

UTILIZING TWITTER DATA TO UNDERSTAND GLOBAL HALAL INDUSTRY TRENDS AND DEVELOPMENTS IN THE DIGITAL ERA

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Abstract

The research aims to identify and collect issues related to the halal industry discussed by users' activities, sentiments, and content on Twitter. The method used involved collecting 135,050 Twitter conversations over a two-year period from July 21, 2021, to March 15, 2023, utilizing the Drone Emprit Academic (DEA) machine. Text data mining techniques were employed with the assistance of the DEA system, which included sentiment analysis, Social Network Analysis (SNA), and other descriptive analyses. The research findings indicate that the highest number of tweets related to the halal industry originated from Indonesia, followed by Malaysia and the United Kingdom. These tweets were predominantly contributed by millennials and zillennials and were characterized by a 71% positive sentiment, 27% negative sentiment, and 2% neutral sentiment. Furthermore, the Social Network Analysis (SNA) revealed integration and collaboration between the halal industry and Islamic financial institutions, suggesting the potential for creating a halal ecosystem. This research serves as a guideline for policymakers in the halal industry sector to evaluate public sentiment and formulate appropriate advancement strategies. Additionally, this study contributes to a deeper understanding of social media data analysis in the context of the halal industry and offers directions for future research.

Keywords: Halal Industry, Text Mining, Sentiment Analysis, Twitter, Drone Emprit Academic.

Introduction

Currently, the halal industry has become a significant global issue and has received an incredible response from business professionals and researchers (Batubara & Harahap, 2022). In 2019, the global halal food market reached a value of \$1.8 trillion, revealing that this industry has strong potential for near-future growth (Khalique & Shaari, 2022). The world's demand for halal products, including food, cosmetics, pharmaceuticals, services, and other goods, continues to rise in line with the global Muslim population's increase. The number of Muslim populations and the fact that Islam is the second-largest religion in the world (Batubara & Harahap, 2022; Izza et al., 2022). Reviewing available data on the distribution of the world's population by religion, the Muslim population makes up approximately 22-23% of the total global population (El-Gohary, 2020). This sparks optimism that the halal industry has significant potential for mature development, as evidenced by its continued growth prospects year after year. Additionally, the increase in the Muslim population will lead to more demand for halal products (Priantina & Sopian, 2023).

Indonesia is one of the countries with significant potential for developing the halal industry. According to the RISSC 2022 report, the Muslim population in Indonesia is estimated to be around 237.56 million people. This Muslim population is equivalent to 86.7% of the country's total population. When compared globally, this figure represents approximately 12.30% of the world's Muslim population, which stands at 1.93 billion people (The Royal Islamic Strategic Studies Centre, 2022). Furthermore, Indonesia's Islamic economic indicators continue to show strong performance, with the country ranking fourth in the world. Indonesia is one of the largest consumers of halal products globally, accounting for 11.34% of global halal expenditure. In the halal food sector, Indonesia is the second-largest consumer globally, while in the halal cosmetics sector, it ranks fourth. With such a significant demographic potential, the government is also encouraging the people of Indonesia to use and take pride in domestically produced halal products (The State of the Global Islamic Economy Report, 2022).

Despite the increasing purchasing power and value of the halal industry, it has not yet reached its optimal potential (Surjandari et al., 2021). On the other hand, various issues related to the halal industry and emerging phenomena in the field have triggered a range of comments, both positive and negative, on social media among Muslim communities. Social media has become a platform for people to express their opinions, and emotions, and disseminate news, whether they are facts or hoaxes (Samsir et al., 2021; Zhang et al., 2018). According to the Digital 2022 report, Indonesia is one of the countries with the largest Twitter user base in the world. The number of Twitter users in Indonesia reached 18.45 million in 2022, which is equivalent to 4.23% of the total Twitter users worldwide, totaling 436 million. The number of Twitter users in Indonesia in 2022 also increased by 31.3% compared to the previous year when it was 14.05 million (Hootsuite & We Are Social, 2022). Twitter is the leading social media platform used by people to express their perceptions or behaviors regarding various issues (Rahmanti et al., 2021, 2022; Sahir et al., 2021; Samsir et al., 2021).

Therefore, it is important to understand the public's perception of the halal industry on the social media platform Twitter. One method that can be employed to gauge public perception is by using a social media analysis approach to determine the sentiment of the community toward

the halal industry. Social media analysis on Twitter is popularly used because it provides a substantial amount of data and is easily accessible (Miftahuddin et al., 2023). However, researchers have found that sentiment-related research using Twitter and other social media platforms is still limited to areas such as halal food (Izza et al., 2022; M M Mostafa, 2020; Mohamed M. Mostafa, 2017, 2019, 2020), halal tourism (Feizollah et al., 2021), halal certification (Hakim et al., 2022; Rusydiana & Marlina, 2020), and halal cosmetics (Ainin et al., 2020).

