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STOCK MARKET PREDICTION TECHNIQUES: A BIBLIOMETRIC REVIEW

Anchal Jain
Neha Goyal

Department of Management Studies, J.C. Bose University of Science and Technology, YMCA, Faridabad

Abstract

The techniques of Stock market forecasting anticipate future changes in stock prices at earlier stages. If the fluctuations in stock prices are properly predicted, then investors shall be able to earn expected profit. The stock exchange has attracted investor's attention due to the successful implication of prediction techniques. Most researchers have employed a variety of methodologies, such as technical analysis, fundamental analysis, deep learning, machine learning, artificial neural network (ANN), fuzzy theory, etc. to predict the stock prices. These methods can make precise market predictions. Despite its importance, there has not been a comprehensive study that unifies the field's intellectual framework, so the literature on stock market prediction approaches is still fragmented. This research covers the knowledge gap by conducting a bibliometric review. This study depicts most prolific authors, publications, journals, and citation trends, through a detailed examination of 485 publications that were retrieved from Scopus database published between 1973 and 2022. For analysis the data many programmes has been used i.e., R-studio, VOS viewer and MS-Excel. As a result, the major trends in journals, articles, authors, and countries performance are revealed in this review.

Keywords: *Bibliometric Review, Stock Market Forecasting, Artificial Neural Networks, Deep Learning, Machine Learning.*

INTRODUCTION

The stock market is one of the most rapidly rising businesses in any country. Many people nowadays are actively or indirectly involved in this industry (Selvamuthu *et al.,* 2019). Time series data of the stock market is exceedingly volatile and non-linear. Because of the vague and unexpected nature of the stock market, stock market forecasting carries a higher amount of risk than other businesses. It is among the most significant causes of the difficulty in making accurate stock market predictions (Hiransha *et al.,* 2018). To forecast the stock market, various techniques are available such as fundamental analysis, technical analysis, random walk theory, efficient market hypothesis (EMH), linear regression models and non-linear regression models i.e., Artificial intelligence (AI), Artificial Neural Network (ANN), Machine learning (ML) techniques, Deep learning models and Fuzzy theory etc. (Hiransha *et al.,* 2018, Selvamuthu *et al.,* 2019, Ticknor 2013, Yetis *et al.,* 2014, Moghaddam *et al.,* 2016, Chen *et al.,* 2006, Qiu and Song, 2016). As technology develops, stock traders are turning to Intelligent Trading Systems—which allows them to make quick investment decisions (Selvamuthu *et al.,* 2019). Artificial neural networks (ANN) are used in today's world to anticipate exchange indexes. ANNs have been used to forecast stock market movements over the last ten years. Kimoto used ANNs for the first time to forecast the Tokyo stock exchange index (Yetis *et al.,* 2014). The main aim of this paper is to seek and perform a bibliometric review of prior studies on stock market prediction based on different techniques of forecasting. From the various articles and papers, it is clear that no one has focused on the bibliometric information. So, this paper covers a foresaid research gap.

The structure of this paper is organised as follows: Section 1 depicts the introduction of stock market, stock market prediction, need of stock market prediction, aim or objectives, and organizational framework. Section 2 includes the research questions or approaches. Section 3 contains the research methodology. Section 4 consists of the findings and discussions. Section 5 provides a conclusion and future directions.

Research Questions/Approaches

After study various papers, articles, and reviews the following research questions, which have mostly gone unsolved, are the focus of the current review's investigation:

RQ1. What are the trends in the stock market prediction's, publication and citation?

RQ2. Who/Which are the top authors, countries, articles, journals, and institutions for Stock market prediction?

RQ3. What are the major themes and knowledge clusters of stock market prediction's intellectual structure?

RESEARCH METHODOLOGY

Planning

Based on our goals and research questions, we established the scope of this bibliometric review. We focused on research projects from 1973 to 2022 and kept our focus on articles that used various stock market prediction approaches (Kumbure and Lohrmann, 2022).

Search queries

The keywords were selected because they reflect the purpose of our study. We employed our field of expertise and experience, as well as qualitative stimulation from the titles, abstract, and keywords of the papers in the search query, to define them. For data source, we applied the terms "prediction" and "forecasting" individually because relevant papers defined at least one of them. Table 1 illustrates the terms utilised in the search query (Kumbure and Lohrmann, 2022).

Table 1: Search through the Keywords

Database	Search Query
Scopus	"Stock price predict" OR "stock price forecast" OR "stock market predicts" OR "stock market forecast"

Source: Author's Compilation

Selection of studies along with inclusion as well as exclusion criteria

The selection of papers we considered to be the most pertinent for our study were chosen using inclusion and exclusion criteria. Table 2 provides all those choices.

