“Sentiment analysis on cryptocurrency in a Muslim-majority country: Evidence from Indonesian social media”

AUTHORS	Nur Rizqi Febriandika Annisa Nur Faizah Helmi Imaduddin

ARTICLE INFO	Nur Rizqi Febriandika, Annisa Nur Faizah and Helmi Imaduddin (2026). Sentiment analysis on cryptocurrency in a Muslim-majority country: Evidence from Indonesian social media. *Investment Management and Financial Innovations*, *23*(2), 264-275. doi:10.21511/imfi.23(2).2026.20
DOI	http://dx.doi.org/10.21511/imfi.23(2).2026.20
RELEASED ON	Wednesday, 20 May 2026
RECEIVED ON	Saturday, 08 November 2025
ACCEPTED ON	Wednesday, 06 May 2026

JOURNAL	"Investment Management and Financial Innovations"
ISSN PRINT	1810-4967
ISSN ONLINE	1812-9358
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
49	3	1

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

Nur Rizqi Febriandika (Indonesia), **Annisa Nur Faizah** (Indonesia), **Helmi Imaduddin** (Indonesia)

SENTIMENT ANALYSIS ON CRYPTOCURRENCY IN A MUSLIM-MAJORITY COUNTRY: EVIDENCE FROM INDONESIAN SOCIAL MEDIA

Abstract

The rapid growth of cryptocurrency has generated significant debate in Muslim-majority societies, where financial transactions are expected to conform to Islamic legal principles. In Indonesia, the Indonesian Ulema Council (MUI) issued a fatwa in 2021 declaring the use of cryptocurrency as a means of exchange unlawful (haram) on the grounds that it contains elements of excessive uncertainty and harm. Despite this religious prohibition, the government continues to permit cryptocurrency trading as a regulated commodity, creating a complex normative environment that shapes public discourse. This study analyzes the sentiment of Indonesian Muslims toward cryptocurrency by applying Natural Language Processing (NLP) techniques to a corpus of 1,065 Indonesian-language tweets collected from the X (formerly Twitter) platform over six months (October 2024–March 2025). The IndoBERT-base-p1 model, a state-of-the-art transformer-based language model pre-trained on Indonesian text, was employed for three-class sentiment classification (positive, neutral, negative). The results indicate that neutral sentiment is dominant, accounting for 80.8% of the corpus (861 tweets), while positive sentiment represents 12.9% (137 tweets) and negative sentiment 6.4% (67 tweets). The predominance of neutral sentiment suggests that the majority of Indonesian Muslim social media users maintain a cautious and observational stance, shaped by ongoing scholarly debate, limited digital financial literacy, and regulatory ambiguity. The study contributes to the literature by providing the first application of a deep learning NLP model to the analysis of Indonesian Muslim discourse on cryptocurrency, integrating perspectives from Islamic finance and computational linguistics.

Keywords sentiment analysis, cryptocurrency, text mining, natural language processing, Islamic finance, Indonesia

JEL Classification G23, G28, O14, O32, O33

Type of the article: Research Article

Received on: 8th of November, 2025
Accepted on: 6th of May, 2026
Published on: 20th of May, 2026

Nur Rizqi Febriandika, MSc, Lecturer, Researcher, Faculty of Islamic Studies, Department of Islamic Economic Law, Universitas Muhammadiyah Surakarta [Muhammadiyah Surakarta University], Indonesia. (Corresponding author)

Annisa Nur Faizah, Undergraduate, Research Assistant, Faculty of Islamic Studies, Department of Islamic Economic Law, Universitas Muhammadiyah Surakarta [Muhammadiyah Surakarta University], Indonesia.

Helmi Imaduddin, Master's degree, Lecturer, Researcher, Faculty of Informatics and Communication, Department of Informatics, Universitas Muhammadiyah Surakarta [Muhammadiyah Surakarta University], Indonesia.

Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

The global diffusion of financial technology has fundamentally altered the landscape of economic participation, with cryptocurrency emerging as one of its most consequential and contested innovations. Defined as a decentralized digital asset secured by cryptographic protocols and recorded on a distributed ledger known as the blockchain, cryptocurrency enables peer-to-peer transactions without the involvement of traditional financial intermediaries (Bartoletti et al., 2021; Nakamoto, 2008). Since the introduction of Bitcoin in 2008, the cryptocurrency market has expanded dramatically, encompassing thousands of digital assets and attracting the attention of investors, regulators, and scholars across the world (Liu et al., 2022).

Within this global context, Indonesia occupies a particularly significant position. As the world's most populous Muslim nation, accounting for approximately 87.08% of the population, or some 245 million individuals, Indonesia presents a unique intersection of digital financial inno-

http://dx.doi.org/10.21511/imfi.23(2).2026.20

vation and Islamic legal discourse (Sari & Rofiuddin, 2022). The rise of cryptocurrency in Indonesia has not been met with uniform acceptance; rather, it has prompted intense debate among religious authorities, policymakers, and ordinary citizens regarding its compatibility with Sharia principles (Fitriana & Nuraini, 2023). In 2021, the Indonesian Ulema Council (Majelis Ulama Indonesia, MUI) issued a fatwa declaring the use of cryptocurrency as a means of exchange unlawful (haram), citing the presence of *gharar* (excessive uncertainty), dharar (harm), and the absence of a legitimate underlying asset recognized under Islamic law (Rohman et al., 2023). Notwithstanding this prohibition, the Indonesian government, through the Commodity Futures Trading Regulatory Agency (BAPPEBTI), continues to authorize cryptocurrency trading as an investment commodity, thereby creating a normative duality that leaves many citizens in a state of interpretive uncertainty (Sekar Bidari & Nurviana, 2022).

1. LITERATURE REVIEW

Cryptocurrency represents a form of digital asset whose ownership and transfer are governed by cryptographic protocols embedded in a distributed ledger system known as the blockchain (Nadiar et al., 2022). The foundational architecture was introduced by Nakamoto (2008) in a seminal whitepaper proposing Bitcoin as a decentralized electronic cash system capable of enabling trustless peer-to-peer transactions without reliance on centralized financial authorities. Subsequent developments have produced a diverse ecosystem of digital assets, including smart-contract-enabled platforms such as Ethereum, non-fungible tokens (NFTs), and stablecoins, each with distinct technical and economic characteristics (Liu et al., 2022; Gupta et al., 2023). Studies on cryptocurrency governance also reveal that although the system is designed to operate as a fully decentralized network, in practice the cryptocurrency ecosystem involves various actors and institutions (Wu et al., 2021).

