

Discourse Analysis of Indonesian Sharia Stocks: Insights from Twitter Using Social Network Analysis

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Abstract. This study employs computational network analysis to investigate the digital discourse surrounding Indonesian Sharia stocks on Twitter. Using Social Network Analysis (SNA) and the Drone Emprit Academic (DEA) tool, the study analyzes Twitter conversations related to Sharia stocks from May 21 to June 19, 2023. The analysis focuses on identifying the most active users, popular topics, influential sources, sentiment trends, and demographic characteristics of the Twitter community engaged in discussions about Sharia stocks. The results reveal peak activity on May 26, 2023, with a surge in mentions, retweets, and replies, indicating a potential reaction to significant events or news related to Sharia stocks. Sentiment analysis indicates a higher prevalence of negative comments compared to positive ones. The study also identifies key influencers and influential websites contributing to the discourse. Demographic insights suggest that millennials aged 19-29 years constituted the most active age group, while male users dominated the conversations. The findings contribute to understanding the digital pulse of the Sharia stock market in Indonesia and highlight the potential of computational network analysis in exploring social media discussions related to financial markets.

Keywords: Twitter community, Stock market development, Social network analysis, Information dissemination

1. Introduction

Sharia capital market is already Not foreign Again heard in Indonesian society, where Indonesia is one of the countries with the majority religious Islam (Apriantoro et al., 2022). This is a factor in Indonesian society's interest in investment in shares (Hana, 2018). The presence of a Sharia-based capital market, Power is a big pull for Indonesian society (Hastuti, 2018). However, No means with presence. This Sharia-based capital market is only especially for followers of the Islamic religion, Customers who do not adhere to the Islamic religion can still invest because the Islamic religion teaches them to stay away from usury and the presence of innovation (Apriantoro et al., 2023). This, of course just, can make it easier for customers who adhere to the Islamic religion to get it still invest without worrying about problems about usury with all laws based on the Islamic religion with a purpose (Ashfahany et al., 2022). To avoid factors that can cause sin in the form of usury (Muflikha et al., 2023).

The success of the Islamic stock market in Indonesia can be achieved as a reflection of solid support for drafting ethical and sustainable finance (Apriantoro, Diniyah, et al., 2024), with a growing fast economy (Ratnaningrum & Susilowati, 2011). The success of Sharia-based capital markets can be achieved by lifting the economy in Indonesia at the moment. More is needed to be happy with the development. This still needs an enthusiastic community within the digital Sharia capital market community to increase the percentage of development economy in Indonesia. Many benefits can be obtained with the presence of a capital market-based Sharia (Faizah et al., 2019).

In the current era, this awareness of the development of internet technology has changed the method of public interaction via the Twitter platform, including interaction in the fields of business, economic, social, and cultural (Athief & Ma'ruf, 2023). The presence of the Internet has increased the effectiveness and efficiency of Company operations or agencies, especially as tool communications, publications, and sources of necessary information. This matter is strengthened with the additional possible investment (Asriani, 2011), which We expect from the utilization of technology as receptacle information as well as opinions from users to the public via Twitter and special platforms. Community investment can help the country's problem economy to develop quickly (Khoirunisa et al., 2023). Drone Emprit Academic is an impressive tool with diverse and exciting applications in the modern era, which is filled with rapid technological development. Drone Emprit Academic use is not limited to commercial and military sectors but has also penetrated the world of education and academics. Drone Emprit Academic, or normal, also known as mini drones or beginner drones, is one type of drone that has a role in the context of; under discussion, we will explain how drones have become more prevalent in the environment and the number of their function fulfills (Suharso, 2019).

This research is crucial as it delves into the influence of the Twitter community on investor perceptions and behaviors regarding Sharia-compliant securities in Indonesia, highlighting its importance in several key areas. First, it enhances financial inclusion by demonstrating how social media can introduce Sharia-compliant investment opportunities to a broader audience, including those traditionally underserved by financial education (Kazaal & Maki, 2024). Second, it provides insights into the impact of digital platforms on financial decisions, crucial for policymakers, financial analysts, and strategists aiming to harness social media's power effectively (Grant et al., 2024). Additionally, this study underscores the importance of ethical investing, analyzing the motivations behind investor interest in Sharia-compliant stocks and supporting the development of ethically aligned investment products (Teichmann et al., 2024). The findings also offer strategic value to financial institutions and marketers by identifying optimal times for engagement and information dissemination on Twitter, enabling more effective communication strategies. Lastly, the research assists in policy development by providing regulators with a better understanding of investor sentiments and informational catalysts on social media, guiding the creation of supportive policies for the growth of Sharia-compliant markets. Overall, this study maps the significant role of digital conversations in shaping the landscape of ethical and Sharia-compliant investing in Indonesia.

The research conducted on the Twitter community's engagement with Sharia-compliant securities

in Indonesia meticulously analyzes various critical aspects, including mentions, sentiment, source influence, and demographics, each providing unique and interconnected insights. Mentions analysis helps quantify the discussion extent and reveals temporal patterns, indicating optimal times for stakeholders to disseminate educational or promotional content effectively. Sentiment analysis goes further to assess the emotional tone of these discussions, offering a gauge of public perception and emotional response towards Sharia stocks, highlighting areas of enthusiasm or concern that can be strategically addressed (Apriantoro, Faradilla, et al., 2024).

Analyzing source influence by identifying influential websites, hashtags, and Twitter personalities elucidates which sources shape the opinions and narratives within the community. This understanding is essential for recognizing information dissemination pathways and the narratives that gain traction, enabling stakeholders to align with key influencers or counter misinformation (Pattanayak et al., 2024). Furthermore, demographic analysis segments the conversation participants by age, user type, and gender, pinpointing the market segments most engaged or receptive. This segmentation allows for the customization of financial products and marketing strategies to suit specific needs and preferences, enhancing reach and impact (Naznin et al., 2024).

Social Network Analysis (SNA) provides a theoretical and computational framework to study the structures of relationships within a network, offering profound insights into how information flows and how communities form around specific topics such as Sharia-compliant stocks. The theory underpinning SNA is that social networks are not merely random interactions, but structured patterns of relationships influenced by sharing of information, social influence, and collective behavior (Scott, 2015). By applying SNA to Twitter data, this research can uncover the central nodes (i.e., highly connected individuals or influencers within the network) and the ties between them that facilitate or constrain the flow of information. This understanding is crucial for identifying how key actors influence discussions and sentiment towards Sharia stocks, potentially guiding market trends (Borgatti et al., 2009). The analysis of centrality measures within the network, such as degree, betweenness, and closeness, helps in pinpointing influential stakeholders whose tweets might change perceptions or encourage new investments in Sharia-compliant funds.