We made the decision to not include any articles that fell outside of the 1973–2022, conference papers, conference reviews, book chapters, books, and book series. Articles published in languages other than English were also excluded (Kumbure and Lohrmann, 2022).

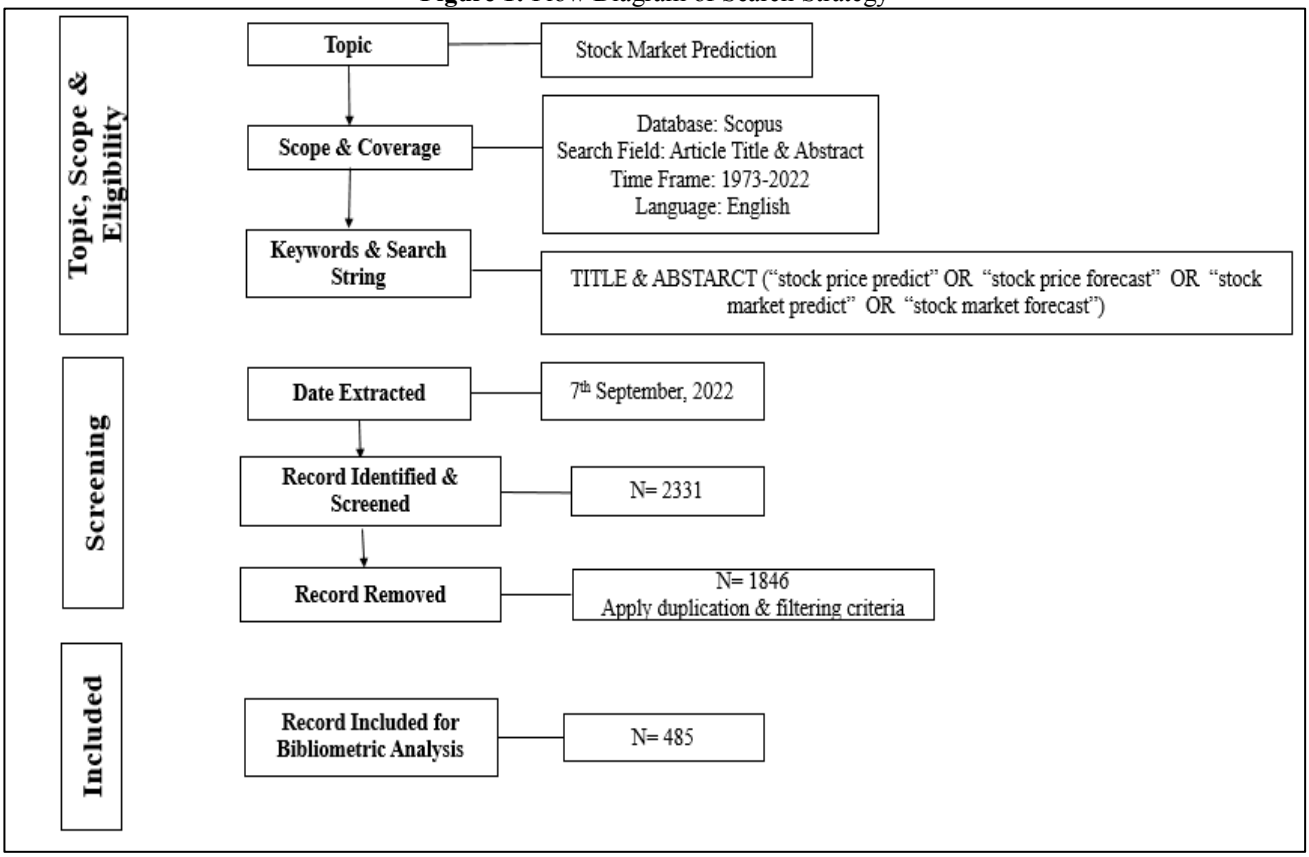
Table 2: Filtering Options Have Been Utilized During the Search Process

Filtering options	**Specifications**
Publication years	1973-2022
Article type	Journal only
language	English
Publication stage	Final
Text availability	Full text available

Source: Author's Compilation

The results of each stage's search through the selected database are shown graphically. The database search yielded 2331 articles as the top hit. Applying the filtration criteria was the next step, and it resulted in 485 articles collectively. Figure 1 depicts our search strategy. The bibliometric analysis was performed on all the document.