From a conventional economic perspective, the classification of cryptocurrency remains contested. Some scholars argue that its capacity to facilitate rapid and low-cost cross-border transfers positions it as a viable alternative payment infrastructure (Thoma, 2020). Others, however, dispute this characterization on the grounds of extreme price volatility, noting that cryptocurrencies have functioned primarily as speculative investment vehicles rather than stable stores of value or reliable mediums of exchange (Gechev, 2024; Norisnita & Indriati, 2022). The high volatility of cryptocurrency prices has been documented extensively and is attributed to a combination of factors, including thin liquidity, sentiment-driven trading, and the absence of fundamental valuation anchors (Chen et al., 2022).

Globally, cryptocurrency regulations vary. Countries such as Australia and Singapore regulate it within the framework of investment and taxation (Alekseenko, 2022; Cameron, 2020). Japan recognizes it as a legal means of payment, the United States treats it as taxable property, while El Salvador has even adopted it as an official currency (Arora, 2020; Filimonov & Tajti, 2023; Krause, 2025). Despite these debates, the blockchain technology underlying cryptocurrency has attracted significant attention from researchers and international financial institutions due to its potential to improve the efficiency of digital financial systems (Garba et al., 2024). However, several economists remain skeptical about its stability as a currency (Taniady et al., 2022).

The governance of cryptocurrency ecosystems constitutes a further area of scholarly inquiry. Although the decentralized architecture of blockchain technology is intended to eliminate the need for centralized oversight, empirical studies have revealed significant concentrations of power within cryptocurrency networks. Spithoven (2019) demonstrates that the mining of proof-of-work cryptocurrencies is increasingly dominated by a small number of industrial-scale operators, raising concerns about de facto centralization, market manipulation, and systemic vulnerability. These structural characteristics have attracted sustained attention from international regulatory bodies, including the International Monetary Fund and the World Bank, which have examined the implications of cryptocurrency proliferation for global financial stability (Recskó & Aranyossy, 2024).

The security dimensions of cryptocurrency also merit consideration. High-profile exchange hacking incidents, including the 2024 breach of the

Indonesian exchange Indodax, which resulted in losses estimated at Rp 8.1 trillion, have underscored the risks associated with the custody of digital assets and highlighted deficiencies in the security infrastructure of cryptocurrency platforms (Liu & Li, 2025; Nelson et al., 2024). Such incidents have intensified public scepticism and contributed to negative sentiment in affected markets.

The evaluation of cryptocurrency within the framework of Islamic jurisprudence (fiqh) has generated a rich and unresolved scholarly debate. Islamic finance is governed by a set of normative principles derived from the Quran, the Sunnah, and the jurisprudential tradition, which collectively prohibit riba (usury or interest), gharar (excessive uncertainty in contractual terms), and maysir (gambling or speculative activity) (Koeswandana & Sugino, 2023). The permissibility of any financial instrument is therefore contingent upon its conformity with these prohibitions, as well as its recognition as mal (wealth or property) possessing genuine economic utility.

Scholars who regard cryptocurrency as impermissible under Islamic law typically emphasize the element of gharar, arguing that the extreme price volatility, technological opacity, and absence of an identifiable underlying asset render digital currencies incompatible with the requirement for contractual certainty (Selcuk & Kaya, 2021; Khan, 2022). Furthermore, the anonymous and pseudonymous nature of many cryptocurrency transactions is seen as facilitating the concealment of illicit financial flows, thereby potentially violating the Islamic principle of preventing harm (mafsadah). In Indonesia, this position is institutionally represented by the MUI fatwa of 2021, which concluded that cryptocurrency does not satisfy the conditions for recognition as mal, and that its use as a payment instrument is therefore haram (Rohman et al., 2023; Abadi et al., 2023).

Conversely, a number of scholars have advanced more permissive interpretations. Akbar (2022) argues that digital assets may be classified as mal if they are widely recognized as having economic value within society, drawing on the principle of 'urf (customary acceptance). Febriandika et al. (2022) similarly contend that the legal status of NFTs and related digital assets should be determined on a case-by-case basis with reference to the specific use and utility of each instrument, rather than through categorical prohibition. These interpretive divergences reflect broader methodological disagreements within Islamic jurisprudence regarding the application of classical legal categories to novel technological phenomena (Ali & Jumat, 2024).

The regulatory responses of Muslim-majority states to cryptocurrency have mirrored this doctrinal heterogeneity. Egypt and Turkey have tended toward restrictive frameworks informed by religious authority, while jurisdictions such as the United Arab Emirates and Qatar have adopted permissive approaches that authorize cryptocurrency under Sharia-compliant regulatory conditions (Abdelgawad, 2024; Othman & El Dosh, 2023; Selcuk & Kaya, 2021). Malaysia has pursued an intermediate path, permitting regulated trading while prohibiting use as legal tender. In Indonesia, the regulatory framework is characterized by a fundamental tension between the MUI's prohibition of cryptocurrency as a payment medium and BAPPEBTI's authorization of it as a tradeable commodity asset, a duality that creates substantial ambiguity for market participants and contributes to the observed uncertainty in public discourse (Sekar Bidari & Nurviana, 2022; Mardi, 2021).

Sentiment analysis, the computational extraction and classification of subjective opinions from textual data, has emerged as a prominent methodological approach for understanding public perceptions of cryptocurrency (Alghamdi et al., 2022). The proliferation of social media platforms as sites of financial discourse has made Twitter (now X) and similar networks a primary data source for such analyses, providing access to large volumes of naturalistic, real-time public expression (Bello et al., 2023). A substantial body of prior research has employed sentiment analysis to investigate the relationship between cryptocurrency-related social media activity and market price dynamics, finding that sentiment measures derived from Twitter data exhibit predictive associations with cryptocurrency returns (Alghamdi et al., 2022).

Hassan et al. (2022) applied a lexicon-based method to a corpus of 15,000 tweets, finding a predominance of positive sentiment (33%) and anticipa-

http://dx.doi.org/10.21511/imfi.23(2).2026.20

tion (18%), consistent with speculative enthusiasm in the cryptocurrency market. Ramaputra et al. (2024) analyzed user reviews on Indonesian cryptocurrency applications using the Multinomial Naive Bayes classifier, reporting positive sentiment dominance and an accuracy rate of 82.97%. In contrast, Riani and Ikhwan (2024) employed the TextBlob library to analyze 18,304 cryptocurrency-related tweets and found that neutral sentiment was most prevalent (91%), suggesting that the overall social media discourse on cryptocurrency is more observational than strongly evaluative. These divergent findings may reflect differences in data sources, temporal contexts, and methodological approaches, and underscore the importance of context-specific analysis.