The "Drone Emprit" method employed in our study introduces an innovative approach to investigating the halal industry. It sets itself apart with its extended data collection period spanning from July 2021 to March 2023, a clear departure from prior research, as seen in Apriantoro & Nuraini (2022) and Asep Miftahuddin et al. (2023), who were limited by shorter time frames, ranging from August to September 2022 and March to August 2022, respectively. This innovation extends to our theoretical framework, where we introduce new concepts and models, aiming for a comprehensive understanding of the dynamics within the halal industry. In contrast to previous studies, our focus shifts to a different subject of investigation, illuminating underexplored aspects of the industry. Methodologically, "Drone Emprit" distinguishes itself with unique data collection and analysis tools, setting it apart from the methods used in the reviewed papers. Moreover, our study delves into a distinct aspect of the halal industry, offering previously overlooked insights.

To address the limitations of earlier research, we make significant progress in expanding the scope and depth of our study. Previous studies, like those conducted by Mostafa, M. M (2017), Mohamed M. Mostafa (2019), Mostafa, M. M (2020a), and Mostafa, M. M (2020b), provided valuable insights into consumer sentiments but were restricted by relatively small sample sizes and limited global perspectives. On a different note, Hety Handayani Hidayat, et al. (2021) primarily focused on the halal status of products using text mining and a naive Bayes classifier. In the realm of halal certification, research by Rusydiana & Marlina (2020) and Hakim et al. (2022) utilized specific tools and narrow datasets for sentiment analysis. Our "Drone Emprit" method stands out for its extended data collection period and novel theoretical approach, aiming to address the limitations of previous research. By extending the data collection period to encompass the overall conversation trends related to the halal industry from July 21, 2021, to March 15, 2023, our goal is to provide a more comprehensive understanding of the conversations and insights regarding the halal industry, derived from user activities, sentiments, and Twitter content.

Therefore, this research aims to observe, identify, and collect the issues frequently discussed regarding the Halal industry based on user activities, sentiments, and content on Twitter. Through the analysis conducted, the authors hope to provide a general overview to the public and policymakers that there are various public sentiments surrounding the Halal industry. It is expected that this information can serve as a foundation for improvements by relevant parties, particularly in addressing negative sentiments. Furthermore, this paper is structured as follows. First, it provides the research background, followed by a review of related literature. The subsequent section presents the research methodology and its findings. Finally, the paper discusses contributions, practical implications, and research limitations.

- Cluster 1, highlighted in red, emerges as the largest cluster, comprising 19 research items. This cluster predominantly focuses on the halal industry with a significant emphasis on halal tourism, addressing subjects such as "halal tourism," "halal tourism destination," "halal tourism industry," "hotel," "Muslim tourist," "non-Muslim country," and "tourism industry."
- Cluster 2, colored in green, encompasses 18 research items and is dedicated to the halal food industry. It delves into topics such as the "halal food supply chain," "halal status," "halal supply chain," "halal supply chain management," "halal value chain," "raw materials," and "traceability."
- Cluster 3, represented in blue, contains 16 items and centers on factors influencing the halalness of products. It investigates aspects like "purchase intention," "attitude," "trust," and "religiosity."
- Cluster 4, denoted in purple, is the smallest with only four items, but it focuses on halal logistics and barriers in the halal industry.
- Cluster 5, depicted in orange, relates to halal fashion and holds potential for further development.

The examination of the bibliometric clusters provides a structured perspective on the facets of the halal industry, which plays a pivotal role within the overarching halal economy, primarily influenced by Islamic ethics and law. This industry comprises eight core sectors, including halal food, modest clothing, halal pharmaceuticals, halal cosmetics, halal travel and tourism, Islamic finance, Islamic education, and halal media and recreation. The halal economy, with its fundamental tenets rooted in the religious values of Muslims, has become increasingly integral to the global economy, driven by the surging demand for halal products and services among Muslim consumers on a worldwide scale (Annual OIC Halal Economy Report, 2022).

Within the landscape of the halal industry, one of the most intertwined and inseparable sectors is halal tourism. Halal tourism, defined as offering travel experiences tailored to meet the specific interests and needs of Muslim travelers, incorporates essential elements such as halal restaurants, catering, food shops, transportation, Islamic banking, Sharia-compliant tour packages, and halal spas. Moreover, destinations catering to halal tourism adhere to Islamic principles by not serving alcohol and providing separate facilities for men and women, including swimming pools and spas (Izza et al., 2021; Mahdzar et al., 2021).

Additionally, the halal food segment has emerged as a thriving sector within the global halal industry. The increased demand for halal food products has been fueled by the growing Muslim population worldwide. The halal food sector stands out, housing more companies than any other sector within the Islamic economy (The State of the Global Islamic Economy Report 2018/2019). Halal food adheres to Islamic dietary standards, ensuring that it is free from ingredients prohibited for consumption under Islamic law and that it is processed, produced, or stored in containers that meet Islamic cleanliness standards (Priantina & Sopian, 2021). Halal food is esteemed for its safety, ethical production, reduced susceptibility to contamination, and its contribution to better metabolism due to its exclusion of pork, alcohol, toxins, and unhygienic elements (Izza et al., 2022).

The increase in the global Muslim population has played a pivotal role in propelling the halal food market. As the number of practicing Muslims has grown, the demand for halal-certified food has surged, driven by the assurance of food safety and cleanliness. Technological

advancements in halal food production, including food safety measures, product analysis for maintaining quality standards, and detecting the presence of prohibited elements such as pork or alcohol, have gained traction. Innovations like blockchain and the Internet of Things (IoT) have further fortified the halal food market, ensuring transparency and adherence to halal standards (Halal Food Global Market Report, 2023).