Figure 1: Flow Diagram of Search Strategy



Source: Author's Compilation

RESULTS AND DISCUSSION

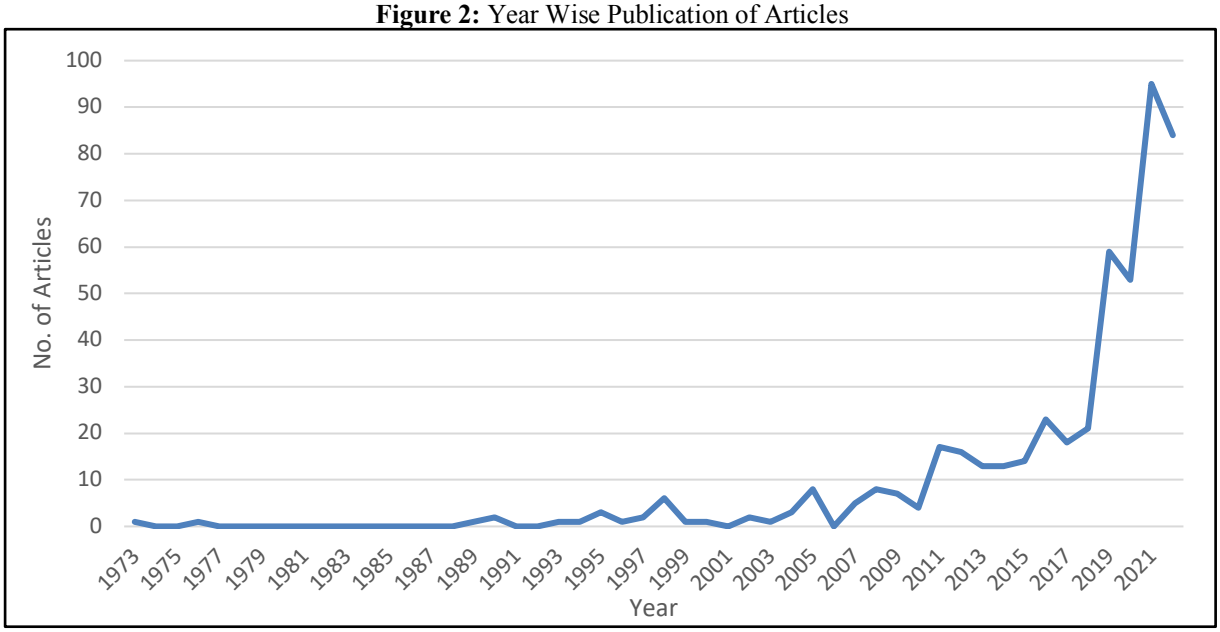
We will investigate the research questions from the previous section in this section. Following were the queries for research:

RQ1: What are the trends in stock market prediction's publication and citation?

Year Wise Publication of Articles

The annual growth rate of articles publication is shown in Figure 2 since 1973, which is 9.46 percent. If we divide the entire period into three intervals, 1973-1990, 1991-2010, and 2011-2022, the annual scientific production remains constant during the first interval. In the following interval, we will notice some changes; production will gradually increase. The last one depicts the dramatic change in annual scientific production until 2022, when it reaches a peak.