The application of transformer-based deep learning models to sentiment analysis has advanced significantly since the introduction of BERT (Bidirectional Encoder Representations from Transformers) by Devlin et al. (2019). BERT and its derivatives achieve superior performance on a wide range of natural language understanding tasks by pre-training on large unlabeled corpora and then fine-tuning on task-specific labeled data, enabling the model to capture rich contextual semantic representations (Saadah et al., 2022). For the Indonesian language, IndoBERT, developed by Wilie et al. (2020), represents the leading monolingual transformer model, having been pretrained on over 220 million words drawn from diverse Indonesian-language sources, including Wikipedia, national newspapers, and web corpora. Prior studies have demonstrated the superiority of IndoBERT over lexicon-based and traditional machine learning approaches in classification tasks involving Indonesian-language social media data (Imaduddin et al., 2023; Jayadianti et al., 2022; Sayarizki & Nurrahmi, 2024).

Despite the growth of this literature, a notable gap remains: no study has specifically examined the sentiments of Indonesian Muslims toward cryptocurrency using a deep learning NLP approach, and none has situated the analysis within the specific context of Islamic legal discourse and the MUI fatwa. As-Salafiyah and Huda (2021) conducted an early sentiment study on cryptocurrency in Indonesia using a lexicon-based methodology, but their work predates the MUI fatwa and does not engage with IndoBERT or transformer-based modeling. Birjaman et al. (2024) examined cryptocurrency sentiment in an Islamic context but employed less sophisticated computational methods and did not specifically focus on Indonesia. The present study addresses this lacuna directly.

This tension between religious prohibition and regulatory accommodation constitutes the core scientific problem that motivates the present study. Despite the evident significance of Indonesia as a case study for the intersection of Islamic law and digital finance, the empirical literature on how Indonesian Muslims actually perceive and discuss cryptocurrency on social media remains underdeveloped. Existing studies on cryptocurrency sentiment have predominantly focused on general populations or English-language data sources, and very few have engaged with the specific socio-religious context of Muslim-majority countries (Birjaman et al., 2024; Hassan et al., 2022). Moreover, the handful of studies that have examined Indonesia have relied on relatively simple lexical or machine learning methods, such as the Multinomial Naive Bayes classifier, which are limited in their capacity to capture the semantic complexity and contextual nuance of Indonesian-language discourse (Ramaputra et al., 2024; Riani & Ikhwan, 2024).

To address this gap, the present study employs IndoBERT-base-p1, a transformer-based deep learning model trained specifically on large-scale Indonesian-language corpora, to perform sentiment classification on cryptocurrency-related tweets. This approach offers several advances over prior work. First, the IndoBERT model is capable of capturing bidirectional contextual relationships between words, enabling more accurate disambiguation of sentiment in informal and colloquial text. Second, by specifically sampling tweets from Indonesian users and filtering for religious and financial discourse, the study situates its analysis firmly within the socio-cultural context of Indonesian Muslim society. Third, the data collection period, October 2024 to March 2025, provides a contemporaneous window into public attitudes during an active phase of both global cryptocurrency market activity and ongoing domestic regulatory deliberation.

2. METHODS

This study adopts a quantitative, exploratory-descriptive research design to analyze Indonesian public sentiment toward cryptocurrency through the application of Natural Language Processing techniques. The analytical approach transforms unstructured textual data into quantifiable sentiment classifications, enabling systematic examination of large-scale social media discourse.

This study was conducted on the Google Colab platform by utilizing GPU resources to achieve better computational speed (Johary et al., 2023). Primary data were collected from the X platform using the Tweet-Harvest tool, a Node.js-based application that enables large-scale data retrieval directly from the X interface without the restrictions imposed by the official API. Data collection was conducted over a six-month period from 1 October 2024 to 31 March 2025. The search query employed the following keywords: "Kripto," "Cryptocurrency," "Bitcoin," "NFT," and "Ethereum." These terms were selected to capture broad cryptocurrency discourse while encompassing the major digital asset categories relevant to Indonesian public discussion. Only tweets in the Indonesian language were included in the dataset. After deduplication and filtering to remove retweets and non-original content, the final dataset comprised 1,065 tweets. The complete data processing pipeline, from raw collection through classification, is illustrated in Figure 1.

Prior to model training, all 1,065 tweets were manually labeled by trained annotators who classified each tweet into one of three sentiment categories: positive, negative, or neutral. Positive labels were assigned to tweets expressing favorable views toward cryptocurrency, including those highlighting its potential as an investment opportunity, technological innovation, or instrument of financial inclusion. Negative labels were assigned to tweets expressing unfavorable attitudes, including concerns about religious impermissibility, financial risk, fraud, or regulatory non-compliance. Neutral labels were assigned to tweets that were informational, factual, ambivalent, or otherwise non-evaluative in tone.

Prior to model input, all tweets underwent a standardized pre-processing pipeline designed to reduce noise and normalize linguistic variation. The pre-processing steps were applied in the following sequence:

- **Case folding:** All text was converted to lowercase to ensure uniformity of token representation.
- **Text cleaning:** Punctuation marks, numerical characters, URLs, @mentions, hashtags, and emoji were removed to reduce non-semantic noise.
- **Tokenization:** Text was segmented into individual tokens (words or subword units) in preparation for model input.