The halal economy has been envisioned as a pivotal driver of economic growth, with Muslims constituting 25% of the global population in 2020 and contributing a substantial \$1.9 trillion in consumer spending. Muslims exhibit distinct religious-based preferences in various product categories, particularly in food, clothing, pharmaceuticals, cosmetics, travel, and media and recreation. Halal trade is intrinsically a global value chain, with significant players spanning the globe, leading to exports of halal goods amounting to \$200 billion. Indonesia, as the largest consumer market for the halal economy with a competitive production base, has a unique opportunity to harness this potential, serving as a model for the world economy through responsible socio-economic policies and positioning itself as a global champion of the halal industry.

In conclusion, the burgeoning sectors within the halal industry not only drive the halal economy but also have the potential to play a crucial role in achieving the Sustainable Development Goals (SDGs), particularly in Goal Three, which seeks to enhance prosperity, well-being, and healthy lives. Strengthening the halal value chain is a pivotal strategy for accelerating the growth of the Islamic economy, making these sectors relevant supporters of broader economic growth and societal well-being.

Social Media Analysis with Text Mining

Text data is prevalent in various domains, including the web, social networks, news services, and libraries. As the archiving of human speech and expression becomes easier, the volume of text data will only increase over time. This trend is reinforced by the growing digitization of libraries and the ubiquity of the web and social networks (Aggarwal, 2015). Text mining is the process of extracting patterns or valuable knowledge from an unstructured text by combining techniques from data mining, machine learning, natural language processing, information retrieval, and knowledge management (Fahmi, 2018).

Among scientists, Twitter is recognized as a positive social networking tool accessible to netizens in various countries, promoting accessibility and inclusion in science through the use of rich image content and alternative text (Power, 2022). The social media platform Twitter also plays a crucial role in understanding user sentiment by identifying and categorizing the polarity of a text to determine whether a specific document has a positive or negative value according to predefined categorizations (Wariantos et al., 2022). The majority of Twitter users are free to express their views on various topics. This can be effectively used to understand public responses, which has the potential to assist governments in influencing public behavior (Rahmanti et al., 2022).

In its application, there are various branches of text mining depending on its objectives. In this research, sentiment analysis is the primary focus. According to Liu (2015), sentiment analysis, or opinion mining, is the computational study of people's opinions, sentiments, emotions, assessments, and attitudes toward entities such as products, services, organizations, individuals, issues, events, topics, and their attributes. Sentiment analysis is often used to ascertain public

sentiment on specific issues. The primary goal of sentiment analysis is to classify the polarity of text at the document, phrase, or feature and aspect levels, determining whether the opinions expressed in the documents, sentences, and feature entities are positive, negative, or neutral (Rusydiana & Izza, 2022).

Since the early 2000s, sentiment analysis has evolved into one of the most active research areas in natural language processing (NLP). Sentiment has also been widely studied in data mining, web content, text, and information retrieval. It has even spread from computer science to fields like management and social sciences, including marketing, finance, political science, communication, health sciences, and even history, due to its importance for businesses and society as a whole. This proliferation is driven by the fact that opinions are at the core of nearly all human activities and have a significant influence on our behavior. Our beliefs and perceptions of reality, as well as the choices we make, are largely conditioned by how others view and assess the world. Therefore, whenever making decisions, we often seek the opinions of others as a reference (Zhang et al., 2018).

Previous Research

As sentiment analysis has evolved into one of the most active research areas in natural language processing (NLP), researchers in various fields (including the halal industry) have recognized that this methodology offers advantages and ease in identifying public sentiment or opinions on specific issues related to the halal industry on social media. Previous research related to the halal industry sectors includes the halal food sector. For instance, Mostafa, M. M (2017) mapped consumers of halal food and conducted sentiment polarity analysis on geographically located Twitter tweets related to halal food, using a predefined lexicon of adjectives by experts. The study found that the "religious diaspora" extensively used digital posts to communicate about halal food. A similar method was employed by Mohamed M. Mostafa (2019) using a random sample of 3,919 halal food-related tweets and found generally positive sentiments towards food and segmented halal food consumers based on religiosity levels, identity, animal welfare attitudes, and food authenticity concerns.

Furthermore, using a Social Network Analysis (SNA) approach, Mostafa, M. M (2020a) collected around 12,000 halal food tweets, confirming the existence of a small-world preferential attachment network connecting digital halal food consumers. Mostafa, M. M (2020b) delved into the global halal food discourse using a sample of 11,700 random tweets worldwide, employing the NRC and AFINN lexicons. The results showed positive sentiments, reflecting a general concern about animal welfare. Finally, Hety Handayani Hidayat, et al. (2021) conducted keyword mapping and sentiment polarity analysis of Twitter users regarding the halal status of products using text mining in Rstudio. They analyzed polarity using a naive Bayes classifier and found that the trend of halal products was positively appreciated by the majority of Twitter users, with 70% showing positivity, 16% being neutral, and the rest being negative.