Figure 2: Year Wise Publication of Articles

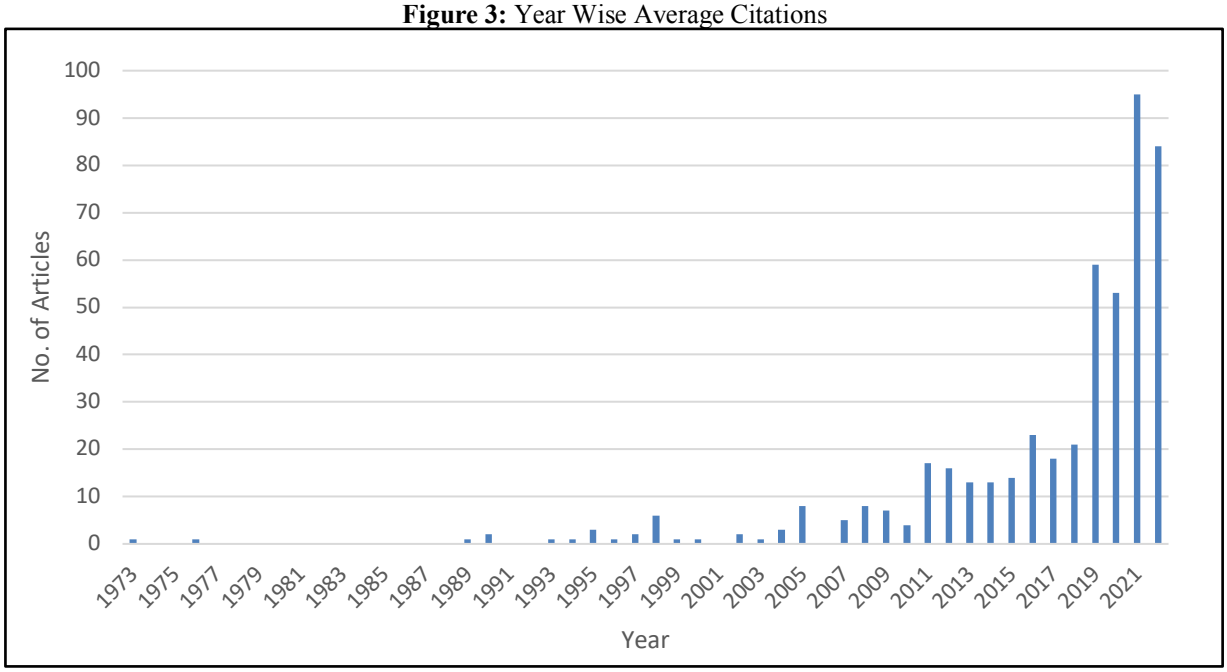


Source: Author's Compilation

Year wise average citations

Figure 3 shows that there were much less citations on average before the year 2000. Since 2011, there has been growth in this area; the years 2021 and 2022 saw the highest citation rate.

Figure 3: Year Wise Average Citations



Source: Author's Compilation

Article's performance

Out of the 485 stock market prediction publications in the corpus that were extracted from Scopus between 1973 and 2022, Table 4 lists the ten most-cited articles.

The most-cited article was Size and Book-to-Market Factors in Earnings and Returns (1469 citations). Overall, the top ten most-cited stock market prediction articles received 3,391 citations together

Table 3: Top Ten Most Cited SM articles

Rank	Title	Year	Citation	TC per year
1	Size and Book-to-Market Factors in Earnings and Returns	1995	1469	52.46
2	The financial analyst forecasting literature: A taxonomy with suggestions for further research	2008	301	20.07
3	News impact on stock price return via sentiment analysis	2014	269	29.89
4	Integrating a Piecewise Linear Representation Method and a Neural Network Model for Stock Trading Points Prediction	2008	241	16.07
5	Comparison of ARIMA and Artificial Neural Networks Models for Stock Price Prediction	2014	239	26.56
6	Automated news reading: Stock price prediction based on financial news using context-capturing features	2013	216	21.6
7	Integrating metaheuristics and Artificial Neural Networks for improved stock price prediction	2016	178	25.43
8	Automatic Relevance Determination in Nonnegative Matrix Factorization with the /spl beta/-Divergence	2013	166	16.6
9	Deep learning-based feature engineering for stock price movement prediction	2019	160	40
10	A type-2 fuzzy rule-based expert system model for stock price analysis	2009	152	10.86

Source: Author's Compilation

RQ2. What are the Top Authors, Countries, Articles, Journals, and Institutions for Stock Market Prediction?

Journal's Performance

Figure 4 depicts the top ten journals that published articles on stock market prediction techniques. Expert system with applications (31 articles), neural computing and applications (15 articles), and IEEE access (9 articles) were the three finest journals in the top three rankings in terms of stock market prediction techniques articles published. Figure 5 shows the top three most cited journals, including Expert System with Applications (640 citations), Neuro Computing (272 citations), and Expert Syst Appl (269 citations). However, the most successful and cited journals do not always publish the most significant papers.