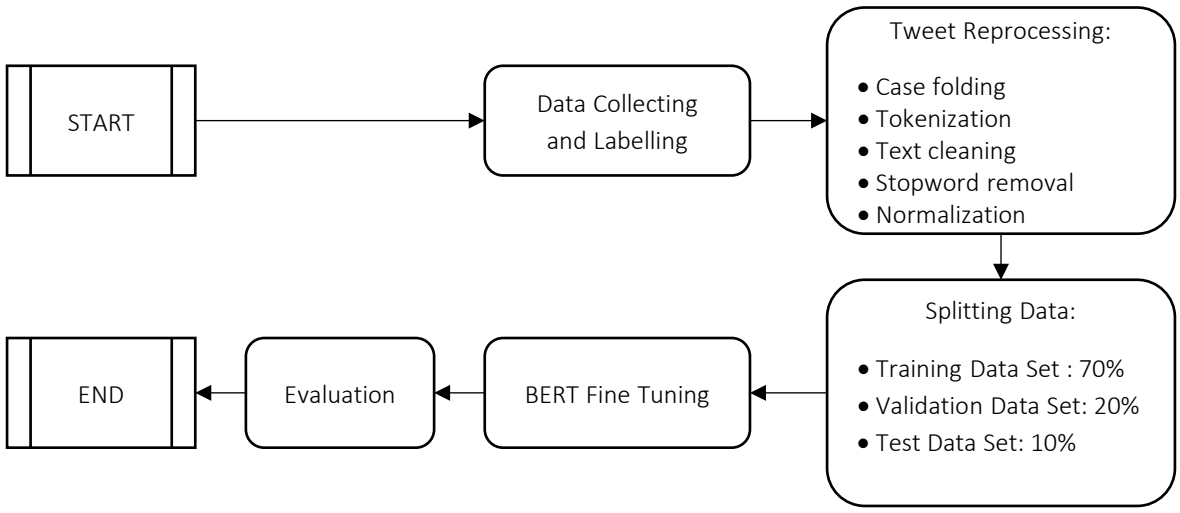

Figure 1. Research data processing workflow

http://dx.doi.org/10.21511/imfi.23(2).2026.20

- **Stop word removal:** High-frequency function words with low semantic content were removed using a standard Indonesian stop word list.

- **Normalization:** Non-standard spellings, abbreviations, and informal lexical forms common in Indonesian social media were converted to their standard equivalents using a curated normalization dictionary.

These preprocessing procedures align with established best practices in NLP for informal social media text and are consistent with prior applications of IndoBERT to Indonesian-language classification tasks (Imaduddin et al., 2023; Saadah et al., 2022). This study employs IndoBERT-base-p1, developed by Wilie et al. (2020) as part of the IndoNLU benchmark initiative. IndoBERT is a monolingual transformer-based language model built on the BERT architecture (Devlin et al., 2019) and pre-trained exclusively on Indonesian-language data. The pre-training corpus includes texts drawn from Indonesian Wikipedia, three major national newspapers (Kompas, Tempo, and Liputan6), and a large web corpus totaling over 220 million words. The model underwent pre-training for approximately two months involving around 2.4 million steps (180 epochs). The IndoBERT-base-p1 variant employed in this study consists of 12 transformer layers, a hidden dimensionality of 768, 12 attention heads, a feed-forward dimension of 3,072, and approximately 110 million parameters.

The BERT architecture processes text bidirectionally, enabling the model to construct contextual representations of each token informed by its full sentence context rather than relying on unidirectional sequential dependencies. Pre-training involves two self-supervised objectives: Masked Language Modeling (MLM), in which a proportion of input tokens are randomly masked and the model is trained to predict the masked tokens; and Next Sentence Prediction (NSP), in which the model is trained to determine whether two input sentences are contiguous in the original corpus. This pre-training regime equips the model with rich linguistic knowledge that can be efficiently transferred to downstream tasks through fine-tuning. Figure 2 illustrates the fine-tuning procedure.

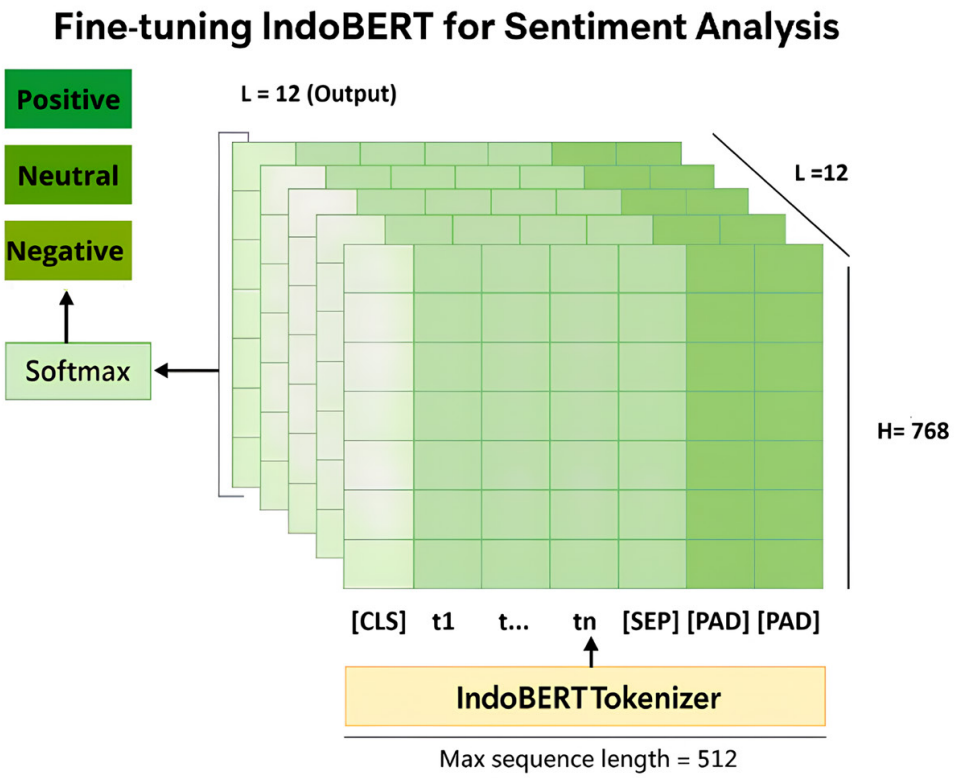

Figure 2. Illustration of the BERT fine-tuning procedure

In this study, model evaluation was carried out using a confusion matrix, a tool that helps visualize and calculate the model's classification performance. The confusion matrix produces four key values: True Positive (TP), False Positive (FP), False Negative (FN), and True Negative (TN). In this study, the model's performance evaluation was conducted using several metrics, namely accuracy, sensitivity, specificity, precision, and F1-score. The formulas for each metric are presented sequentially, where equation (1) represents accuracy, equation (2) represents recall, equation (3) represents precision, and equation (4) represents the F1-score.

$$Accuracy = \frac{(TP+TN)}{(TP+TN+FP+FN)}. \quad (1)$$

$$Precision = \frac{TP}{(TP+FP)}. \quad (2)$$

3. RESULTS AND DISCUSSION

The classification performance of the fine-tuned IndoBERT-base-p1 model on the held-out test set is summarized in Table 1. The model achieved an overall accuracy of 85%, indicating that the majority of test samples were correctly classified. The confusion matrix, presented in Figure 3, provides a disaggregated view of classification outcomes across the three sentiment categories.