Collectively, these analyses provide a holistic view of the digital discourse around Sharia-compliant investments, uncovering how peak mention times might align with specific demographic activities or shifts in sentiment. This integrated approach not only enriches the academic understanding of financial communication on social media but also serves as a practical guide for financial institutions aiming to optimize their engagement strategies and promote ethical investing within Sharia compliance frameworks. Through such detailed exploration, the research highlights the multifaceted relationship between digital conversations and investor behavior, offering valuable insights for enhancing the effectiveness of financial services in the digital age.

The study provides valuable insights into the engagement of the Indonesian Twitter community with Sharia-compliant stocks, yet it encompasses several limitations, potential biases, and methodological constraints. First, the research is limited by its exclusive focus on Twitter, potentially overlooking perspectives from users on other social platforms like Facebook or LinkedIn, which might attract different demographic segments. The temporal scope of the data also restricts the findings to a specific timeframe, which may not reflect changes in user behavior or external economic conditions over a longer period. Additionally, the geographical focus on Indonesia, while comprehensive, might not accurately capture the diversity of the Indonesian investing populace, particularly those in less digitally connected or rural areas.

Potential biases include a selection bias from using only Twitter data, which may not represent the entire spectrum of investors interested in Sharia-compliant stocks (Ng & Chow, 2024). There is also a language bias, as the analysis might predominantly cover tweets in Indonesian or English, potentially excluding non-speakers. Furthermore, the study relies heavily on automated tools for data collection and analysis, such as Social Network Analysis (SNA) and Drone Emprit Academic, which might carry

inherent algorithmic biases that could affect the interpretation of community influence and sentiment.

2. Method

In this study, we adopt a descriptive qualitative research design to dissect the intricate dynamics of Twitter conversations concerning Sharia Stocks in Indonesia. Our methodology hinges on utilizing Social Network Analysis (SNA), facilitated by Drone Emprit Academic (DEA), a sophisticated tool engineered for the in-depth analysis of social media interactions. This approach allows us to meticulously sift through Twitter conversations, identifying clusters based on shared themes or hashtags, laying the groundwork for our investigation (Mikhailova et al., 2018).

The data collection phase is marked by a strategic extraction of critical elements such as the frequency of retweets, mentions, user account activity by day and time, and prevalent hashtags. For this study, data were specifically gathered from May 21 to June 19, 2023, focusing on tweets tagged with #sahamislam and #shariastock, to capture targeted discussions and trends related to Islamic and Sharia-compliant stocks. A significant aspect of our analysis involves distinguishing bot accounts to ensure our data's authenticity, coupled with examining the most frequently shared sites to gauge external influences on the conversation. Additionally, we delve into demographic insights, capturing the age and gender of participants, which enriches our understanding of the conversation landscape (Haque et al., 2022).

Our methodology's cornerstone is identifying key influencers within conversation clusters. By leveraging SNA, we can pinpoint accounts that command significant engagement and play a pivotal role in disseminating information. This step is crucial in unraveling the fabric of interaction patterns, peak activity times, and the dominant themes that emerge within these digital discourses (Apriantoro & Nuraini, 2022).

Furthermore, our analysis extends to users' geographical origins, offering a lens through which we can explore regional nuances in participation. When combined with our rigorous bot detection and data cleaning processes, this geographical analysis ensures a holistic view of the conversation dynamics. Identifying automated accounts is a critical step in purifying our dataset, thereby enhancing the integrity of our findings.

The culmination of this meticulous methodology is expected to yield a comprehensive map of conversation clusters surrounding Sharia Stocks in Indonesia on Twitter. Insights into the influential figures steering these conversations, the nuanced patterns of user interaction, and the impact of geographical diversity on discussion themes are anticipated. By navigating through the digital chatter with a fine-tooth comb, this research aims to uncover the multifaceted relationship between digital conversations and financial discourse within Sharia compliance, presenting a nuanced narrative that transcends the mere aggregation of tweets.

3. Result and Discussion

From 21 May to 19 June 2023, Drone Emprit Academic discovered phenomenal discussions about Sharia shares in Indonesia involving 323 active social media users. Findings This describes turmoil and enthusiasm outside normal from netizens towards investing in Sharia shares in Indonesia.

3.1. Mentions Analysis

In May 2023, Twitter users were actively conversing about attractive Sharia shares in Indonesia for observation. Starting from 25 tweets on May 23, 2023, the total Then decreased drastically to 7 tweets in a day next. However, activity reached peaks on May 26, 2023, with a surge significant to 250 tweets in One day. Phenomenon interesting happened afterward. From May 28 to June 19, 2023, conversations about Sharia shares seemed dim on Twitter, perhaps caused by influencing factors that interested users in discussion.

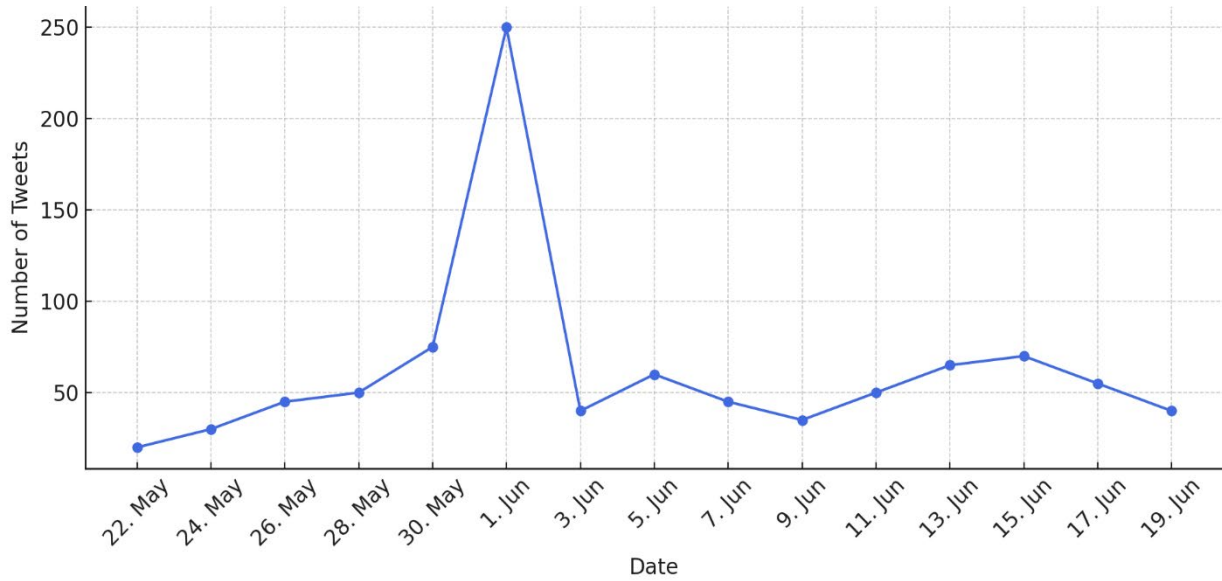


Fig. 1: Trends of total mentions

Based on the day, Drone Emprit Academic showed activity on Twitter, discussing Sharia shares in Indonesia. Shares were discussed from Monday until Thursday, which experienced ups and downs and increased drastically on Friday, reaching 252 Twitter users who discussed Sharia shares in Indonesia. From that, the highest point is available on Friday. From Monday to Tuesday, the number of Twitter users who discussed the topic increased from 17 to 26. Then, from Wednesday to Thursday, the number of Twitter users is also increasing from 7 to 16. On Saturday, I had time. No, there is a conversation about the matter. From Friday to Sunday, there was a decline from 252 to 5 Twitter users, showing that interest in Twitter users against the topic decreased by day Sunday.