Figure 4: Journal's Performance Based on Total Articles

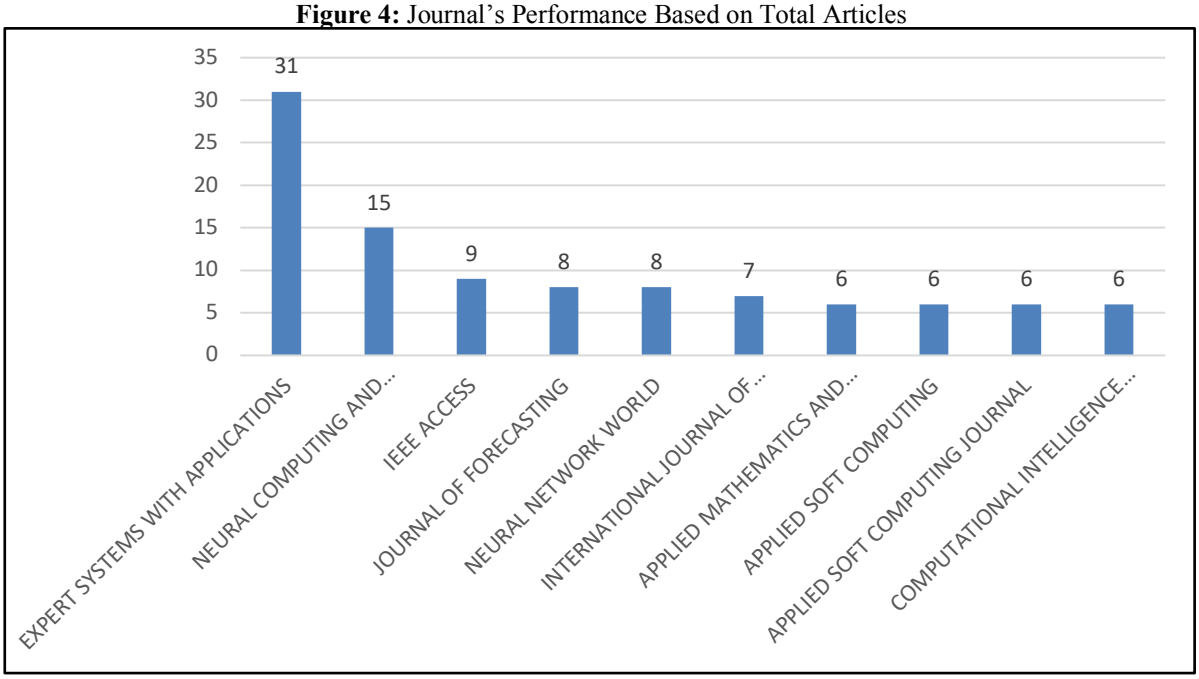


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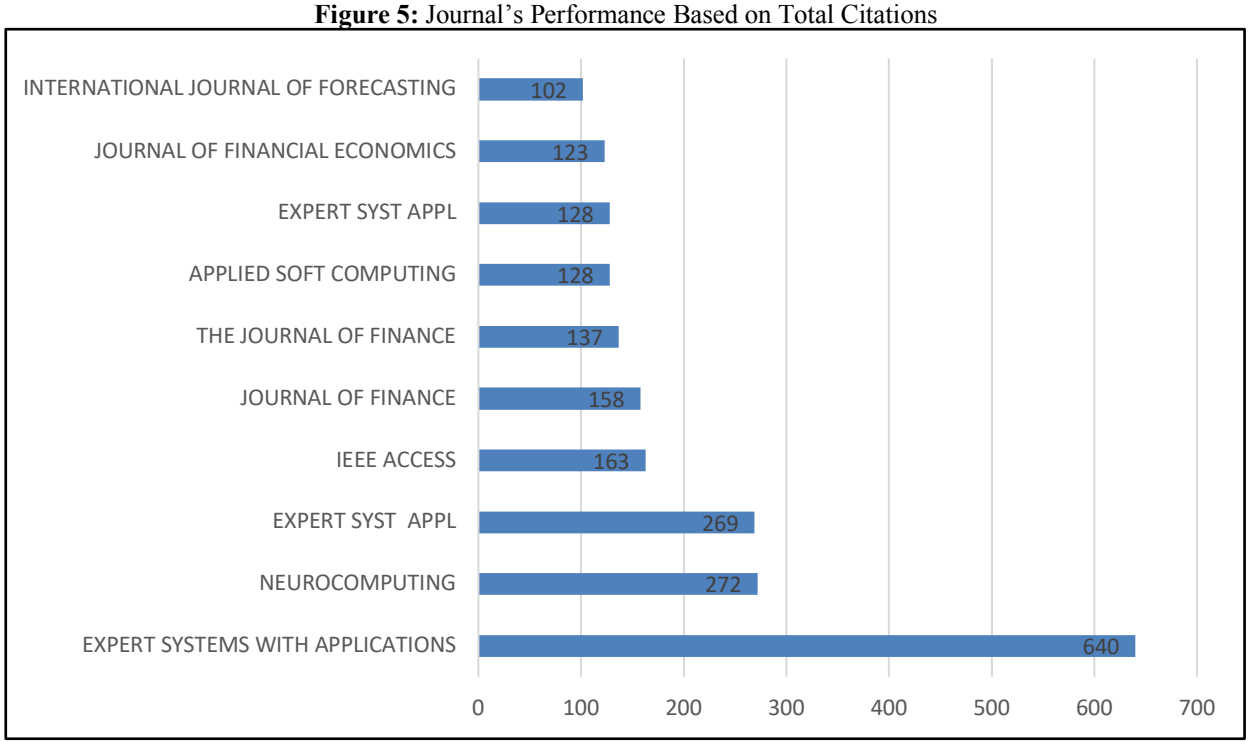
Figure 5: Journal's Performance Based on Total Citations



Source: Author's Compilation

Author's Performance

Based on the total citations and h-index of their papers that were retrieved from Scopus, Table 5 lists the ten most prolific authors. The author's performance was ranked using the h-index and total citations since these metrics provide varying insights on the outcome, impact, and influence of the author's work.

The top five authors, as determined by the h-index, are Chen Y, LI J, LI X, LI Y, and Song Y. This index indicates the production and influence of each author. Based on total citations, which indicate an author's impact, the top five authors are Fama EF, French KR, Chang P-C, LI X, and XIE H (Lim *et al.,* 2021).