Table 1. Classification performance metrics of the IndoBERT-base-p1 model

Class	Precision	Recall	F1-Score	Support
Positive	0.75	0.43	0.55	7
Neutral	0.88	0.96	0.92	85
Negative	0.56	0.38	0.43	14
Accuracy			0.85	106
Macro Avg	0.73	0.58	0.63	106
Weighted Avg	0.83	0.85	0.83	106

As shown in Table 1, the model performs particularly well on the neutral class, achieving a precision of 0.88, a recall of 0.96, and an F1-score of 0.92. This strong performance on the dominant class is expected, given the greater volume of training examples available. Performance on the minority classes is comparatively lower: the positive class yields an F1-score of 0.55 and the negative class an F1-score of 0.43. These discrepancies reflect the well-documented challenge of class imbalance in supervised text classification, wherein models trained on skewed distributions tend to underperform on underrepresented categories. Future work

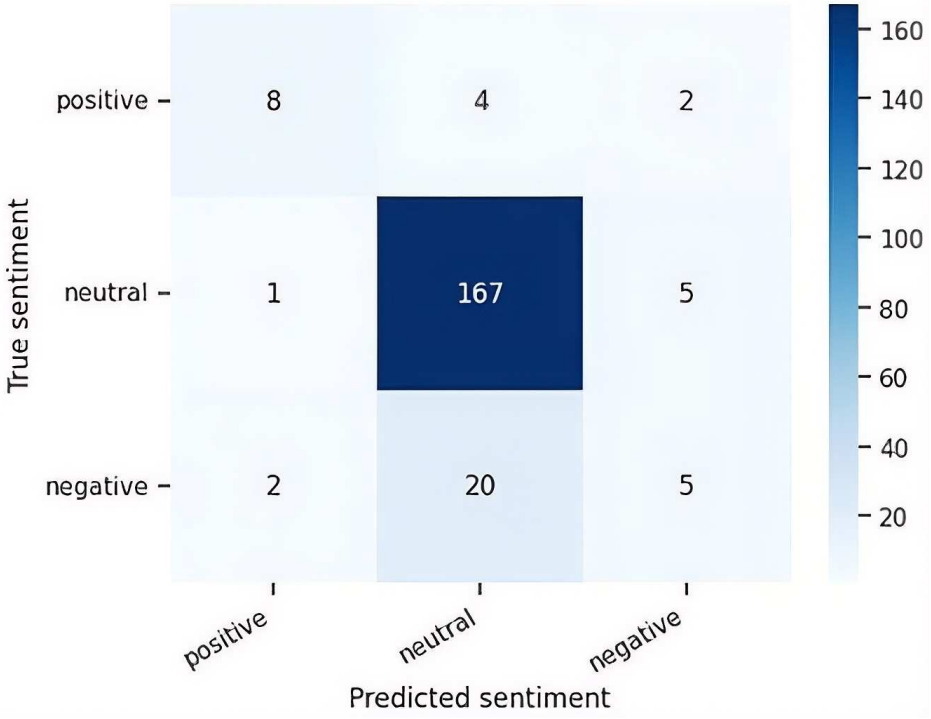

Figure 3. Confusion matrix for the IndoBERT model on the test set

http://dx.doi.org/10.21511/imfi.23(2).2026.20

may address this through oversampling strategies such as SMOTE or by applying class-weighted loss functions during fine-tuning. Notwithstanding these limitations, the weighted-average F1-score of 0.83 and the overall accuracy of 85% are consistent with or exceed the performance benchmarks reported in comparable sentiment classification studies using IndoBERT (Imaduddin et al., 2023; Saadah et al., 2022; Sayarizki & Nurrahmi, 2024).

The aggregate sentiment distribution across the full dataset reveals a clear dominance of neutral sentiment, which accounts for 80.8% of all classified tweets (860 out of 1,065). Positive sentiment constitutes 12.9% of the corpus (137 tweets), while negative sentiment represents 6.4% (68 tweets). These proportions are broadly consistent with the findings of Riani and Ikhwan (2024), who similarly reported the predominance of neutral sentiment in cryptocurrency-related Twitter data, and are interpreted below in relation to the specific socio-religious context of Indonesia.

The overwhelming prevalence of neutral sentiment in the dataset suggests that Indonesian Muslim social media users predominantly engage with cryptocurrency discourse in an informational or observational mode rather than expressing strong evaluative judgments. This finding is theoretically significant and can be attributed to several interconnected factors.

First, the MUI fatwa declaring cryptocurrency haram does not appear to have produced a corresponding surge in negative discourse; rather, it appears to have generated a condition of normative suspension in which many users are withholding judgment pending greater regulatory or scholarly clarity. This interpretation is consistent with the broader sociological literature on fatwa reception in Indonesian Muslim society, which emphasizes the diversity of responses to religious rulings across different educational, generational, and socio-economic strata (Rohman et al., 2023). Second, the coexistence of religious prohibition and government-sanctioned commodity trading creates an inherent ambiguity that discourages strong positioning. Users who are uncertain whether their engagement with cryptocurrency constitutes a permissible investment or an impermissible exchange may rationally adopt a neutral stance as a form of risk management in both the financial and spiritual sense.

Third, limited digital and financial literacy constitutes a structural constraint on the formation of strong sentiment. For many Indonesians, cryptocurrency remains a technically opaque phenomenon with uncertain practical relevance to daily economic life, and the social media discourse reflects this orientation toward information-seeking rather than advocacy or critique (Birjaman et al., 2024). Finally, the collective orientation of Indonesian Muslim society, which tends to defer to the guidance of religious authorities, community leaders, and government agencies before forming individual opinions on contested matters, further reinforces the observed caution (As-Salafiyah & Huda, 2021).

The 12.9% of tweets classified as positive reveal that a meaningful segment of Indonesian Muslim social media users perceives cryptocurrency positively, primarily through the lenses of technological innovation and investment opportunity. Positive tweets frequently highlight the potential of blockchain technology to democratize access to financial services, enable cross-border remittances at reduced cost, and provide alternative investment vehicles in an environment of low bank deposit yields. This framing is consistent with global narratives that position cryptocurrency as part of a broader fintech transformation with potentially inclusive economic consequences (Gupta et al., 2023).