In addition to sentiment research related to the halal food sector, there are also studies related to halal certification. Rusydiana & Marlina (2020) used 112 articles with sentiment analysis and the SentiStrength tool. They found that the overall sentiment assessment of halal certification systems worldwide showed 76% sentiment, 12% positive sentiment, and 12% negative sentiment. Furthermore, using the Python VADER library, Hakim et al. (2022) analyzed a sample of 13,824 tweets related to halal certification. Their findings indicated a tendency towards

positive perceptions of halal certification, with 41.8% positive sentiment, 30.8% neutral sentiment, and 27.4% negative sentiment.

Research Methods

Sources and Methods of Data Collection

This research utilized data by analyzing a total of 135,050 Twitter conversations within the scope of the Halal Industry collected over the past two years from July 21, 2021, to March 15, 2023, using Drone Emprit Academic (DEA). The collected data includes user profiles (user ID, username, number of followers) and tweet data (user, timestamp, geolocation, number of retweets, number of replies, and tweet content).

General Process of the Drone Emprit Academic

The research method used in this study involved the collection of data from Twitter, utilizing the Twitter Crawling technique with the Drone Emprit Academic (DEA) engine. The DEA engine, developed by Media Kernel Indonesia, is a comprehensive big data analysis platform designed to monitor and analyze real-time data from various sources, including social media (Fahmi et al., 2021).

Twitter was chosen as the primary source of social media data due to its vast volume and accessibility. The DEA system, specifically the Drone Emprit Academic (DEA) system, leverages the Application Program Interface (API) services provided by Twitter to collect conversations in real time through the streaming method (Fahmi, 2018). Twitter developers offer the Twitter Search API, which allows access to tweets published within the past seven days, filtered by specific queries (Miftahuddin et al., 2023). This API provides valuable data such as trending percentages, retweet relationships, trending mention graphs, the most retweeted statuses, and conversation trends. This data serves as a reference point for understanding various current social phenomena (Arianto, 2020).

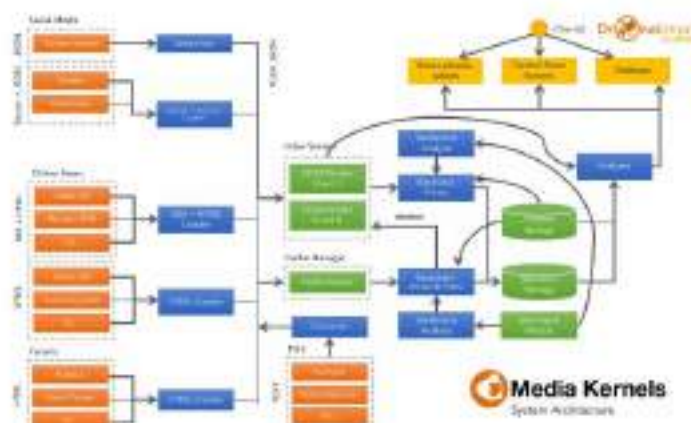
The research process, as depicted in Figure 1, involves two main steps. In the first step, the DEA API searches to collect the requested tweets. In the second step, data is gathered from Twitter Streaming and Twitter Crawl. Subsequently, the collected data is processed and organized into an index server based on the SOLR system. This process aligns with the big data architecture framework of DEA, as illustrated in Figure 2.

In summary, this research method capitalizes on the capabilities of the DEA platform to collect and analyze real-time data from Twitter using the Twitter Crawling technique. The API services from Twitter play a pivotal role in accessing and retrieving relevant tweets, enabling the research team to examine and understand various social phenomena related to the halal industry and its associated discussions on Twitter. The data collection and analysis process is integral to the study's findings and insights.



Figure 2. Research Process

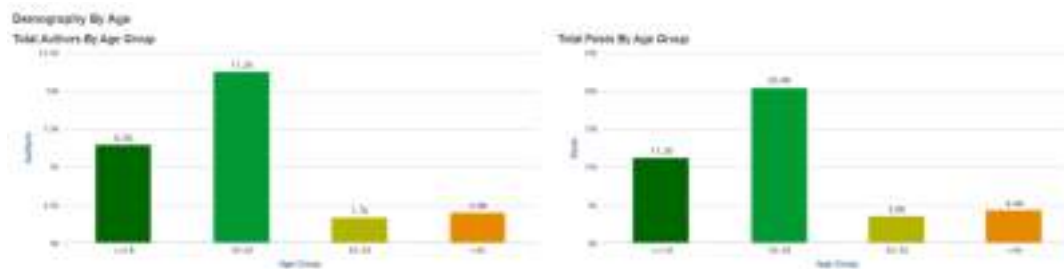
Figure 3. Drone Emprit Academic (DEA) Big Data Architecture (Fahmi, 2016)



Analysis

Twitter Demographics

First, the analysis of Twitter user demographics aims to understand the perspectives of specific groups. In the context of the Halal industry, understanding the demographics of Twitter users helps evaluate how relevant research findings are to the target market. Demographics can provide insights into potential market segments, such as age groups that are more active on social media. This information can assist companies or groups in creating more targeted marketing plans to meet the needs of specific market segments.

Figure 4. Distribution of the Number of Authors and Number of Post Based on Age

The analysis presented in Figure 4 reveals a notable equilibrium between the number of authors and the volume of posts, signifying the sustained prominence of discussions surrounding the Halal industry on social media platforms, particularly Twitter. Within this discourse, a total of 79,212 active users have been actively engaged in conversations about the Halal industry. Millennials take center stage in these dialogues, constituting a substantial 52.47% or 11,243 active participants, while the Z-generation contributes significantly with 30.12% or 6,454 active users on Twitter. The classification of tweets to their respective generational origins is firmly substantiated by the demographic information attainable from users' profiles, where birthdates are provided during the creation of Twitter accounts, offering invaluable insights into their generational alignment.