Table 4: Top 10 author's performance based on citation and H-index

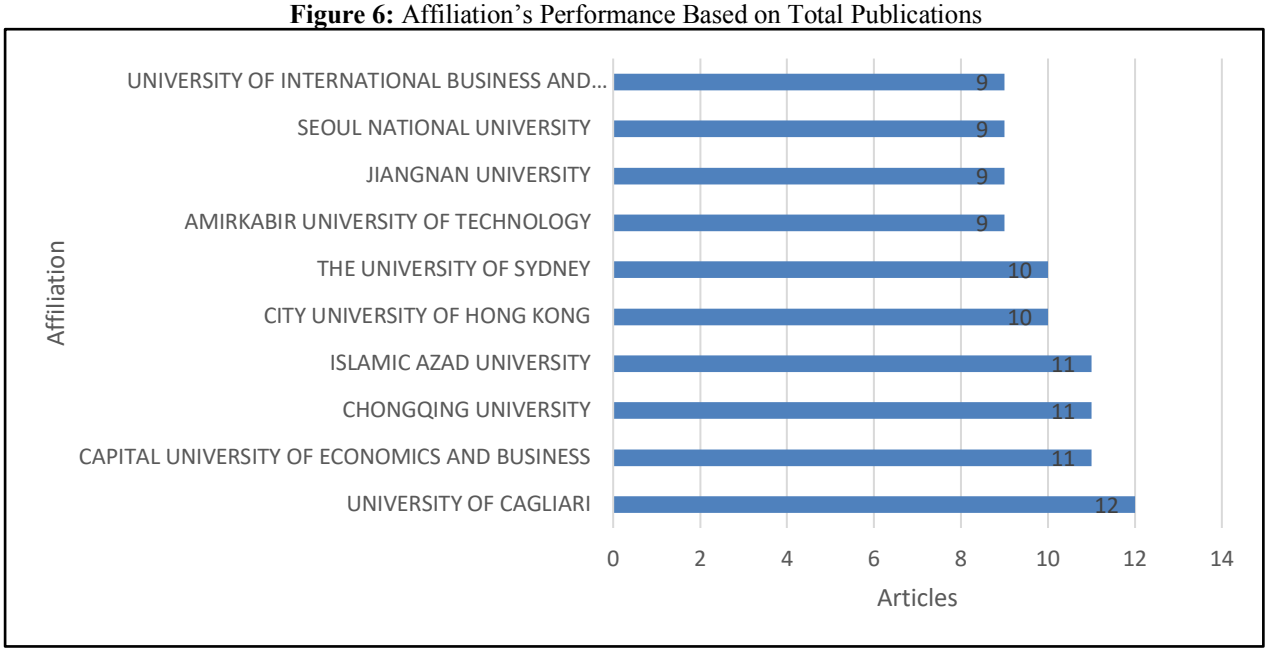
Rank	Authors	Citation(s)	Rank	Authors	h-index
1	FAMA EF	1469	1	CHEN Y	4
2	FRENCH KR	1469	2	LI J	4
3	CHANG P-C	433	3	LI X	4
4	LI X	408	4	LI Y	4
5	XIE H	402	5	SONG Y	4
6	DENG X	352	6	WANG J	4
7	WANG J	328	7	XIE H	4
8	RAMNATH S	301	8	CAO Q	3
9	ROCK S	301	9	CHANG P-C	3
10	SHANE P	301	10	CHANG V	3

Source: Author's Compilation

Affiliation's Performance

Figure 6 depicts the status of affiliations or universities associated with SM articles that have been published. Top three affiliations include the University of Cagliari (12 articles), the Capital University of Economics and Business (11 articles), and Chongqing University (11 articles).

Figure 6: Affiliation's Performance Based on Total Publications



Source: Author's Compilation

Country's Performance

The top ten countries according to the total publications and citations are listed in Table 6. China, India, the US, and Korea are the top four countries with respect of total articles contributed; each country has more than 100 articles predicting the stock market. China, the US, Iran, and India account for the top four countries in terms of overall citations, each generating more than 3,000 citations (Lim *et al.,* 2021).