The relatively modest proportion of positive sentiment (12.9%) compared with studies conducted in non-Muslim contexts, such as Hassan et al. (2022), who found 33% positive sentiment, suggests that the Islamic legal environment moderates positive enthusiasm. Even among users who view cryptocurrency favorably, the shadow of the MUI fatwa may inhibit unequivocal endorsement, resulting in qualified or hedged positive expressions. This interpretation aligns with the findings of Koeswandana and Sugino (2023), who report that intention to use cryptocurrency among Indonesian respondents is significantly attenuated by religious identity and social norm considerations.

Negative sentiment, while comprising the smallest proportion of the dataset (6.4%), nonetheless reveals substantive patterns in the nature of objections to cryptocurrency among Indonesian Muslim users. Content analysis of negatively classified tweets indicates that objections fall primarily into two categories: religious concerns and financial risk concerns. In the religious domain, users invoke the concepts of gharar, maysir, and the absence of underlying assets to argue against the permissibility of cryptocurrency transactions, directly echoing the reasoning of the MUI fatwa (Rohman et al., 2023). In the financial domain, concerns relate to price volatility, exchange security vulnerabilities, and the risk of speculative loss, consistent with the broader critical literature on cryptocurrency stability (Gechev, 2024).

The relatively low proportion of negative sentiment is noteworthy and should not be interpreted as indicating widespread acceptance. Rather, it may reflect a discursive environment in which strong criticism of cryptocurrency is unnecessary because the dominant institutional position – represented by the MUI fatwa – already provides authoritative negative guidance. In this context, expressing negative sentiment may be perceived as redundant, while expressing positive sentiment carries social and religious risk, thereby contributing to the general gravitational pull toward neutrality.

A cross-cutting theme in the interpretation of all three sentiment categories is the regulatory duality that characterizes Indonesia's approach to cryptocurrency. The simultaneous prohibition by the MUI and authorization by BAPPEBTI creates a legally and normatively complex environment that does not afford citizens a clear behavioral mandate. This duality is arguably the most structurally distinctive feature of the Indonesian context compared with other Muslim-majority countries, and its influence on the distribution of public sentiment deserves explicit recognition. The high proportion of neutral sentiment observed in this study may be understood, at least in part, as a rational response to institutional ambiguity: in the absence of a coherent and unified guidance framework, the rational posture for many individuals is one of cautious observation rather than decisive action.

From a methodological perspective, the IndoBERT model proved well-suited to the complexities of Indonesian-language social media text, demonstrating the value of language-specific transformer models over generic multilingual alternatives for tasks involving informal, code-switched, and culturally specific discourse.

CONCLUSION

This study analyzed the sentiment of Indonesian Muslim social media users toward cryptocurrency by applying the IndoBERT-base-p1 deep learning model to a corpus of 1,065 tweets collected between October 2024 and March 2025. The model achieved an overall classification accuracy of 85% and a weighted-average F1-score of 0.83, demonstrating reliable performance for the three-class sentiment classification task. The principal empirical finding is the overwhelming dominance of neutral sentiment (80.8%), with positive (12.9%) and negative (6.4%) sentiment playing secondary roles. This distribution is interpreted as reflecting a condition of normative suspension among Indonesian Muslim social media users, shaped by the coexistence of the MUI's religious prohibition of cryptocurrency as a payment medium and the government's authorization of it as an investment commodity, compounded by limited digital financial literacy and the characteristic tendency of Indonesian Muslim society to defer to institutional guidance on contested normative questions.

This study makes several contributions to the existing literature. Theoretically, it provides the first application of a transformer-based deep learning model to the analysis of Indonesian Muslim discourse on cryptocurrency, establishing a methodological template for future work in this area. Empirically, the study contributes to the nascent literature on cryptocurrency sentiment in Muslim-majority contexts, demonstrating that the Indonesian case exhibits a distinctive pattern of cautious neutrality that differs from the more polarized sentiment distributions reported in general-population studies. From a policy

http://dx.doi.org/10.21511/imfi.23(2).2026.20

perspective, the predominance of neutral and uncertain sentiment suggests an unmet need for clear, consistent, and accessible communication from both religious authorities and financial regulators regarding the legal status and practical implications of cryptocurrency. Greater institutional clarity could reduce the uncertainty that currently inhibits informed decision-making.

Several limitations of the present study should be acknowledged. The dataset is limited to tweets from the X platform, which may not be representative of the broader Indonesian Muslim population or of sentiment expressed through other channels. The class imbalance in the dataset constrains the model's performance on minority sentiment classes, and the study does not employ topic modeling or qualitative discourse analysis to illuminate the substantive content of different sentiment categories. Future research may address these limitations by incorporating multi-platform data, employing data augmentation or resampling techniques to address class imbalance, applying topic modeling to identify dominant themes within each sentiment category, and extending the comparative analysis to other Muslim-majority countries.

AUTHOR CONTRIBUTIONS

Conceptualization: Nur Rizqi Febriandika, Annisa Nur Faizah, Helmi Imaduddin.
Data curation: Nur Rizqi Febriandika.
Formal analysis: Nur Rizqi Febriandika, Annisa Nur Faizah.
Funding acquisition: Nur Rizqi Febriandika.
Investigation: Helmi Imaduddin.
Methodology: Nur Rizqi Febriandika, Annisa Nur Faizah, Helmi Imaduddin.
Project administration: Nur Rizqi Febriandika.
Resources: Nur Rizqi Febriandika.
Software: Nur Rizqi Febriandika, Annisa Nur Faizah, Helmi Imaduddin.
Supervision: Nur Rizqi Febriandika.
Validation: Nur Rizqi Febriandika, Annisa Nur Faizah.
Writing – original draft: Nur Rizqi Febriandika.
Writing – review & editing: Nur Rizqi Febriandika, Annisa Nur Faizah, Helmi Imaduddin.

ACKNOWLEDGMENT

The substantial financial support for this study is sponsored by the Ministry of Religious Affairs (MoRA) and the Indonesia Endowment Fund for Education (LPDP) of the Ministry of Finance of the Republic of Indonesia.