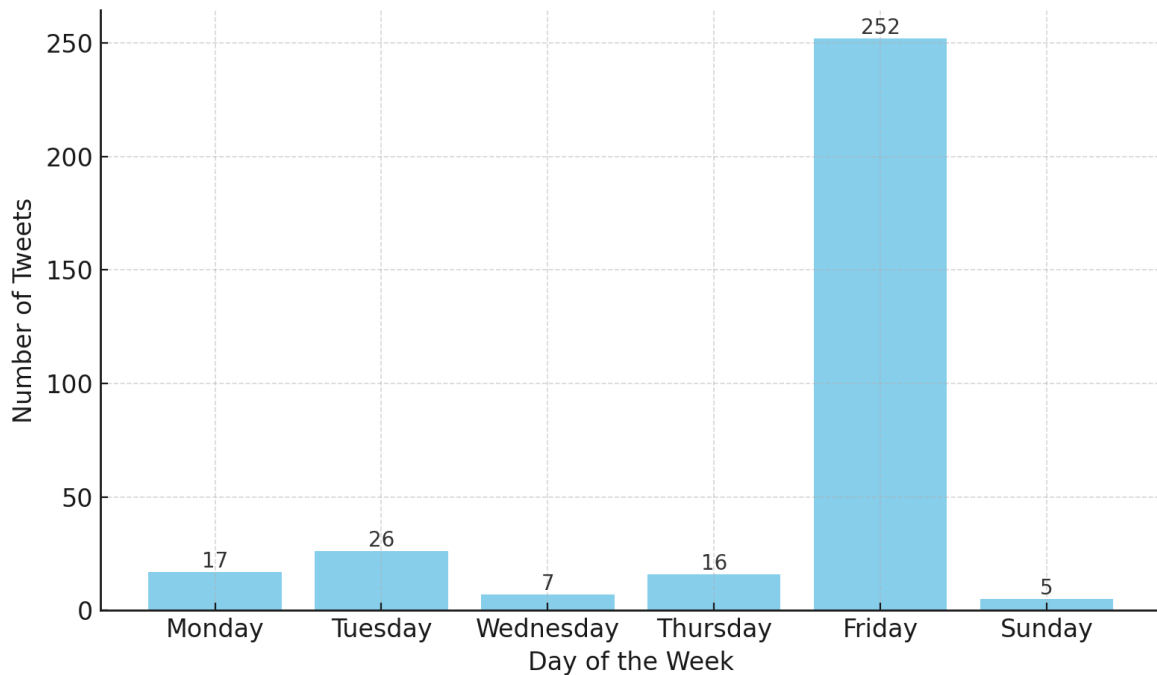


Fig. 2: Mentions by weekday

Figure 2 displays the frequency of weekday Twitter mentions related to conversations about Sharia

shares in Indonesia. A marked peak in activity is observed on Friday, with 252 mentions, which dwarfs the mentions on other days: Monday (17), Tuesday (26), Wednesday (7), Thursday (16), and Sunday (5). No data is shown for Saturday, which could be an oversight or may indicate that no data was collected for that day.

The narrative suggests that discussions begin in the morning with minimal activity, represented by a single user, and rise notably to 64 mentions by mid-morning. Then, there is a drop in mentions as the day progresses towards the evening. This pattern could indicate users' engagement with the topic during their morning routines or work commutes, with a decline as the day progresses and users wind down or become occupied with end-of-day activities.

The significant spike on Friday aligns with the Muslim day of the congregation and may reflect a cultural or religious synergy with the topic of Sharia shares, leading to increased discussions. The low activity observed on the weekends, particularly Sundays, could suggest that user engagement with financial topics decreases outside of the typical workweek.

Overall, the data indicates that conversations about Sharia shares in Indonesia on Twitter are not evenly distributed throughout the week but are significantly influenced by the day of the week, with Friday being the most active. This might inform stakeholders in the financial sector about optimal times for releasing information or engaging with the community. However, it is essential to note the absence of Saturday's data and to consider whether this pattern is consistent over time or was specific to the analyzed week.

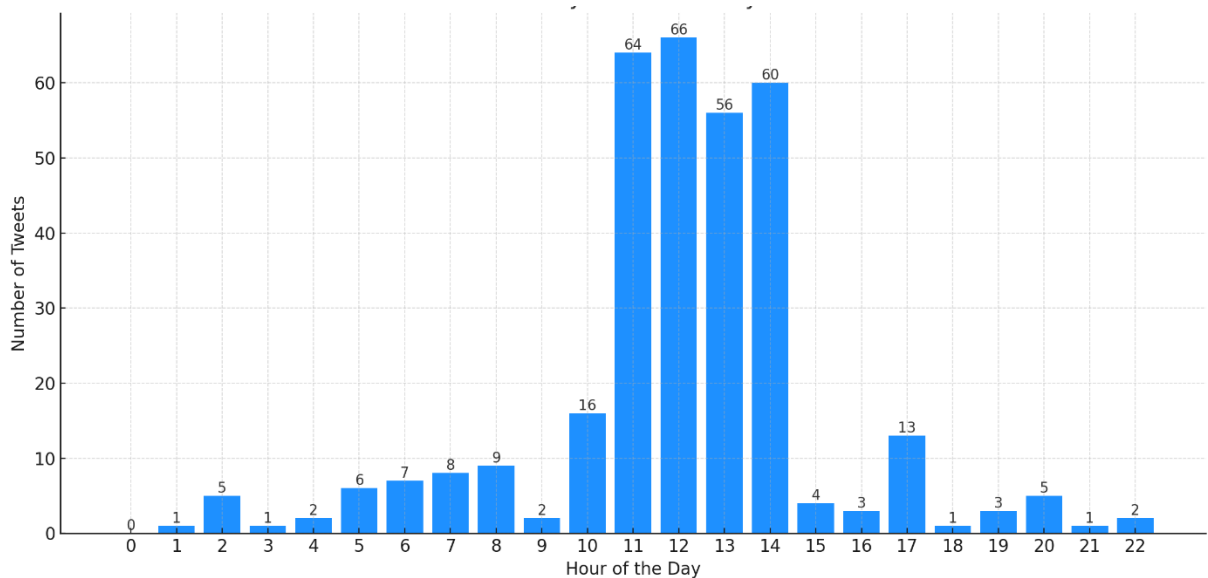


Fig. 3: Mention by hour

Figure 3 displays the distribution of Twitter mentions by hour, related to discussions on Sharia shares in Indonesia, from May 20 to May 26, 2023. The chart shows variable engagement throughout the day with distinct peaks at 9 am (64 mentions), 10 am (66 mentions), 1 pm (56 mentions), and 2 pm (60 mentions). These times may represent periods when users are more active on Twitter, during morning work breaks, and during lunch hours when individuals have free time to engage with content and participate in discussions.