Table 5: Top 10 Country's Performance Based on Total Citation and Articles

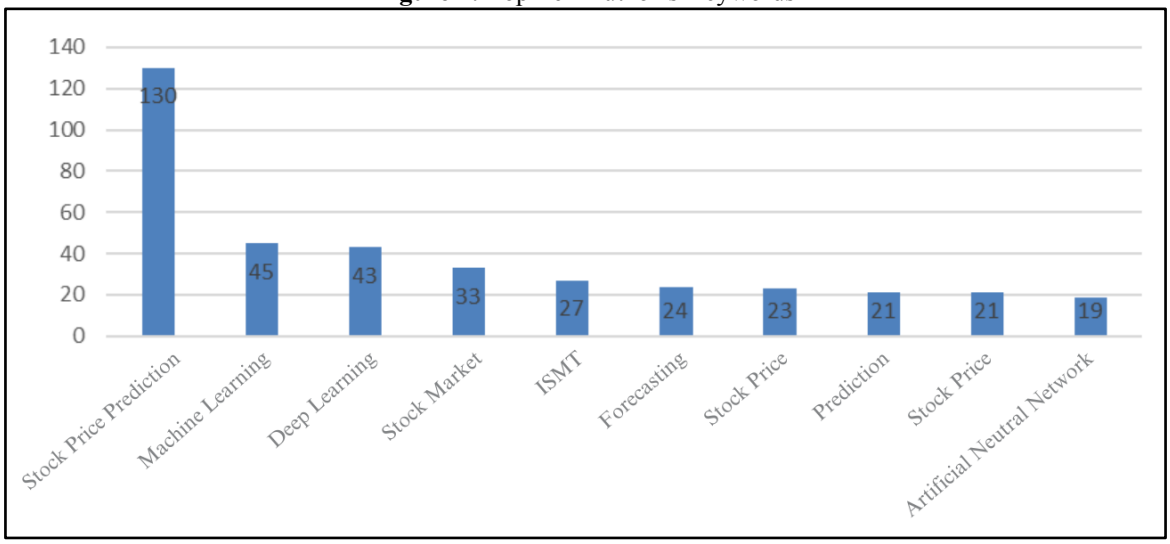
Rank	Country	Citation(s)	Rank	Country	Article(s)
1	CHINA	2508	1	CHINA	443
2	USA	1154	2	INDIA	213
3	IRAN	688	3	USA	93
4	INDIA	414	4	SOUTH KOREA	65
5	KOREA	343	5	JAPAN	56
6	HONG KONG	283	6	INDONESIA	53
7	SINGAPORE	256	7	IRAN	53
8	SOUTH AFRICA	240	8	AUSTRALIA	40
9	UNITED KINGDOM	240	9	UK	34
10	GERMANY	233	10	MALAYSIA	32

Source: Author's Compilation

Keyword's Analysis

The top three keywords among the author's list, as shown in Figure 7, are deep learning (43), machine learning (45), and stock price prediction (130). Figure 8 shows a word cloud of the top 50 keywords. The author uses the keyword "deep learning" and "machine learning" most often.

Figure 7: Top Ten Author's Keywords



Source: Author's Compilation

Figure 8: Top 50 Author's Keyword

Source: Author's Compilation

RQ3. What are the major themes and knowledge clusters of stock market prediction's intellectual structure?

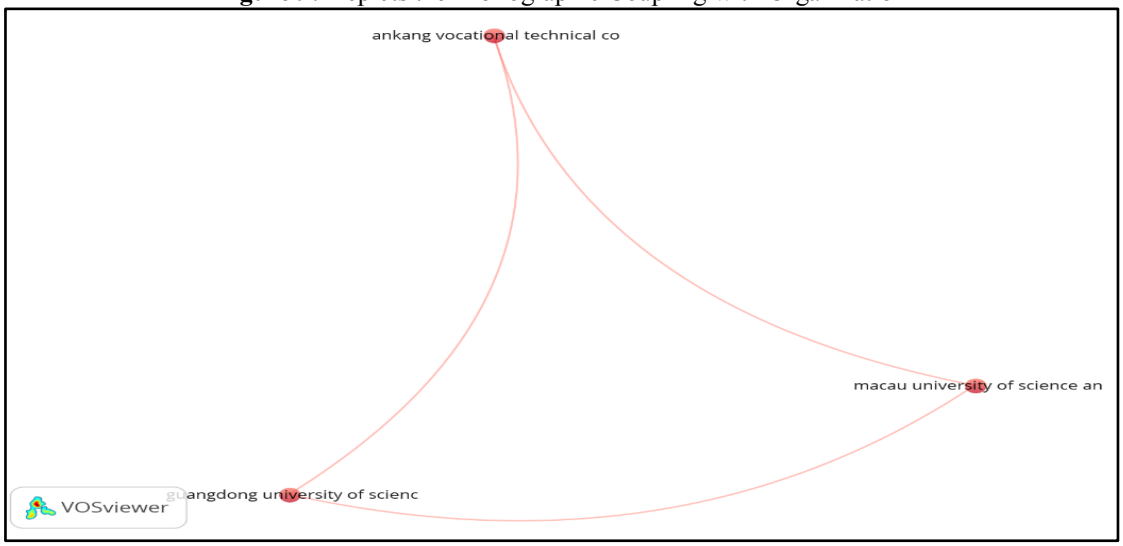
Bibliographic Coupling of Stock Market Prediction

Bibliographic coupling occurs when two articles cite the same thing in the third article. Citations are used to demonstrate the similarities between two organisations and nations. This approach is based on the idea that two articles that reference a third item is probably related to each other and belong in the same cluster in the visualisation map's cluster solution. The extent of the bibliographic connection is based on how many references or citations the third paper has overall. Bibliographic coupling analyses the semantic relationships between publications to identify latent research themes and direct future study (Donthu *et al.,* 2021).

