Chapter 2: Literature Review

2.1 Introduction

Specifically, chapter-2 of it overviews the state of the existing sentiment analysis literature and its application to the financial markets including the context of Malaysia stock market. As well, it offers the brief description of main developments, challenges, and opportunities in the given area. Section 2.2 explains the role of sentiment analysis in the financial markets and the usage of more sophisticated models such as FinBERT and eXplainable Lexicons (XLex) to enhance effectiveness and interpretability. Section 2.3 examines the relationship between sentiment analysis and the fluctuation in stock prices, as well as how sentiments affect stock performance. Section 2.4 examines the use of sentiment analysis in the Malaysian stock market especially during the COVID-19 outbreak. Section 2.5 offers multiple approaches for creating the models for prediction of the stocks' price, including but not limited to LSTM, GRU, as well as the mixed frameworks. In conclusion, Section 2.6 identified sections under development or gaps in the literature and proposed research opportunities that include examining news article headings, improving the techniques to determine effectiveness of sentiments in news articles and increasing the accuracy of categorizing neutral sentiments.

2.2 Sentiment Analysis in Financial Markets

Hence, Sentiment Analysis in the financial markets could be helpful in capturing the dynamics of the market through processing the textual data of the financial articles, news and posts in social media. Various methodologies have been studied and proposed to improve the results and the effectiveness of the sentiment analysis in this domain. One particular strategy is based on FinBERT, the transformer model that is optimized for the financial sector and the detection of sentiment; FinBERT has reported success in predicting fluctuations in a particular stock when used on the text data of stock news. This model performs better than the previous models such as BERT, LSTM, ARIMA, and so on, and revealed the significance of the sentiment as a driver (Jiang & Zeng, 2023). However, transformer models because of their better performance are more computationally costly and therefore not so friendly with systems

with limited computational resources or real time applications (Rizinski et al., 2024). In order to overcome these limitations, the eXplainable Lexicons (XLex) approach integrates the benefits of lexicon-based methods integrated with transformer models while the model uses SHAP (SHapley Additive exPlanations) for explainability. This not only enhances the coverage of the financial lexicons' vocabulary coverage but also increases the efficiency and interpretability of the lexicon over traditional transformer models, thus making the lexicon a suitable tool for financial decisions (Rizinski et al., 2024).

2.3 Sentiment Analysis and Stock Price Movements

Thereby, sentiment analysis can be emerged as a pivotal tool to predicts the stock price movements, use the textual data coming out from social media, news and reports financial. Past research also predicts that social media and more specifically Stocktwits can impact stock prices despite problems like the categorization of tweet messages as either positive or negative. For these, enhanced models such as FinBERT has been applied, which is highly efficient in sentiment analysis and enhances the overall prediction capability when used in combination with ensemble support vector machines (Liu et al., 2023). Moreover, data integration, particularly with parameters like historical stock prices, and commodities' prices, have been beneficial while using sentiment analysis. For instance, one of the classification model based on Naive Bayes produced the accuracy of the stock movements prediction for the next three days, which was 60% and included such variables as the copper prices and sentiment (Sinatrya et al., 2022).

Long & Short-Term Memory (LSTM) models along with lexicon-based sentiment analysis are proposed by Aslim et al. (2023) for stock price forecasting where sentiment data improves the accuracy of the model. It also gives the investors a clear vision of what they should upon after having scrutinized all the necessary information. Likewise, Praturi et al. (2023) proposed an application to analyse sentiment scores of financial news using deep learning and cloud computing, and the authors proved the application's effectiveness for an accurate stock price prediction. Hence, we have Shah et al. (2019) who discuss about the effects of Twitter sentiments on the stock market and concluded that social media has significant effects on stock price movements. Based from these researches, the examination of sentiments, whether sourced from business and financial newspapers or social media is a helpful technique in the prediction of future variations in stock prices and in decision making regarding

investments. Altogether, their conclusions state that sentiment analysis is a significant factor to stock price prediction, especially when applied along with other analytical tools and stable models.

2.4 Sentiment Analysis in the Malaysian Stock Market

Sentiment analyzing the movements of stock markets in Malaysia particularly the COVID-19 crisis period. Research has proved on aspects such as factors from news portals can affect significantly the movements of Bursa Malaysia stocks. For example, a study employing the long short term memory (LSTM) model proved that the addition of news polarity values enhanced the ability to predict stock prices with less than one RMSE (root mean squared error) for all examined companies' stock (Sidek et al., 2023). As highlighted in the analysis of the COVID-19 pandemic BAC, the sentiment analysis of the management and analysis sections of the annual reports of the MALAYSIAN incorporated public limited companies was mainly negative due to the consideration of the pandemic impact on firms' operations. This is in effect was supported by both the automated text analysis and consequent qualitative content analysis. (Non & Ab Aziz, 2023). Analyzing the happenings of the pandemic, it was evident that the sentiment of investors and the stock market was affected significantly. Again, the sharp decline in the FTSE BURSA 100 Index(T100) during early months of the outbreak was evidenced by it. The trend was more visible in the number of Current cases and Deaths, while the uncertainty level increased health and wealth risks which influenced the investment decisions as depicted by the Sentiment Index (SMI) using PCA (principal component analysis) (Albada & Nizar, 2022).