The data analysis accompanying the chart reveals that 45.51% of the total Twitter user involvement is due to users posting original tweets about Sharia shares. Additionally, responses to other users' tweets accounted for considerable interaction (20.12%), indicating a robust two-way dialogue rather than a series of isolated statements. The reposting activity, wherein users retweet content to their followers, constitutes 34.37% of the total activity, showcasing the importance of information dissemination in these conversations.

The average level of discussion, as indicated by a ratio of 1.20, suggests that for every Twitter user engaging, a slightly higher volume of tweets is produced. This could point to a highly engaged subset of users creating more content than the average participant.

The timing and pattern of engagement suggest that stakeholders interested in targeting this demographic might consider timing their communications to coincide with peak activity hours. Moreover, the relatively high level of original posting and retweeting activity suggests that information can spread quickly through this network, and there is a receptive audience for interactive dialogue.

However, the histogram does not show an entire 24-hour cycle for each day; it only provides counts up to 2 pm. The histogram should ideally cover all hours to gain a comprehensive understanding of daily activity. Furthermore, this data would be more informative if contextualized within broader market trends, news events, or specific discussions related to Sharia shares in Indonesia during the same timeframe. This contextual analysis could help clarify what drives engagement at different times of the day.

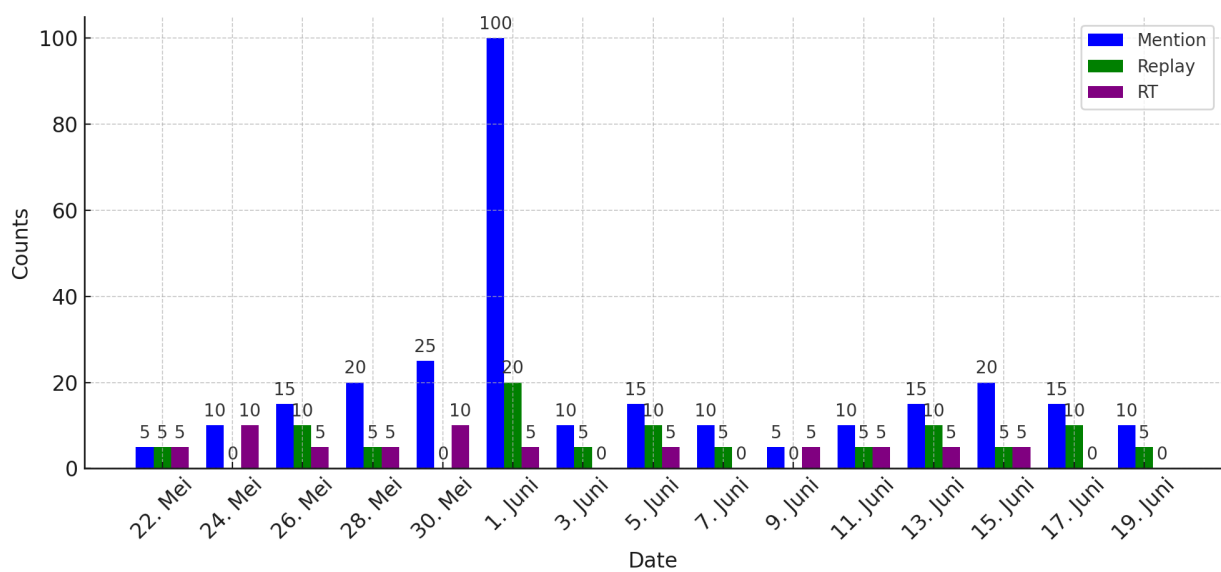


Fig. 4: Total daily rt, reply, and mentions

Figure 4 illustrates the frequency of three types of Twitter activities—mentions, replies, and retweets (R.T.)—from May 22nd to June 19th. There is a notable surge in activity around May 26th, where all three types of interactions show significant increases, particularly mentions and retweets. This could indicate a key event or release of important information on that date, which sparked heightened interest and engagement among Twitter users.

Mentions are generally used when users want to direct a tweet toward another user, which may suggest that on May 26th, many were engaging in conversations with or directing attention to specific other users. The high volume of retweets suggests that users extensively shared existing content, a common reaction to significant news or events. Replies indicate back-and-forth conversations; the presence of replies in significant numbers suggests that users were not only sharing information but also engaging in discussions about it.

A peak on a single day surrounded by periods of lower activity could indicate a reaction to a specific event. This could be related to a significant market movement, a political event, a corporate announcement, or other news relevant to Sharia shares. The pattern of engagement suggests that information spread rapidly through the network of Twitter users on this date.

After the spike, mentions, replies, and retweets return to a more baseline state, which might suggest that the event's immediate impact or interest diminished quickly.

With additional context on what happened around May 26th, it is easier to determine the precise

cause of this spike. Nonetheless, this data can be valuable for identifying when users are most receptive to new information and for planning the timing of communications or marketing efforts. It also emphasizes the importance of being prepared to engage with users during high-activity periods to maximize reach and impact.

In Figure 5, we analyze the number of tweets based on the number of followers sent by related Twitter users regarding Sharia shares in Indonesia. From Twitter followers 0-3 posts as many as 17 (5.26%) tweets, then continues from followers 4-25 posts as many as 30 (9.29%) tweets, followers from 26-50 posts as many as 8 (2.48%) tweets, 51-100 followers posted as many as 18 (5.57%) tweets, from 101-500 posts as many as 61 (18.89%), of followers 501-1000 posted 29 (8.98%). The highest is in the numbers 1001-10k followers posted, as many as 105 (32.51%). So, from that number of whole posts from many followers, obtain the equivalent number 323 with 100%.