In this context, the validation and rationale for identifying tweets as being attributed to Millennial and Gen-Z demographics find robust grounding in the graphical depiction of data, vividly exemplifying their dominance in the ongoing discourse surrounding the Halal industry. This empirical evidence serves as a compelling basis for asserting that these tweets predominantly emanate from these generational cohorts, given the age information gleaned during the account registration process. The amalgamation of this rigorous user identification method with the tangible proof of their active involvement significantly augments the confidence in attributing these tweets to the Millennial and Gen-Z demographics.

These findings collectively underscore the increasing awareness of Halal issues within both the Millennial and Z-generations concerning the Halal industry. Consequently, the evolution of the Halal industry should thoughtfully incorporate the profiles of these generational segments, with Millennials emerging as dominant forces within the global population pyramid. In summary, the Millennial cohort demonstrates a growing sensitivity to the integrity of Halal status, a curiosity about supply chain intricacies, and a concern for product Halal integrity from production to consumption (Osman & Aziz, 2018). This underscores the importance of aligning strategies in the Halal industry to capture this vast market potential, accommodate evolving consumption trends, harness the power of social media, promote sustainable consumption practices, and cultivate a favorable brand image within these generational segments. By actively engaging Millennials and Z in advancing the Halal industry, businesses can effectively lead in catering to the needs and preferences of present and future generations.

Figure 5. User Demographics by Country and City



Next is the demographic data of Twitter users in discussions related to the Halal industry, including countries, provinces, and cities. Figure 4 shows the distribution of tweets worldwide, with Indonesia having the highest number of conversations related to the Halal industry (14,032 conversations), followed by Malaysia (3,894 conversations). One of the triggers is the rapid growth of the middle-class Muslim population, along with their desire to adopt a Halal lifestyle. Additionally, discussions extend to non-Muslim countries such as the United Kingdom, Singapore, the United States, South Korea, and others, indicating that the concept of Halal exists not only in majority-Muslim countries. Furthermore, Figure 6 shows that conversations about the Halal industry are predominantly dominated by provinces in Java Island, which is the center of most discussions, consisting of major cities like DKI Jakarta (5,320 conversations) and other cities. In addition to cities in Indonesia, Kuala Lumpur (2,659 conversations) ranks second, followed by Surabaya (1,080 conversations). To understand tastes, demands, cultures, and local contexts, it is important to approach the Halal industry while taking into consideration the demographics of each country. Promoting the Halal industry can be better tailored to achieve objectives and success in various markets by considering demographic variations among

[illegible]

No.	Topic	Hashtags	Explanation
1.	Halal Industry	#BangkitBersamaET #IndustriHalalMaju	The hashtags #BangkitBersamaET (ET stands for Erick Thohir) and #AdvancedHalalIndustry indicate the close relationship between politics and the halal industry. They reflect the very relevant role of politics in supporting and encouraging the growth of the halal industry. In this context, government involvement is a key element that can form the basis for the

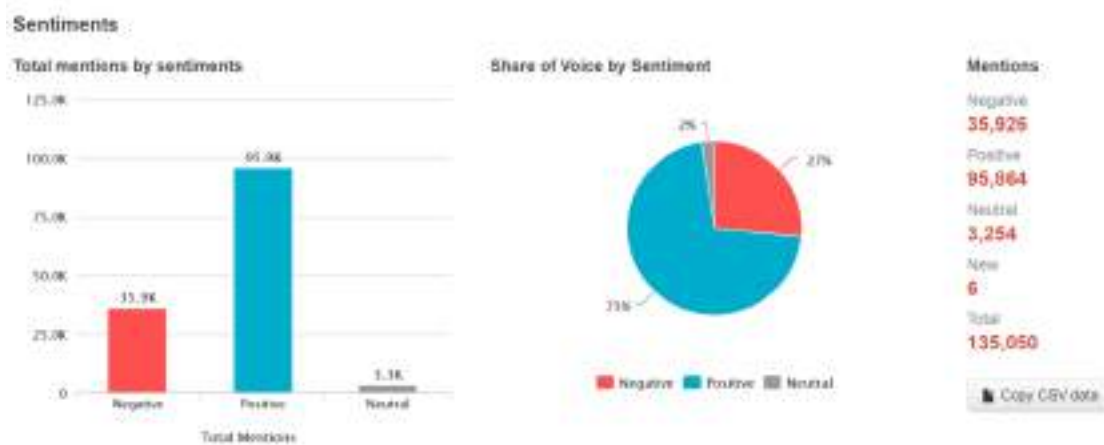
			development of the halal sector. Political efforts in creating a conducive environment for the growth of the halal industry, promoting halal products to the global market, increasing halal certification, and facilitating investment in this sector are important elements.
2.	Sharia Finance	#Milad2thBSI #BSIGlobalDukungG20 #BSIBanggaBuatanIndonesia #TalentaWirausahaBSI2023 #SobatRupiah	Hashtags such as #Milad2thBSI, #BSIGlobalDukungG20, #BSIBanggaBuatanIndonesia, #TalentaWirausahaBSI2023, and #SobatRupiah reflect support and enthusiasm for the development of sharia banking and sharia finance in Indonesia. Through celebrating the achievements of Bank Syariah Indonesia (BSI), which has been established for 2 years, support for global efforts such as the G20 meeting, pride in domestic products, focus on developing talent and entrepreneurship, as well as sharia financial literacy, this hashtag reflects efforts to advance the financial sector sharia.
3.	Halal Certification	#Sehati #HalalItuBaik	These two hashtags reflect efforts to increase the accessibility of halal certification, strengthen public understanding of the goodness of halal products, and support the development of the halal industry in Indonesia. The Sehati program is a positive step in supporting halal certification, enabling micro and small businesses to more easily enter the halal market.
4.	Halal Market	#Jamune	The hashtag #Jamune refers to the Halal Herbal business in Indonesia, which is related to the halal market. Herbal products such as <i>jamu</i> have great potential in the halal market because they meet halal standards and are considered a healthy alternative. This reflects the role of herbal businesses in meeting the demands of consumers who are increasingly aware of healthy

