prediction results for stock prices during the pandemic period.	Three machine learning models, SVM, BPNN, and LSTM, were developed and trained on the JCI data, and their performance was evaluated using RMSE and MAE values.	The study used data from the Indonesian stock market, specifically the Jakarta Composite Index (JCI) from January to December 2020, which includes the pandemic period.	Technical analysis

11)	Forecasting stock price using integrated artificial neural network and metaheuristic algorithms compared to time series models	-to predict stock price indices using artificial neural network (ANN) and train it with some new metaheuristic algorithms such as social spider optimization (SSO) and bat algorithm (BA) with time series forecasting method such as ARMA and ARIMA. -To compare the results of ANN-Metaheuristic algorithms, a hybrid method and time series model.	An integrated approach combining an ANN with genetic algorithms (GA), study used some technical indicators as input variables. Then the study used GA as a heuristic algorithm for feature selection and choosing the best and most related indicators.	The primary indices studied in the article are S&P500, DAX, FTSE100, Nasdaq and DJI. The study collected daily stock price data for 10 companies listed on the exchange over a period of 10 years from 2009 to 2018.	Technical analysis
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12)	Efficient Stock-Market Prediction Using Ensemble Support Vector Machine	-To propose a novel homogeneous ensemble classifier called GASVM based on support vector machine (SVM) enhanced with Genetic Algorithm (GA) for feature-selection and SVM kernel parameter optimisation for stock market prediction.	An ensemble GASVM model was proposed and designed to achieve higher prediction accuracy and efficiency than existing SVM-based methods. Its performance was evaluated using real-world stock market data and compared to existing SVM-based methods for stock market prediction.	The article studied the Ghana Stock Exchange (GSE) and used daily stock market data for a period of 12 years, from June 2007 to August 2019.	Technical analysis
13)	A Multilayer Feedforward Perceptron Model in Neural Networks for Predicting Stock Market Short-term Trends	-To develop a multilayer feedforward Perceptron model in neural networks for predicting short-term trends in the stock market. -To evaluate the performance of the developed model on real-world stock market data and compare it with other commonly used machine learning algorithms for stock price prediction.	A multilayer feedforward Perceptron model in neural networks was developed and trained using a training data set, and its hyperparameters were adjusted to optimize its performance. The model's performance was evaluated using various evaluation metrics on a testing data set.	Pakistan Stock Exchange (PSX) and collected daily stock market data for four companies listed on the PSX from January 2015 to December 2020. Period studied is from January 2015 to December 2020.	Mixed Fundamental and Technical Analysis

14)	An innovative neural network approach for stock market prediction	-to develop a new neural network architecture that propose deep long short-term memory neural network (LSTM) with embedded layer and the long short-term memory neural network with automatic encoder.	The study proposed deep long short-term memory neural network (LSTM) with embedded layer and the long short-term memory neural network with automatic encoder to predict the stock market, which called ELSTM. In these two models, the embedded layer, and the automatic encoder, respectively, to vectorize the data, in a bid to forecast the stock via long short-term memory neural network produced an improved model.	Shanghai stock market. S&P500 index and Nasdaq index were used. The study collected data from January 2000 to December 2015, which suggests that the study covers a period of 16 years.	Technical Analysis
15)	Analysis of various approaches for stock market prediction	-To compare the effectiveness and accuracy of different models and techniques for predicting stock prices, including machine learning algorithms, statistical methods, and other approaches.	The article compares different methods for predicting stock market prices, such as machine learning algorithms, statistical methods, and other techniques. The study evaluate the advantages and disadvantages of each method and explain how each study was conducted in detail. A methodolgy literature review.	-	Fundamental Analysis

The data collected from Table 3 are specifically, the objectives, methodology used, primary market studied and period (dataset), and analysis type. These aspects are being considered in this study to analyse further on the topic. Objectives are being considered to identify the key points of the study which provides clarity on the research scope. Methodology is an essential part of the stock market analysis because most researchers employ various methods to obtain accurate predicting results. Meanwhile, the primary market and period studied helps make an informed decisions in stock market. Lastly, the analysis type consists of fundamental analysis and technical analysis. These analysis are the most common technique used for stock market. Table 3 shows the results of the 15 articles being analysed.

5. Results And Discussion

a) Objectives

The objectives of each study are important to identify the keypoints of the study. Knowing the research objectives helps in understanding the specific aspect of stock market forecasting that the study aims to address. It provides clarity on the scope of the research and the specific questions the researchers are trying to answer. Such as what are the most investigate issues among stock market forecasters. Was it the accuracy of trend, the price, volatility or the error of the accuracy results identified. In conclusion from the 15 articles objectives, most researchers aim to obtain a highly accurate method used for stock market forecasting. The methods are mostly develop a new method as they made remodelling, enhancing and hybriding of various existing methods in order to have an accurate result.

b) Methodology

The stock market has gained popularity among investors due to enhanced applications in which forecasting can lead to successful market prediction. The methods used for stock market prediction can monitor, predict, and manage the market, allowing for better decision-making (Majumder & Hussian, 2007). The stock market prediction mechanism play a significant role in bringing more people and existing investors together. Accurate predictions of the stock market assist investors in making better judgments (Gandhmal & Kumar, 2019). Table 4 shows the results of various methods used in the 15 articles literature. Based on Table 4, the main method used in forecasting stock market analysis are machine learning and fuzzy based techniques. Many previous studies used machine learning as their main method, such as Support Vector Machines (SVM), Artificial Neural Networks (ANN), Genetic Algorithms (GA), Random Forest (RF), Artificial Neural Networks (ANN), k-Nearest Neighbours (k-NN), etc. have routinely employed these methods to analyse stock markets. However, these methods were only employed for data mining, and the final results can only be used in that timeframe because the stock price fluctuates every second (Ji, 2022; Ijegwa, 2020; Nguyen, 2019; Rustam, 2018; Mailinda, 2021; Shahvaroughi Farahani, 2021; Nti, 2020; Namdari, 2021; Pang, 2018; Rahul, 2020). Meanwhile, for fuzzy based technique required more time and the accuracy computed by the fuzzy time series model for the prediction is perpetually affected due to length, and the formulation of splitting methods is very complicated, leading to complex computational process (Ijegwa, 2020; Escobar, 2013; Taş, 2016; Janková, 2021; Rustam, 2018).