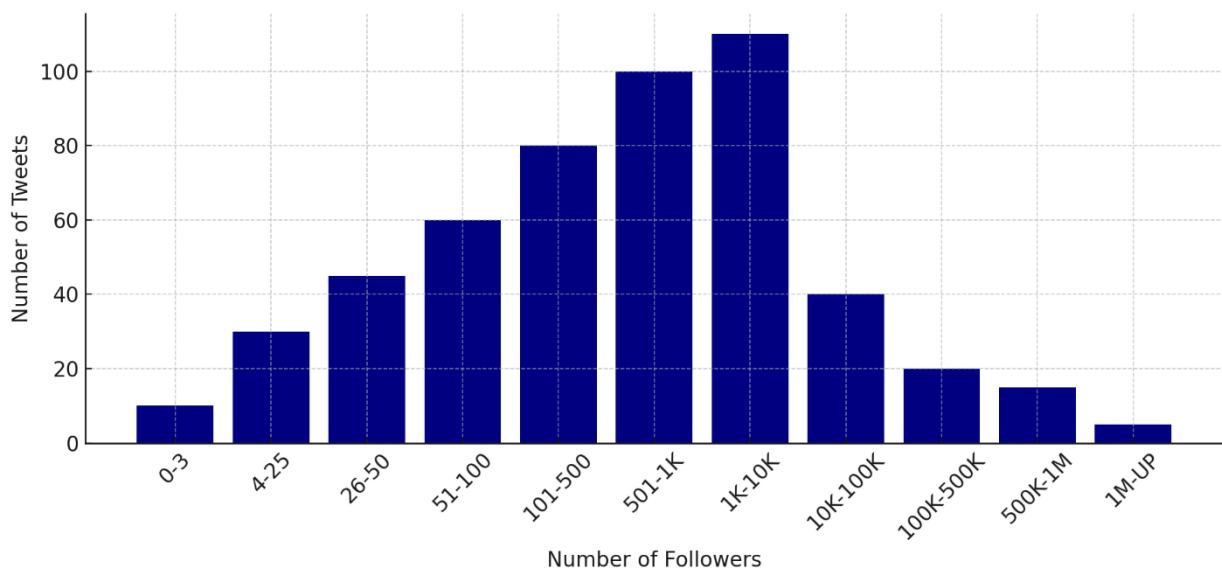


Fig. 5: Tweet frequency based on follower count

3.2. Sentiment Analysis

To enhance the sentiment analysis of Sharia stocks in Indonesia based on Twitter data, it is crucial to integrate relevant theories and methods from the contemporary literature. Sentiment analysis, a branch of data mining, has evolved significantly as a method for extracting views, opinions, and emotions from text, playing a critical role in market research and decision-making processes (Liu, 2012). Specifically, in the financial context of Sharia stocks, understanding public sentiment toward certain financial instruments can reveal valuable insights into risk perceptions and investment potentials (Rao & Srivastava, 2012). Common methodologies in sentiment analysis include lexicon-based approaches, which utilize a set of sentiment-associated words to score textual sentiments (Taboada et al., 2011), and machine learning models that train classification algorithms like Support Vector Machines or neural networks to identify sentiments from text (Pang & Lee, 2008).

The temporal variability of sentiments, especially on social media, exhibits dynamic fluctuations often influenced by external events such as economic news or policy changes (Bollen et al., 2011). Furthermore, crowd behavior theory in social psychology provides a framework to understand how opinions can form and dominate within certain communities, often triggering chain reactions that affect market sentiments.

The significance of social networks in the dissemination of information and sentiments has also been extensively studied. Social network analysis techniques reveal how interactions among individuals influence the spread and dominance of certain sentiments on social media (Kwak et al., 2010). These studies show that nodes or users with numerous followers tend to have a greater impact on shaping

market sentiments (Cha et al., 2010).

Thus, the Twitter sentiment analysis of Sharia stocks in Indonesia can be enhanced by integrating an interdisciplinary approach that includes data mining, social psychology, and social network analysis to gain a more comprehensive and accurate understanding of market dynamics.

Based on Figure 6 and Figure 7, sentiment talks about sharia shares in Indonesia from May 20 to May 26, 2023; there are indicated negative comments up to 169 or 43% of mentions; there were also those who responded with positive in comments with 138 results or 52% mentions. However, a few Twitter users are on point neutral, only 16 or 5% of mentions. So, the total number of Twitter users who spoke about shares in Indonesia is 323. The analysis describes how Twitter users responded to the topic. More negative comments dominated than positive comments and temporary comments were neutral and made minimal contributions to the conversation.

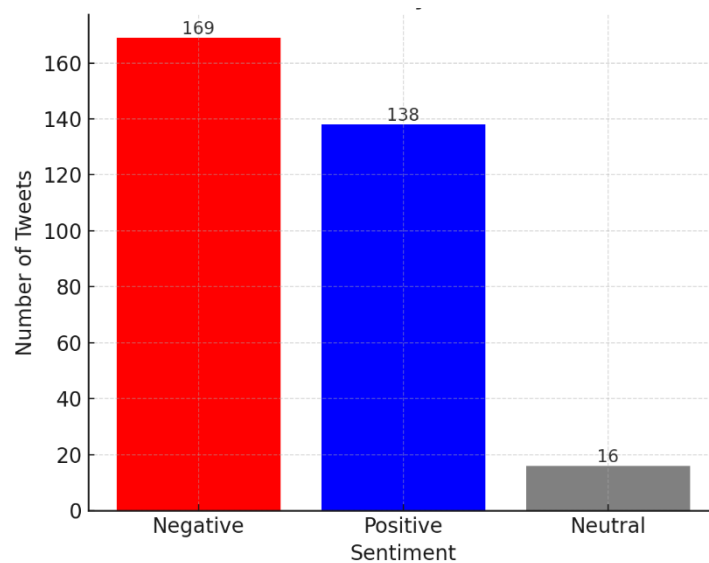


Fig. 6: Total mentions

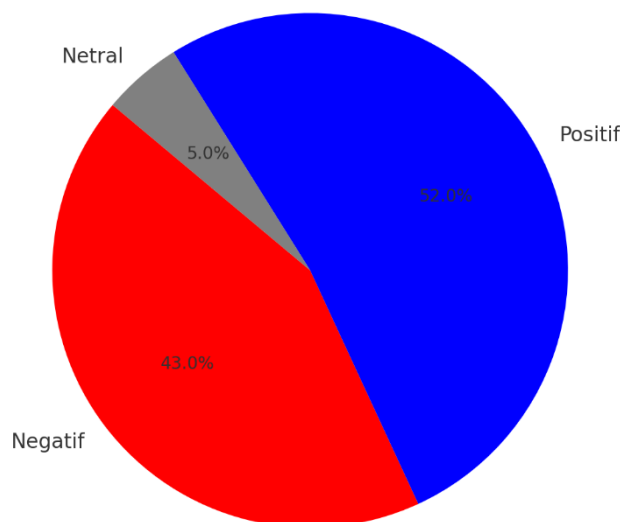


Fig. 7: Share of voice by sentiment

Figure 8 shows Sourced from Drone Emprit Academic based day with positive, negative, and

neutral responses. On Monday, there were 17 mentions: in colored images, blue shows positive responses with results of 12 netizens, and red shows negative responses with results of five netizens. The next day, Tuesday, there were 26 mentions, with 23 responses positive and three negatives. Next in the day, Wednesday only, there is one response from netizens, with 7 in position neutral. Then, on the day, Thursday increased a little with a total of 16 responses, of which there are three responses neutral, 10 responses positive, and 3 responses negative. Then, the peak highest on Friday is for a total of 252, with 8 in position neutral, 92 in position positive, and 152 in position negative. Had No There was a response on Saturday, but on Sunday, there was a slight response in position neutral, namely five responses.