			products that comply with halal principles.
5.	Halal Cosmetic	#TanBeautyPedia #SekilasTentangOriflame	Related to the promotion of cosmetics that have been labeled halal
6.	Halal Pharmetics	#Vitamin #VaksinHalal	These two hashtags show the importance of halal aspects in pharmaceutical products such as vitamins and vaccines
7.	Halal Preneur	#SantriGayengNusantara #GusYasin	Hashtags #SantriGayengNusantara dan #GusYasin mencerminkan potensi pesantren sebagai produsen produk halal dan sumber ekonomi halal yang signifikan.
8.	Government Programme	#KumhamSumsel #Ilhamdjaya #LapasPerempuanPalembang #KumhamBabel #HarunSulianto	The hashtags #KumhamSumsel, #Ilhamdjaya, #LapasWomenPalembang, #KumhamBabel, and #HarunSulianto show activities involving the halal industry in the correctional institution (prison) environment. The implied message is that prisons provide training and education to prisoners, encourage them to become entrepreneurs, and then seek halal certification for businesses run by these prisoners. This reflects efforts to improve skills and social reintegration for prisoners as well as the contribution of the halal industry in supporting rehabilitation activities in the prison environment.

Sentiment Analysis

Drone Emprit utilizes a method referred to as Drone Emprit Academic (DEA) to provide interesting and significant results in social media analysis, specifically the sentiment of netizens regarding the analyzed topics. The "lexicon" method is employed to classify public conversations based on sentiment by collecting words classified as positive, negative, or neutral (Miftahuddin et al., 2023). Whenever public conversations are analyzed, the words used are compared to a predefined lexicon. After the analysis, the conversations are classified into positive, negative, or neutral categories. Figure 10 represents the results of sentiment analysis regarding the halal industry topic:

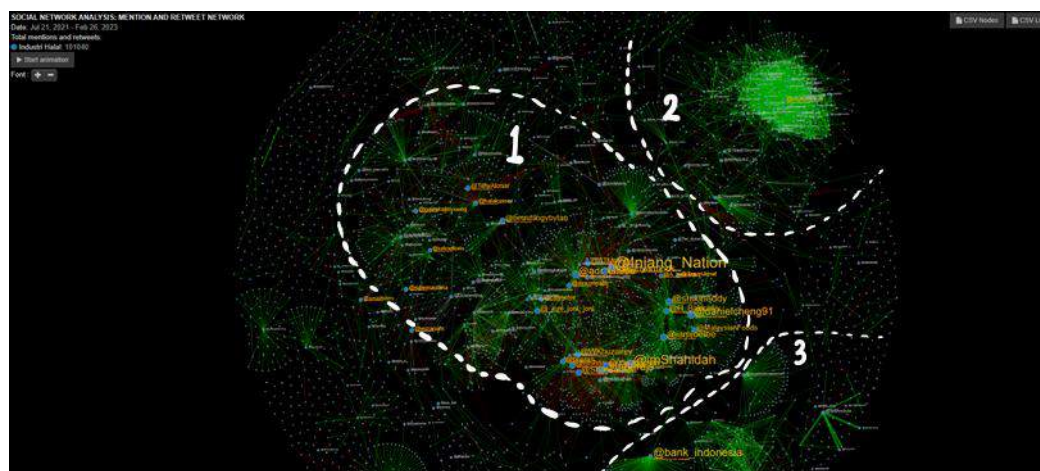
Figure 10. Sentiment Analysis



Based on the analysis period, there are 71% or 95,846 netizen conversations with a positive sentiment, and 27% or 35,926 conversations with a negative sentiment. Only 2% or 3,254 mentions are recorded as neutral. In conclusion, these results indicate that netizen conversations about the halal industry tend to have a positive sentiment. Conversations with positive sentiment are generally related to public awareness of consuming halal products because they feel protected, along with the business opportunities provided by the halal industry. On the other hand, negative sentiment conversations involve people who feel limited in their food choices, lack understanding of the halal concept, varying halal standards, and other related issues.