2.5 Advanced Predictive Models for Stock Price Forecasting

Advanced predictive models are developed by using sophisticated machine leaning and deep learning where the unknown and unpredictable feature of stock market and its non-linear characteristic are dealt effectively. GRU and LSTM models are self-wrought predictive models because of their capability to model the long-term dependencies and interdependencies of the time series data (Momaya et al., 2023). For instance, the analysis of the blue-chip stocks of India expounded that LSTM and GRU models were proficient in predicting the future stock prices with significant accuracy by training on such historical data as covering 17 years

(Momaya et al., 2023). In addition, the MSLSTMA model of LSTM with autoencoder part has been discovered to perform well in the case of the multivariate time series prediction that can handle dependencies of various kinds between multiple variables and enhance the accuracy of the prediction by the unsupervised learning system of the autoencoder part (G et al., 2023). In the experiments with real stock market data, this model proved to be better than other techniques including Univariate Sequential LSTM, GRU, Random Forest, GAN (G et al., 2023). Another has a stacked LSTM with a Convolutional network which is researched to have a good level of effectiveness in predicting stock prices with actual experiments being conducted on ADANI stock data for 14 years (Singh & Malhotra, 2023). With the help of deep learning architectures and hybrid frameworks on advanced models, bring reliable tools for the investors with the focus on maximum of returns from accurate prediction of stock prices.

2.6 Gaps in the Literature and Research Opportunities

Prior research works on the link between sentiment analysis and stock price changes have been made in the literature especially in Malaysia. Nevertheless, there are some limitations which can be noted in the existing literature with the further scope of research and development:

First, only a few sources have analyzed the sentiment of news article titles, not the titles of articles. Although there is prior work on sentiment analysis of different textual sources, including social media posts, financial documents, and news articles, the special role of the news headlines as the primary tool investors use to find information on companies has not been investigated comprehensively. When considering the analysis of the association between the sentiment of the news titles and the percent change of the stock prices, it would be possible to provide valuable insights regarding the decision making of investors (Jiang & Zeng, 2023; Jiang et al., 2023).

The second problematic in the research area is that applications of transformer models such as FinBERT for purpose like sentiment analysis are usually computational and data-oriented. These models require computational resources and large datasets, hence they cannot easily be applied for real time, or when the system presents low processing capacity. Hence, it is crucial to search for other, more effective, but at the same time, more intelligible approaches to sentiment analysis, including the XLex strategy that could improve the financial decision-

making process and open up new possibilities for the use of sentiment analysis (Rizinski et al., 2023, 2024).

Also, the advanced studies have some limitations when it comes to the assessment of the neutral remarks in the sentiment analysis of the social media platforms such as Stocktwits. It might serve to enhance the effectiveness of current models for classifying neutral sentiments and even increase the predictive power of fluctuation in stocks' prices (Liu et al., 2022, 2023). These gaps in the existing literature are as follows which is mentioned in Table 2.1, provide the way for the future research to enhance the understanding of the sentiment analysis in the operation of Malaysia's stock market or offer valuable recommendations for investors, policymakers, and financial analysts.

References	*Gap*	*Description*
Jiang & Zeng, 2023; Jiang et al., 2023	Limited focus on sentiment in news article titles	Previous work has discussed sentiment analysis in a number of textual sources, but the influence of news titles (the most important source of information for investors most of the time) has been explored in particular rather limitedly. Exploring the link between the sentiment of news titles and the fluctuations in the stock prices would be useful as it helped investors.
Rizinski et al., 2023, 2024	Computational and data-intensive nature of transformer models	Advanced transformers such as FinBERT used for sentiment analysis, which requires large data and computational power. This makes them unsuitable for reactive use or in systems that allow for only a small amount of processing power. Developing new and less complex approaches for sentiment analysis, for instance, eXplainable Lexicons (XLex), could improve financial decisions made as a result of the sentiment analysis and the application of the method as a whole.

Liu et al., 2022, 2023	Challenges in accurately classifying neutral comments	Indeed, as documented in prior literature, it is challenging to classify neutral posts in the context of SA specifically for social media platforms such as Stocktwits. Neutral sentiment is essential to stock prices; it is possible to advance the models and techniques that have been designed for categorizing words in this context and improve the overall applicability of the model to stock price prediction.
Liu et al., 2022, 2023	Research Opportunities	These gaps highlighted above are the areas of research that offer grounds for further studies concerning the contribution of sentiment analysis to the Malaysian stock market. This could be relevant to the investor, policy-maker and the analyst in the financial market.

Table 2.1: Research gap analysis