Table 5 shows the summary of various method used range among the 15 articles. Table 5 aim to help identify the methods gap and limitations that can be used in future research. Based on the articles, in stock market forecasting, hybrid approaches refer to combining different forecasting methodologies or models to increase prediction accuracy and reliability. These

strategies capitalise on the strengths of several methodologies while attempting to mitigate their weaknesses, resulting in more robust predictions.

Table 4: Various methods used in the 15 articles.

Method used
1. SutteARIMA
2. Adaptive feature selection Machine Learning (ML), technical indicators and Random Forest Model
3. Mamdani fuzzy inference system, fuzzy logic model, ML
4. Investing technical indicators such as DWMA, RSI and MACD, fuzzy inference system
5. ML Algorithms, including Support Vector Machine (SVM), Random Forest (RF), Artificial Neural Networks (ANN), k-Nearest Neighbours (k-NN), Linear Regression (LR), and Gradient Boosting Machine (GBM)
6. Technical indicators including MACD, MA, RSI and OBV, fuzzy logic modeling
7. Linear ARIMA model, a nonlinear NARNN model
8. Support Vector Machines (SVM) and Fuzzy Kernel C-Means
9. Interval Type-2 Fuzzy Expert System, ML
10. Machine learning models, SVM, BPNN, and LSTM using RMSE and MAE values
11. Machine Learning (ML), ANN
12. Ensemble Support Vector Machine (SVM)
13. A Multilayer Feedforward Perceptron Model in Neural Networks, Machine Learning (ML)
14. An innovative ML approach, combines a convolutional neural network (CNN) and a long short-term memory (LSTM) network
15. Machine Learning (ML)

Table 5: Classification of methods used in stock market prediction.

Main Methods	Number of studies
ML	6
Fuzzy Logic	5
ARIMA	2
Technical indicators	3
Hybrid Methods	Number of studies
Hybrid Fuzzy and ML	3
Hybrid various ML algorithm	8
Hybrid Fuzzy and Technical indicators	3
Hybrid ARIMA with α -Sutte Indicator, ML	3

c) Primary Market Studied and Period (Data Set)

To make a better decision making, the best characteristic in specific stock market or index must be reviewed by any investors. Some of the key essentials are Price-to-Earnings (P/E) Ratio which is the current share price relative to its per-share earnings, dividend, the stock market

chart, liquidity, financial statements of the company and etc. Most of the researchers analyses the main world market which are S&P500 and NASDAQ indices.

d) Analysis Type

Fundamentals and technical analysis is a technique that enhances decision-making for stock investors. Other than the stock's trading patterns, the fundamental analysis examines any information that can affect a stock's price and perceived value. According to Ji et al. (2022), fundamental analysis focuses on the intrinsic value of the company and other factors that will affect the stock price, such as policies, macroeconomics, etc. Meanwhile, technical analysis is a trading tool used to evaluate securities and forecast their future performance by deconstructing information from trading activity, such as price movement and volume. Technical analysis studies the stocks past financial behaviors and use them to predict their future movement which helps investors to allocate the most appropriate period to either perform or not perform the trading (Ijegwa et al., 2014). Fundamental and technical analysis are the main analysis used by most researchers. The most reliable analysis is the technical analysis, and it has been said that the combined use of each analysis enhances decision-making for stock investors (Rahul et al., 2020).

Table 6: Classification of Analysis Type

Technical Analysis	Fundamental Analysis	Mixed-Analysis
n=12	n=1	n=2

n – number of article

6. Conclusions

This paper presents a systematic literature which has mainly focused on studies of forecasting stock market using systematic review method on various financial markets around the world. This review was driven by researchers' available recommendations for accompanying systematic literature reviews to search, examine, and categorize all existing and accessible literature on methodology used for forecasting stock market prices or trend. This study analyses 15 articles that have been published from the year 2013 until the year 2022 in reputable international journals and selected based on pre-determined criteria. The purpose of this survey is to classify the existing techniques in terms of publication years, methodologies adapted, datasets used and implementation tools. The techniques utilized for the stock market prediction involves machine learning based technique, fuzzy based techniques, technical indicators, etc. In addition, the research gaps, and the issues for predicting the stock market are elaborated for suggesting effective future scope.

This article provides a clear picture of the SLR forecasting stock market prices and current trends by identifying, classifying, and synthesizing research results based on research themes. There are four main themes found based on data analysis: the objectives of the study, the methodology used, the primary market studied and the analysis type. Fundamental and technical analysis are primarily considered in this study, the most reliable analysis is the technical analysis, and it has been said that the combined use of each analysis enhances decision-making for stock investors. However, one of the limitations is the combined analysis may consume a lot of time to analyse and much more complicated factors needed to take into consideration. The commonly used technique for attaining effective stock market prediction is ANN and the fuzzy-based technique. These techniques can be effectively utilized for controlling and monitoring the entire stock market. Hence, other technique may consider as

gap and can be used to implement in future work. Another limitation of this review is the relatively small number of articles reviewed or analysed. A literature review must be carried out with a broader scope, both in terms of quantity and in producing more comprehensive literature review articles.

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9. Conflict of Interest

The authors have no conflicts of interest to declare.

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