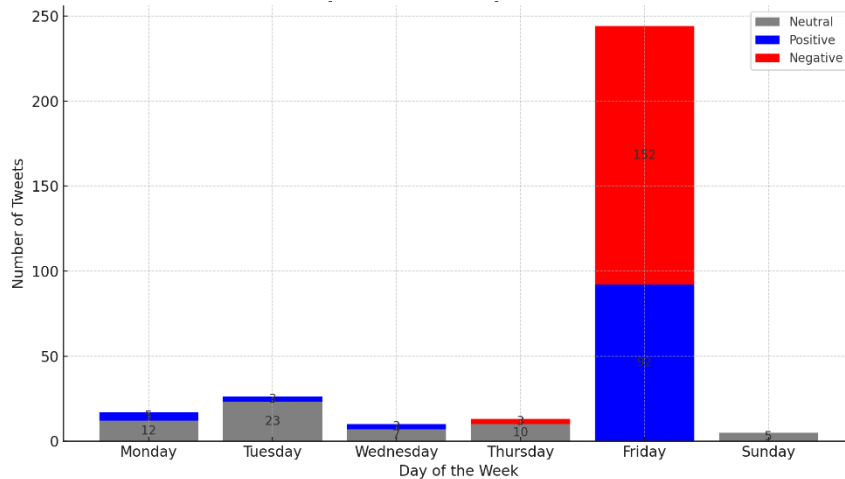


Fig. 8: Sentiment by weekday

Figure 9 analyzes sentiment based on the hours discussed related to Sharia shares in Indonesia. At noon, there was only one negative comment. It increased drastically at 9 am with a total of 64 comments, with description one comment neutral, 25 comments positive, and 38 comments negative. The peak is highest at 10 am, with five neutral, 30 positive, and 31 negatives. Besides that, I experienced ups and downs in comments from related Twitter users' topic shares in Indonesia. This data shows diverse views from Twitter users, and it looks like more negative comments are superior in conversations on the topic. Especially at 9 and 10 am, when talks peak, the highest related to sharia shares in Indonesia. This happened because of the habit of more Twitter users being active then. This is possible because many Twitter users are active during working hours in the morning, and this topic interest's attention at the time.

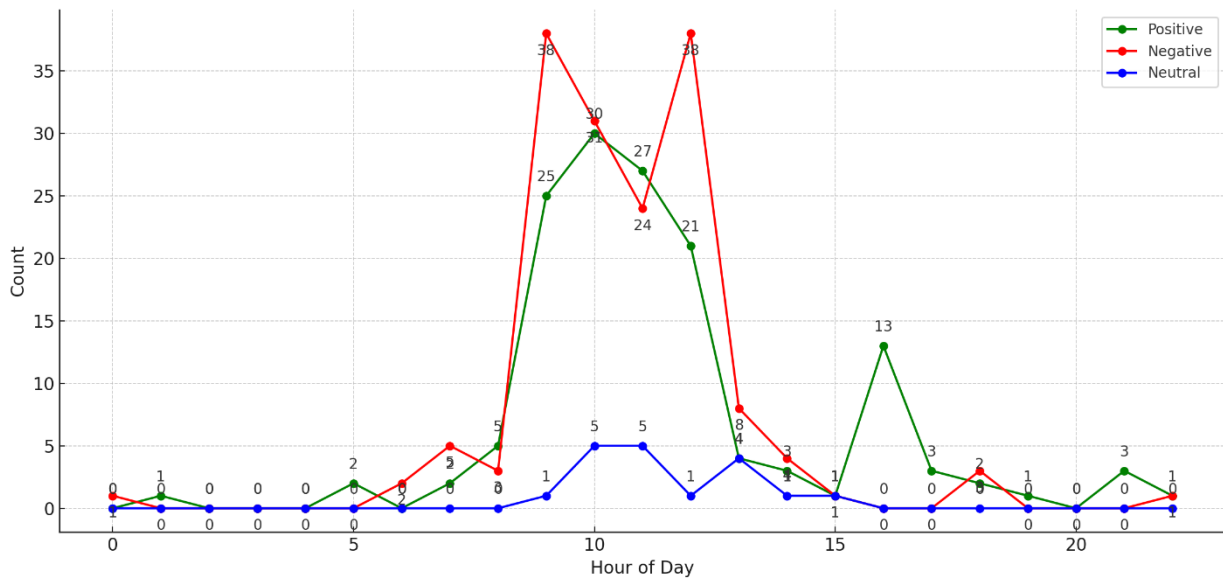


Fig. 9: Hourly sentiment distribution

3.3. Source Influential

Based on Table 1, we analyzed the ten most influential and most numerous sites shared in talks about Sharia shares in Indonesia. All these sites have SimilarWeb traffic. The first site, Bisnis.com, was shared two times with I.P. number 104.18.9.94. Second, the Central Java site. idntimes.com shared two times with I.P. number 13.35.8.105. Third, www.antaraneews.com was shared two times with I.P. number 183.182.92.213. Fourth, it was shared from the camp. On site one time with I.P. number 18.136.135.145. Fifth, from www.teguhhidayat.com, which was shared once with I.P. Number 74.125.200.121. And so on by the Table 1 shared one time

Table 1: Most Shared Sites

No	Sites	Number of Shares	I.P.	Traffic
1.	bisnis.com	2	104.18.9.94	SimilarWeb
2.	jateng.idntimes.com	2	13.35.8.105	SimilarWeb
3.	www.antaraneews.com	2	183.182.92.213	SimilarWeb
4.	www.republika.co.id	2	104.18.9.234	SimilarWeb
5.	km.im	1	18.136.135.145	SimilarWeb
6.	www.teguhhidayat.com	1	74.125.200.121	SimilarWeb
7.	www.cnbcindonesia.com	1	104.18.18.192	SimilarWeb
8.	economy.okezone.com	1	18.155.68.83	SimilarWeb
9.	www.kemenparekraf.go.id	1	103.149.47.148	SimilarWeb
10.	www.riaumakmur.com	1	13.33.33.30	SimilarWeb

Figure 10 is a treemap visualization typically used to represent hierarchical data through nested rectangles. In this context, the treemap displays various hashtags and their frequency of tweets within a given dataset.

The largest rectangle, labeled "TheGoodBadMotherEp10," with 16 tweets, dominates the visualization. This indicates that this hashtag was the most tweeted during the captured period. This hashtag was likely trending or associated with a popular event or topic.

Other hashtags with smaller rectangles, such as "DukungUUCiptaker" and "UUCiptaKerja" with six tweets each, "WeAerMore" and "JumatBerkah" with four tweets, and several others with 1 to 3 tweets, represent less tweeted topics but still significant enough to appear in the treemap. These relate to various issues, events, or discussions happening concurrently.

Hashtags like "HSG," "Investasi," "Eriktohir," "BRIS," "IKN," and "SobatKesykar," along with others such as "Amazing," "Ekonomi," "SAHAM," "ASEAN," "Survivor," "ranging," "IniBudi," and "BULOGMasaKini," all with one tweet each, seem to indicate a wide variety of topics being discussed, though with less frequency.