Bibliographic Coupling with Organization

Bibliographic coupling of organisations is the term used when publications from two different organisations are linked to publications from a third shared organisation. Out of the 922 organisations that must have 2 documents and each document must be cited by at least 2, 20 organisations meet this requirement. Figure 10 depicts a complex network of connections of organisations that have papers on stock market forecast. Ankang vocational technical college has 2 documents and the total link strength is 4 (cluster-1, items- 3, link- 3, total link strength- 6).

Figure 9: Depicts the Bibliographic Coupling with Organization

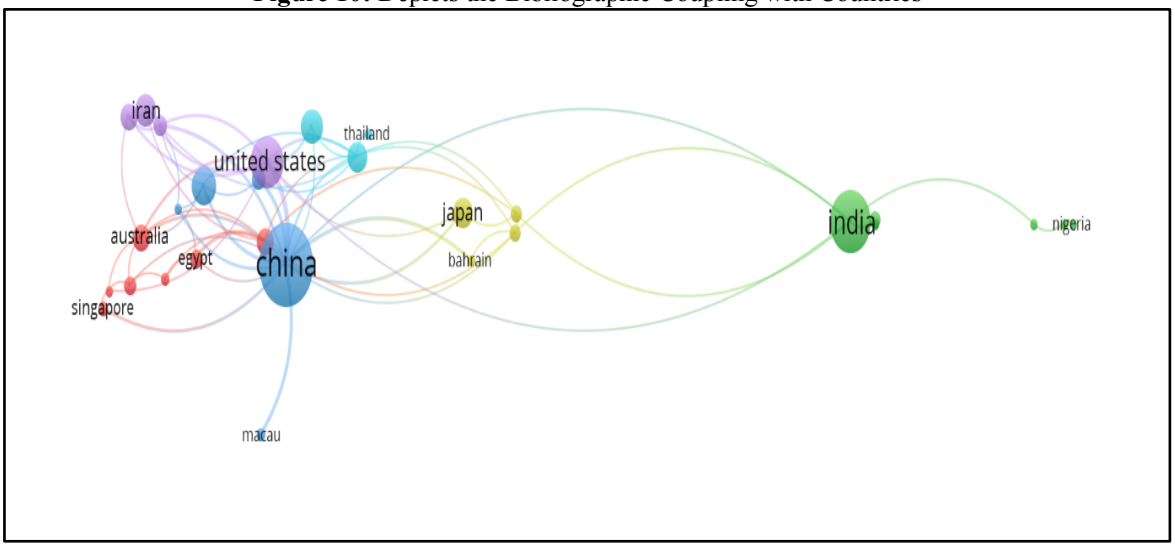


Source: Author's Compilation

Bibliographic Coupling with Country

Bibliographic coupling of countries occurs when publications from two separate countries are related to publications from a third shared country. Out of 71 countries, 38 meet this requirement that at least three papers from those publications must be cited by three other publications. Figure 11 shows that China has links with 37 nations and has 130 documents from the last 50 years of the SM prediction. China has the highest overall link strength (41) out of all countries, followed by the US and Canada.

Figure 10: Depicts the Bibliographic Coupling with Countries



Source: Author's Compilation

CONCLUSION

The 485 stock market prediction publications that were published in journals with a Scopus index between 1973 and 2022 have been thoroughly evaluated in this article. In response to a research topic, this paper provided seven major findings on the conceptual framework and bibliometric performance of studies on stock market prediction techniques. Potential authors who want to reflect on the status of the literature in its most inclusive yet superior sense should find these conclusions useful.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This review is confined to the bibliometric data it utilised as a base, which was retrieved from the Scopus database. The risk of neglecting papers that may have appeared in other journals, such as Web of Science (WoS), cannot be completely ruled out by this study. Therefore, future reviews of stock market prediction techniques, especially those that plan to focus on its specialist areas (such as on any one theme cluster), might consider using the Web of Science as a cross-check method to either confirm or refute the universality of the conclusions in this review. Researchers who are interested in going deeper into this field can perform systematic literature reviews.

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