REFERENCES

1. Abadi, K., Ahmad Taufiq, & Rizka Roikhana. (2023). Cryptocurrency and crypto assets in the perspective of Islamic legal system philosophy. *Hikmatuna: Journal for Integrative Islamic Studies, 9*(2), 131-146. https://doi.org/10.28918/hikmatuna.v9i2.1216
2. Abdelgawad, H. M. (2024). The impact of Islamic law on cryptocurrency regulation in Egypt. *Manchester Journal of Transnational Islamic Law & Practice, 20*(3), 381-388. Retrieved from https://www.electronicpublications.org/stuff/1137
3. Akbar, M. A. (2022). Towards an interpretation of cryptocurrency as a commodity from maqasid al-shari'ah perspective. *Al-Iqtishad: Journal of Islamic Economics, 5*(2), 161-174. Retrieved from https://ijiefer.uis.edu.my/ircief/article/view/90
4. Alekseenko, A. P. (2022). Legal regulation of the use of distributed ledger technologies in financial sector of Singapore. *Revista de Investigaciones Universidad del Quindío, 34*(S2), 381-391. https://doi.org/10.33975/riuq.vol34nS2.957
5. Alghamdi, S., Alqethami, S., Alsubait, T., & Alhakami, H. (2022). Cryptocurrency price prediction using forecasting and sentiment analysis. *International Journal of Advanced Computer Science and Applications, 13*(10).

https://doi.org/10.14569/IJACSA.2022.01310105

6. Ali, S. N., & Jumat, Z. H. (2024). *Islamic finance in the digital age*. Edward Elgar Publishing. https://doi.org/10.4337/9781035322954
7. Arora, G. (2020). Cryptoasset regulatory framework in Japan. *SSRN Electronic Journal*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3720230
8. As-Salafiyah, A., & Huda, N. (2021). Cryptocurrency in Indonesia: A sentiment analysis. *European Journal of Islamic Finance, 10*(3). https://doi.org/10.13135/2421-2172/5985
9. Bartoletti, M., Lande, S., Loddo, A., Pompianu, L., & Serusi, S. (2021). Cryptocurrency scams: Analysis and perspectives. *IEEE Access, 9,* 148353-148373. https://doi.org/10.1109/ACCESS.2021.3123894
10. Bello, A., Ng, S. C., & Leung, M. F. (2023). A BERT framework for sentiment analysis of tweets. *Sensors, 23*(1), 506. https://doi.org/10.3390/s23010506
11. Birjaman, M. I., Marits, S. A., & Herman, S. (2024). Cryptocurrency in Islamic view: Sentiment analysis method approach. *Jurnal Ilmiah Manajemen Kesatuan, 12*(1), 27-32. https://doi.org/10.37641/jimkes.v12i1.2341
12. Cameron, C. (2020). The regulation of cryptocurrency to remunerate employees in Australia. Australian *Journal of Labour Law, 33*(2). Retrieved from https://research.usc.edu.au/esploro/outputs/journalArticle/The-regulation-of-cryptocurrency-to-remunerate/99701598302621
13. Chen, R., Lepori, G. M., Tai, C.-C., & Sung, M.-C. (2022). Explaining cryptocurrency returns: A prospect theory perspective. *Journal of International Financial Markets, Institutions and Money, 79,* 101599. https://doi.org/10.1016/j.intfin.2022.101599
14. Devlin, J., Chang, M.-W., Lee, K., & Toutanova, K. (2019). BERT: Pre-training of deep bidirectional transformers for language understanding. *In Proceedings of NAACL-HLT 2019* (pp. 4171-4186). Association for Computational Linguistics. https://doi.org/10.18653/v1/N19-1423
15. Febriandika, N. R., Fadli, F., & Mi'raj, D. A. (2022). How are NFT (Non-Fungible Token) transactions reviewed according to Islamic law? *Borobudur Law Review, 4*(1), 1-12. https://doi.org/10.31603/burrev.6807
16. Filimonov, I., & Tajti, T. (2023). *Cryptocurrency regulation: A comparative analysis of the European Union and the United States.* Central European University. Retrieved from https://www.etd.ceu.edu/2024/filimonov_igor.pdf
17. Fitriana, W., & Nuraini, M. D. (2023). Juridical Analysis of Legal Updates on Crypto Assets in Indonesia (Comparative Study of Indonesian Law with Singapore and Islamic Law Views). *Journal of Transcendental Law, 5*(1), 55-72. https://doi.org/10.23917/jtl.v5i1.2476
18. Garba, K. H., Lazarus, S., & Button, M. (2024). An assessment of convicted cryptocurrency fraudsters. *Current Issues in Criminal Justice, 37,* 1-17. https://doi.org/10.1080/10345329.2024.2403294
19. Gechev, V. (2024). Crypto and its industry of theft. *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4787114
20. Gupta, S., Himanshu, Dhingra, S., & Aggarwal, R. (2023). What explains the sudden surge in cryptocurrency? A consumption value theory perspective. *Digital Policy, Regulation and Governance, 25*(6), 634-652. https://doi.org/10.1108/DPRG-05-2023-0065
21. Hassan, M. K., Hudaefi, F. A., & Caraka, R. E. (2022). Mining netizen's opinion on cryptocurrency: Sentiment analysis of Twitter data. *Studies in Economics and Finance, 39*(3), 365-385. https://doi.org/10.1108/SEF-06-2021-0237
22. Imaduddin, H., Yusfida A'la, F., & Nugroho, Y. S. (2023). Sentiment analysis in Indonesian healthcare applications using IndoBERT approach. *International Journal of Advanced Computer Science and Applications, 14*(8). http://dx.doi.org/10.14569/IJACSA.2023.0140813
23. Jayadianti, H., Kaswidjanti, W., Utomo, A. T., Saifullah, S., Dwiyanto, F. A., & Drezewski, R. (2022). Sentiment analysis of Indonesian reviews using fine-tuning IndoBERT and R-CNN. *ILKOM Jurnal Ilmiah, 14*(3), 348-354. https://doi.org/10.33096/ilkom.v14i3.1505.348-354
24. Johary, R., Révillion, C., Catry, T., Alexandre, C., Mouquet, P., Rakotoniaina, S., Pennober, G., & Rakotondraompiana, S. (2023). Detection of large-scale floods using Google Earth Engine and Google Colab. *Remote Sensing, 15*(22). https://doi.org/10.3390/rs15225368
25. Khan, S. N. (2022). The legality of cryptocurrency from an Islamic perspective: A research note. *Journal of Islamic Accounting and Business Research, 14*(2), 289-294. https://doi.org/10.1108/JIABR-02-2022-0041
26. Koeswandana, N. A., & Sugino, F. A. (2023). Intention to use cryptocurrency: Social and religious perspective. *Jurnal Ekonomi & Keuangan Islam, 9*(1), 91-103. https://doi.org/10.20885/JEKI.vol9.iss1.art7
27. Krause, D. S. (2025). The rise and fall of Bitcoin as legal tender: An analysis of El Salvador's experiment. *International Journal of Cryptocurrency Research, 5*(1), 1-9. https://doi.org/10.51483/ijccr.5.1.2025.1-9
28. Liu, F., Fan, H. Y., & Qi, J. Y. (2022). Blockchain technology, cryptocurrency: Entropy-based perspective. *Entropy, 24*(4). https://doi.org/10.3390/e24040557
29. Liu, Z., & Li, X. (2025). *SoK: Security analysis of blockchain-based cryptocurrency*. arXiv. http://arxiv.org/abs/2503.22156
30. Mardi, M. (2021). Cryptocurrency technology of Litecoin for investment and business transactions based on Islamic law perspective. *Syaikhuna: Jurnal Pendidikan dan Pranata Islam, 12*(2), 197-209.