Social Network Analysis (SNA)

Figure 11. Social Network Analysis Based on Topic



A social network refers to a collection of socially relevant nodes connected by one or more relations. Nodes or members of the network are the units connected by patterns of relations. The network analysis approach is used to understand and study various phenomena (Scott, 2012). Based on the results of Social Network Analysis (SNA) in conversation topics, they are then classified into three main clusters:

- Cluster 1 is the cluster dominated by discussions related to the halal industry, with the main focus on conversations about halal food and halal certification, followed by topics like halal mart, cosmetics, pharmaceuticals, and more.
- Cluster 2 is related to government policies and support aimed at continuously enhancing the role of the halal industry for a greater contribution to national economic growth.

Currently, the government is working on three areas for the development of the halal industry: infrastructure development, establishing a halal assurance system, and expanding the contribution of halal to the trade balance.

- Cluster 3 pertains to the development of the Islamic economy and finance sector, especially in the halal industry. Bank Indonesia supports the halal industry as a major market force through financial support for its development. The integration between the halal industry and Islamic financial institutions is expected to create a halal ecosystem. Ideally, Islamic financial institutions play a significant role in the halal industry. The high interaction between Islamic financial institutions and the halal industry reflects the strong accommodation of Islamic financial institutions for the halal industry, and vice versa (Utomo et al., 2020).

Bot Analysis

Bots in the context of social media refer to automated accounts or computer programs designed to perform various actions on those platforms (Gorwa & Guilbeault, 2020). While many bots are used for legitimate activities such as posting automated information or responding to users, there are also types of bots that are used for harmful activities, such as spreading spam, defrauding users, or circulating false information and disinformation (Al-Rawi et al., 2019). Furthermore, in polarization analysis using a Social Network Analysis (SNA) approach, it is important to involve bot analysis to assess whether conversations occur naturally or may be influenced by automatic actions carried out by bots to control the narrative or influence the opinions of social media users (Izza, et al., 2023). Bot analysis is performed to identify whether bot or fake accounts are social media accounts controlled by specific software programs, affecting their content and behavior (Mosioi & Mailoa, 2021). Therefore, when analyzing social media conversations in the virtual world, it is advisable to detect the presence of bots and how their conversation patterns are, to determine whether public opinions are being manipulated.

Figure 12. Bot Analysis



The image above shows a Botometer, which is a tool used to check the activity of a Twitter account and provide a probability score, with a score of 0 meaning human and a score of 5 indicating a bot (Fahmi, 2020). Botometer is utilized as a tool to assess the activity of a Twitter account and assign a probability score indicating whether the account is a bot (robot), with scores (Fahmi, 2020) as follows:

- A score of 0-1 indicates that the account's activity and interactions are consistent with the expected patterns of a human account, and there are no suspicious signs related to bot activity.
- A score of 1-2 shows very minimal signs of bot activity, but it is generally considered a

legitimate human account. Interaction patterns may vary slightly but still tend towards human-like behavior.

- A score of 3-4 indicates that interaction patterns may be more mixed, and there are clearer signs of bot activity. The activity may be suspicious and inconsistent with the usual human interaction patterns on the platform.
- A score of 4-5 is considered to have very strong indications of being a bot account. The activity is highly suspicious and often lacks the characteristics of normal human interaction.

The overall bot score for the known bot posts is 1.47. This score of 1.47 confirms that the presence of bot accounts in the conversation on Twitter is relatively low, indicating that the conversation is occurring naturally. In other words, the discussion is not engineered or manipulated, and it can be concluded that the conversation represents the aspirations of the community as expressed by the netizens. This further underscores that social media serves as a channel for public discourse and discussions on the topic of the halal industry, both in support and criticism.

Findings

From the results of the analysis, several findings have emerged from this research. The first finding, in terms of geolocation, is that the largest number of tweets related to the halal industry originates from Indonesia, followed by Malaysia and the United Kingdom (Figure 5). As the country with the largest Muslim population in the world, Indonesia has significant potential for developing the halal industry through a halal and healthy lifestyle. Furthermore, it presents a challenge as the number of tweets is dominated by millennials and Generation Z (Figure 4). Given that millennials constitute a large demographic with strong purchasing power, it is essential to understand the consumption practices of halal products without disregarding the characteristics of the younger generation. The consumption practices of young Muslim generations today reflect a global cultural trend. Media observers describe the younger generation as followers who can be influenced to fit current market trends and changes (Mohamed Nasir, 2022). In this regard, halal awareness and literacy must continue to be improved.

The second finding involves the analysis of word frequency using word clouds (Figure 8) and hashtags (Figure 9) related to issues or topics that are frequently discussed with high repetition. It was found that the most frequently used words include "*makanan*" (food) (307 times), "*produk*" (products) (124 times), and "*sertifikasi*" (certification) (79 times). The hashtags frequently associated with the halal industry include halal industry, halal certification, halal market, halal cosmetics, halal pharmaceuticals, halalpreneurs, and Islamic finance. These findings indicate that the halal product industry will continue to grow, particularly with the emphasis on halal certification as a means of authenticating halal food products. Moreover, the increasing demand and positive perception of halal food provide opportunities for food manufacturers, including small and medium-sized food manufacturers (SMEs). SMEs can seize these opportunities to bolster their economies and ensure that their products not only cater to domestic markets but also command a presence in the global halal market. To meet the demand for halal food products, SME products must obtain halal certification (Giyanti et al., 2021).