Treemaps are valuable for quickly conveying a sense of which topics are most prominent within a particular discourse and how different topics compare in terms of volume. In this case, the visualization suggests a diverse conversation with one particularly dominant topic. The variety of hashtags also suggests that the dataset may cover a range of discussions, from television shows and legislation to economic terms and personal investment. However, without additional context, it is not easy to provide a more thorough analysis of the significance of these hashtags and their relationships with each other.

The treemap visualization in Figure 10 displays the most frequently used hashtags within the dataset. The largest rectangle represents the hashtag 'TheGoodBadMotherEp10,' which had 16 tweets, suggesting a potential connection to a popular television show or event. Other hashtags such as 'DukungUUCiptaker' and 'UUCiptaKerja' (with 6 tweets each) may be related to legislative or regulatory discussions, while hashtags like 'Investasi' and 'SAHAM' (with 2 and 1 tweet, respectively) directly pertain to investment and stock-related topics.

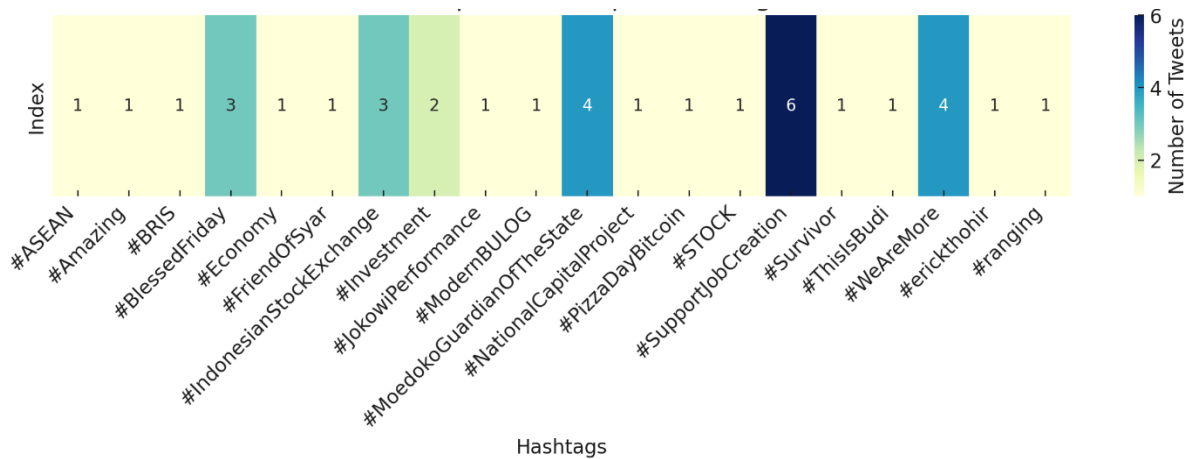


Fig. 10: Top Hashtags

In Social Network Analysis (SNA), identifying top influencers within a network involves evaluating a range of metrics, each highlighting different aspects of influence. Degree Centrality assesses an individual’s direct connections within the network, indicating their direct reach. Betweenness Centrality measures a node's role as a bridge along the shortest path between others, highlighting their control over information flow. Closeness Centrality reveals how quickly information from an individual can reach others in the network, emphasizing rapid dissemination capabilities. Eigenvector Centrality enhances this by not only considering direct connections but also the influence of those connections, thereby valuing nodes connected to well-connected peers. PageRank, similar in nature to Eigenvector Centrality but incorporating a random walk perspective, evaluates the global importance of nodes based on the structure of the entire network. Beyond numerical metrics, the role within a community (core or peripheral) and the ability to bridge structural holes—where a node connects disparate parts of a network—also mark an individual as a key influencer. These metrics together provide a robust framework for identifying influential actors in social networks, each offering unique insights depending on the context of the analysis.

In Figure 11. Several accounts influence the discussion of sharia shares in Indonesia. There are five accounts that we got, namely @k_dramaindo_, @dcristnugroho, @Adhitya_anand4, @timothyronald2, @abuziyad02. These five accounts have a good reputation in this topic and have an essential influence in disseminating information and perceptions to a community by commenting on their understanding of sharia stocks in Indonesia. Moreover, it invites other users to invest from now on.

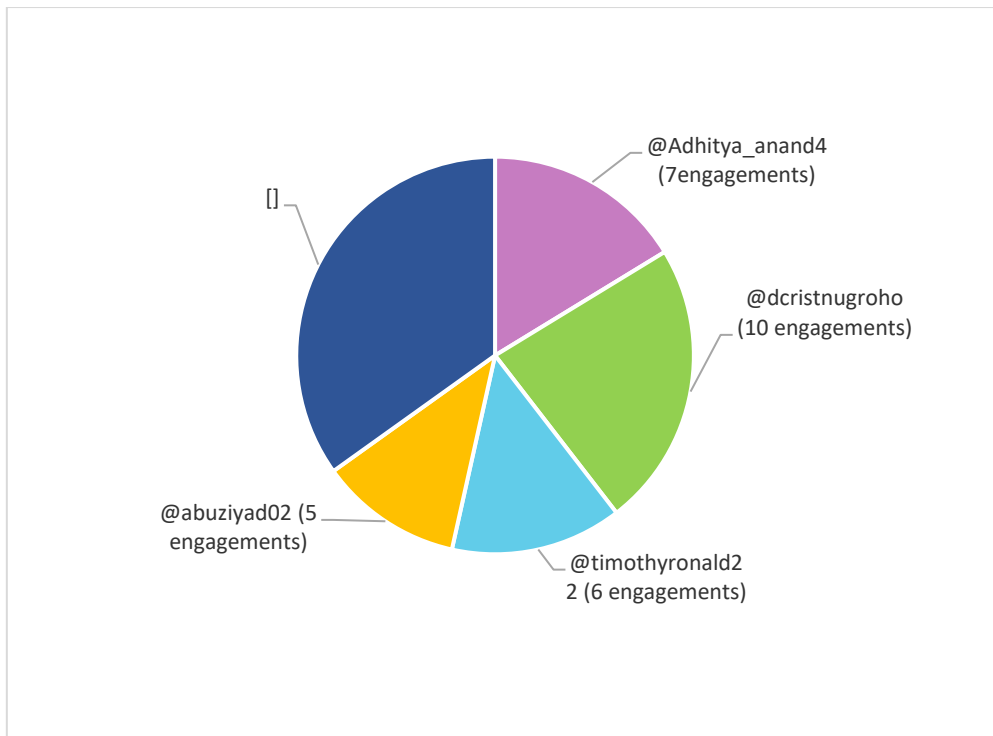


Fig. 11: Top Influencers

In our study, we implemented a range of bot detection techniques to maintain the accuracy and integrity of our data. We analyzed user behavior, such as mouse movements and keystrokes, and conducted IP analysis to detect potential bots. Human interaction challenges and time-based analyses helped identify automated activities, while traffic pattern scrutiny alerted us to typical bot behaviors like rapid action sequences and spikes in activity. We also performed manual checks, including analyzing account followers, verifying profile pictures, and reviewing account creation dates to spot newly created bot profiles. These combined methods established a thorough framework for distinguishing genuine user interactions from bot activities, ensuring the robustness of our findings.