http://dx.doi.org/10.21511/imfi.23(2).2026.20

https://doi.org/10.36835/syaikhuna.v12i2.5132

31. Nadiar, R., Nor, W., & Safrida, L. (2022). Cryptocurrency Transaction: is it Relevant to Indonesian Accounting Standards? *Riset Akuntansi dan Keuangan Indonesia,* 217-226. https://doi.org/10.23917/reaksi.v7i2.18523

32. Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system.* Retrieved from https://bitcoin.org/bitcoin.pdf

33. Nelson, F. M., Prosperiani, M. D., Ramadhan, C. R., & Andini, P. P. (2024). Cracking the code: Investigating the hunt for crypto assets in money laundering cases in Indonesia. *Journal of Indonesian Legal Studies, 9*(1), 89-130. https://doi.org/10.15294/jils.vol9i1.4534

34. Norisnita, M., & Indriati, F. (2022). Application of theory of planned behavior (TPB) in cryptocurrency investment prediction: A literature review. *Journal of Economics and Business, 5*(2). https://doi.org/10.31014/aior.1992.05.02.424

35. Othman, A. M. Z., & El Dosh, E. M. E. (2023). Regulating digital currencies in the Emirate of Dubai: A comparative legislative review. *International Journal of Public Law and Policy*. https://doi.org/10.1504/ijplap.2023.10061089

36. Ramaputra, C. A., Al Faroby, M. H. Z., & Lidiawaty, B. R. (2024). Sentiment analysis of user reviews on cryptocurrency application: Evaluating the impact of dataset split scenarios using multinomial Naive Bayes. *The Indonesian Journal of Computer Science, 13*(4). https://doi.org/10.33022/ijcs.v13i4.4263

37. Recskó, M., & Aranyossy, M. (2024). User acceptance of social network-backed cryptocurrency. *Financial Innovation, 10*(1). https://doi.org/10.1186/s40854-023-00511-4

38. Riani, R., & Ikhwan, I. (2024). Cryptocurrency: A sentiment analysis from Twitter data. *IFT Journal, 1*(1). https://doi.org/10.58968/ift.v1i1.359

39. Rohman, M. H., Rosid, A., & Alfiyanti, A. (2023). Understanding the legal and religious perspectives on cryptocurrency transactions: A study of DSN-MUI fatwa and Indonesian currency regulation. *Istinbath: Jurnal Hukum, 20*(1), 38-53. Retrieved from https://e-journal.metrouniv.ac.id/istinbath/article/view/5688/3349

40. Saadah, S., Auditama, K. M., Fattahila, A. A., Irfan, F. I., Aditsania, A., & Rohmawati, A. A. (2022). Implementation of BERT, IndoBERT, and CNN-LSTM in classifying public opinion about COVID-19 vaccine in Indonesia. *Jurnal RESTI, 6*(4), 648-655. https://doi.org/10.29207/resti.v6i4.4215

41. Sari, M. A., & Rofiuddin, M. (2022). Analysis of inflation, population, and economic growth on poverty in Muslim-majority provinces in Indonesia. Indonesian *Journal of Islamic Economics Research, 4*(2), 76-86. https://doi.org/10.18326/ijier.v4i2.7947

42. Sayarizki, P., & Nurrahmi, H. (2024). Implementation of IndoBERT for sentiment analysis of Indonesian presidential candidates. *Journal on Computing, 9*(2), 61-72. https://doi.org/10.34818/indojc.2024.9.2.934

43. Sekar Bidari, A., & Nurviana, R. (2022). Regulation and the future of cryptocurrency in Indonesia. *Business and Accounting Research (IJEBAR), 6*. https://doi.org/10.29040/ijebar.v6i3.6539

44. Selcuk, M., & Kaya, S. (2021). A critical analysis of cryptocurrencies from an Islamic jurisprudence perspective. *Turkish Journal of Islamic Economics, 8*(1), 137-152. https://doi.org/10.26414/a130

45. Spithoven, A. (2019). Theory and reality of cryptocurrency governance. *Journal of Economic Issues, 53*(2), 385-393. https://doi.org/10.1080/00213624.2019.1594518

46. Taniady, V., Permatasari, S. P., & Nugraha, R. W. (2022). Crypto asset-trade resilience during the Covid-19 pandemic in Indonesia. *Jurnal Jurisprudence, 11*(1), 31-43. https://doi.org/10.23917/jurisprudence.v11i1.13340

47. Thoma, A. (2020). *A prospect theory model for predicting cryptocurrency returns* (Working paper). University of Zurich, Department of Finance. SSRN. Retrieved from https://ssrn.com/abstract=3753530

48. Wilie, B., Vincentio, K., Winata, G. I., Cahyawijaya, S., Li, X., Lim, Z. Y., Soleman, S., Mahendra, R., Fung, P., Bahar, S., & Purwarianti, A. (2020). IndoNLU: Benchmark and resources for evaluating Indonesian natural language understanding. In *Proceedings of AACL-IJCNLP 2020* (pp. 843-857). ACL. https://doi.org/10.48550/arXiv.2009.05387

49. Wu, J., Liu, J., Zhao, Y., & Zheng, Z. (2021). Analysis of cryptocurrency transactions from a network perspective: An overview. *Journal of Network and Computer Applications, 190,* 103139. https://doi.org/10.1016/j.jnca.2021.103139