The third finding pertains to sentiment analysis, which is predominantly characterized by

positive sentiment at 71%. These discussions revolve around the public's awareness of consuming halal products due to a sense of protection, as well as the business opportunities offered by the halal industry. On the other hand, negative sentiment accounts for 27% of the conversations, reflecting concerns such as limitations in food choices, a lack of understanding of the halal concept, variations in halal standards, and other related issues. The 2% neutral sentiment suggests the existence of a knowledge gap concerning the halal industry. Therefore, positive, negative, and neutral sentiments present challenges for various stakeholders, including academics, government bodies, and others, to elucidate and provide a more comprehensive understanding of the halal industry.

Lastly, the findings related to Social Network Analysis (SNA) reveal that there are three main clusters of topics within the discussion of the halal industry: the halal industry itself, the role of government policy support, and the development of Islamic economic and financial sectors. In the halal industry, the conclusion drawn from these findings is that the policy of developing the Islamic economy and financial sector is one of the supporting policies in the efforts of Bank Indonesia to achieve macroeconomic stability. The strategy for the development of the Islamic economy is implemented through the development of the halal value chain ecosystem, which involves strengthening various components within the ecosystem, including the halal industry (Ahyar & Wibowo, 2019; Indonesia Halal Market Report, 2021).

From all the findings mentioned, this research identifies several points for further research in the context of the halal industry:

Table 2. Recommendation for Future Research Direction

Topic	Future Research
Analyze the Differences between Social Media Platforms	Comparing Twitter data with data from other social media platforms (e.g., Instagram, Facebook) to understand the differences in how people discuss the halal industry on various platforms.
Deeper Sentiment Analysis	Further studies can conduct a more in-depth sentiment analysis to understand nuances and variability in positive and negative sentiments related to the halal label, as well as specific factors influencing sentiment changes.
The Influence of Influencer	Researching the role of social media influencers in shaping opinions and behaviors related to the halal industry.
The Influence of Religion in Discussions	Studying the role of religion in Twitter conversations about the halal industry and the extent to which religious aspects influence consumer behavior.
The Influence of Social Media on Government Policy	Researching how social media conversations, including Twitter, can influence government policy-making in various sectors of the halal industry.
Long-Term Analysis	Observing long-term trend changes over a longer period, such as several years, to understand the long-term developments in the halal industry.

Conclusion

The global increase in the Muslim population has generated a growing demand for halal products, coupled with an escalating awareness of these products within Muslim communities. Furthermore, the rapid advancement of technology offers a unique opportunity to monitor and analyze the sentiments and behaviors of netizens related to the halal industry. This study focuses on analyzing the sentiment of halal labels using Social Network Analysis (SNA) with a particular

emphasis on Twitter as a primary platform for netizens to express their views.

The research findings reveal that Indonesia is the most prolific source of tweets related to the halal industry, followed by Malaysia and the United Kingdom. Millennials and Zillennials dominate the conversation, with a predominantly positive sentiment of 71%, alongside a 27% negative sentiment and a 2% neutral sentiment. The Social Network Analysis (SNA) demonstrates collaboration between the halal industry and Islamic financial institutions, illustrating the vital role played by the latter in nurturing the halal ecosystem.

In summary, this study serves as a crucial reference for policymakers and stakeholders aiming to promote the halal industry on Twitter. The focus lies in enhancing consumer awareness, fostering interest in halal products, and strengthening the image of responsive and quality-committed halal brands. Effective Twitter promotion can lead to increased market reach, customer acquisition, and enhanced customer relationships.

However, it is imperative to acknowledge the limitations of this research, including its exclusive reliance on data from a single social media platform, Twitter, and the potential for evolving results. Future research should consider data from a broader spectrum of social media channels to attain a more comprehensive perspective.

Building upon the research findings, recommendations are offered to further the development of the halal industry, addressing both governmental and business dimensions. The government's role is underscored by the need to fortify halal certification procedures through standardization, certification agency enhancement, and the promotion of transparency and integrity. Educational campaigns should be a priority, targeting consumer and business understanding of the halal concept. Supporting SMEs in acquiring halal certification and allocating resources for research and development are essential steps for expanding the global presence of halal products.

For halal industry businesses, a pivotal focus is acquiring and maintaining halal certification to assure authenticity and meet consumer expectations. Venturing into global markets, aligning products with international halal standards, and catering to diverse consumer preferences are paramount. Recognizing the influence of younger generations, namely Millennials and Gen Z, is imperative. Innovative marketing, social media strategies, and product development are key to engaging these demographics. Sustaining the positive sentiment regarding halal products should emphasize their safety, ethical aspects, and health benefits while proactively addressing any concerns.

Collaboration with various sectors of the halal ecosystem strengthens the halal value chain, offering a holistic approach to production and distribution. Bridging knowledge gaps about the halal industry is also crucial, necessitating further research and educational initiatives. An interdisciplinary approach involving academia, industry, government, and consumers can effectively address these gaps, contributing to the overall growth and development of the halal industry. By implementing these recommendations, governments, and businesses can work together to bolster the halal industry, meet consumer demands, and tap into the vast potential of the global halal market, ultimately fostering a thriving and sustainable industry that benefits both the economy and consumers.

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