In the realm of social media research, detecting bot accounts on platforms like Twitter involves a multifaceted approach. Researchers typically analyze account metadata such as the creation date, posting frequency, and the ratio of followers to followings to identify anomalies indicative of bot behavior. Additionally, content analysis techniques assess the repetitiveness of tweets, excessive use of hashtags, and peculiar URL patterns. Advanced machine learning models are also employed, leveraging large datasets to train classifiers that can effectively distinguish between bots and human users based on behavioral patterns. Furthermore, network analysis is applied to examine patterns of interactions and network structures, which can reveal clusters of accounts exhibiting synchronized activities typical of automated bots. These methods collectively enhance the accuracy of bot detection in the dynamic environment of social media.

The data presented in Table 2 provides a breakdown of Twitter activity classified by a Bot Score, which assesses the likelihood of an account being automated. A significant majority of the authors, constituting 67.61%, fall into the 0-1 Bot Score category, with these accounts responsible for 65.91% of the posts. This prevalence suggests that the lion's share of the activity stems from users displaying human-like behavior. As we ascend the Bot Score scale, there is a discernible decline in the proportion of authors and their post contributions. Those with a Bot Score between 1-2 represent 16.90% of authors, who are accountable for 20.45% of posts, implying moderate activity that may slightly lean towards automation.

Further up the scale, authors with a Bot Score of 2-3 make up 9.86% of the dataset, contributing to 9.09% of the posts, with minimal engagement levels indicating a higher chance of automation. The

categories with Bot Scores of 3-4 and 4-5 each comprise a small fraction of authors at 2.82%, with an equal amount of posts, suggesting these are the least active and the most automated accounts within the dataset. Interestingly, within these higher score ranges, engagement through retweets and mentions persists, albeit in diminished numbers, and replies are nearly non-existent, reinforcing the notion of reduced interaction. The descending trend of participation with increasing Bot Scores indicates the effectiveness of bot-detection measures, or perhaps it underscores a predominance of genuine engagement over automation in the analyzed Twitter discourse.

Table 2: Bot Score

Bot Score	Authors	Authors (%)	Posts	Posts (%)	Retweeted	Mentions	Replies
0-1	48	67,61%	58	65,91%	14	33	11
1-2	12	16,90%	18	20,45%	7	5	6
2-3	7	9,86%	8	9,09%	2	5	1
3-4	2	2,82%	2	2,27%	1	1	0
4-5	2	2,82%	2	2,27%	0	2	0

3.4. Demographics Analysis

Table 3 shows that from the total account of these, 40.28% are millennials between 19 and 29 years of age. They constitute the vast majority of users in conversation. Generation millennial This comprised 33.71 % of total related posts with Sharia shares in Indonesia. Twelve accounts were posted repeatedly and mentioned 12 times, and six replies were received on the topic. Meanwhile, from accounts aged 30-39 years old who talk about matters, ten posts are published, around 12.50% of total posts about Sharia shares in Indonesia. From 10 posts of these, 3 of them posted repeat, mentioned seven times, and did not get a reply. There are 72 authors identified in conversation, or around 29.03% of the total account actively involved in talks. From this data, we can describe that generation millennials aged 19-29 years have a significant role in participating in the conversation, with a level of relative involvement compared to the group age other.

Table 3: Demography by age

Age Group	Authors	Authors %	Posts	Posts %	Retweeted	Mentions	Replies
18	11	15,28%	16	17,98%	4	4	8
19-29	29	40,28%	30	33,71%	12	12	6
30-39	9	12,50%	10	11,24%	3	7	0
40	23	31,94%	33	37,08%	4	24	5

Based on type users in Table 4, we found type users discussing Sharia shares in Indonesia. There are as many as 41.67% of the writers in conversation. This is what it is:

Type Is-org users, meanwhile, type non-org users show as much as 58.33%. This data gives understanding based on the type of user in conversation. This is to identify some organizations, communities, and individuals who contribute to the topic.

Table 4: Demography by user type

User Type	Authors	Authors (%)	Posts	Posts (%)	Retweeted	Mentions	Replies
Is-org	30	41,67%	46	51,69%	3	35	8

non-org	42	58,33%	43	48,31%	20	12	11
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Table 5, namely based on type sex, shows that there are 80.56% of authors manifold sex men with a total of 83.15% related posts with Sharia shares in Indonesia. Also visible are 18 retweets, 41 mentions 15 replies. Meanwhile, on type, Females account for 19.44% of authors, making up 16.85% of total posts about Sharia stocks in Indonesia, with five retweets, 6 mentions, and four replies. This shows the difference between men's and women's participation and level of interaction on the topic. From the data obtained, type sex men own more percentage compared to type female genital.

Table 5: Demography by gender

Gender	Authors	Authors %	Posts	Posts %	Retweeted	Mentions	Replies
Male	58	80.56%	74	83.15%	18	41	15
Female	14	19.44%	15	16.85%	5	6	4

4. Conclusion

This study employed computational network analysis to investigate the Twitter community's discourse surrounding Sharia stocks in Indonesia. By leveraging Social Network Analysis (SNA) and the Drone Emprit Academic (DEA) tool, the study uncovered valuable insights into the dynamics of this digital conversation.

The analysis revealed peak activity on May 26, 2023, indicating a potential reaction to significant events or news related to Sharia stocks. Sentiment analysis highlighted a predominance of negative comments, suggesting a need for further exploration of the factors influencing public sentiment. The identification of key influencers and influential websites contributing to the discourse provides stakeholders with an understanding of the information dissemination channels and potential avenues for engagement.

The study's demographic insights, particularly the active participation of millennials aged 19-29 years and the dominance of male users, offer valuable perspectives for targeted communication and engagement strategies within this community.

The findings contribute to the growing body of knowledge on computational network analysis and its application in understanding digital discourse related to financial markets. By shedding light on the intricate dynamics of the Twitter community surrounding Sharia stocks, this study paves the way for further research into the interplay between social media and financial markets, as well as the potential implications for investor behavior and market dynamics.

Additionally, the study demonstrates the potential of computational network analysis as a powerful tool for stakeholders, such as financial institutions, regulators, and market participants, to monitor and analyze digital conversations, identify emerging trends, and develop strategies for effective communication and engagement with the Sharia stock community.

Future research could explore the integration of sentiment analysis with other data sources, such as stock market data or news events, to gain deeper insights into the relationship between public sentiment and market movements. Furthermore, longitudinal studies could provide valuable perspectives on the evolution of digital discourse and its potential impact on investor behavior and market trends over time.

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