NAIVE BAYES SENTIMENT ANALYSIS ON PERCEPTIONS OF HALAL CERTIFICATION: A CASE STUDY ON MIXUE INDONESIA

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ABSTRACT

Indonesia, as a predominantly Muslim country, experiences a high demand for halal products due to its Muslim consumer base. This research focuses on understanding the perceptions of Indonesian society towards businesses, particularly in the food and beverage sector, that lack halal certification. The specific company under investigation is Mixue Indonesia. The study utilizes sentiment analysis through the Naive Bayes method, aided by RapidMiner software, to analyze public comments on Twitter regarding Mixue Indonesia's halal certification issue. Out of the 200 comments analyzed, the sentiment analysis revealed that approximately 122 comments expressed negative sentiments towards Mixue's halal certification. The findings indicate a notable concern and dissatisfaction among the Indonesian community regarding Mixue Indonesia's halal certification status. To address this issue, it is recommended that Mixue Indonesia takes immediate steps to obtain halal certification for their products. Additionally, future research should explore the reasons behind the negative sentiments and further investigate the impact of halal certification on consumer behavior and purchasing decisions. Understanding these factors will enable companies like Mixue Indonesia to meet the demands and expectations of their Muslim consumer base effectively.

Keywords: *Sentiment Analysis, Halal Certification, Naivebayes, Mixue Indonesia*

1. INTRODUCTION

The food and beverage industry (FnB) plays a pivotal and influential role in driving economic growth in Indonesia. According to data sourced from the Minister of Industry of the Republic of Indonesia, the food and beverage industry experienced a growth rate of 1.58 percent in 2020, which marked a notable increase of approximately 1.87 percent compared to the previous quarter, where the growth rate stood at 0.22 percent. The continuous expansion of the FnB industry in Indonesia, accompanied by the growth of its various industrial branches, presents a compelling opportunity for entrepreneurs to actively participate in this thriving sector. The significant prospects and advancements within the culinary industry have enticed numerous business entities to compete for entry. These include not only large corporations but also Small and Medium Enterprises (MSMEs).

One of the burgeoning sectors within the FnB industry in Indonesia today is the contemporary beverage and cafe business, particularly in the fast-food culinary segment. This trend is driven by the growing public interest, especially among millennials, who are actively seeking out delectable and captivating contemporary drinks. These include enticing combinations like ice cream, coffee, chocolate, and various toppings such as tapioca balls or boba. Cafes have become popular havens for relaxation, studying, or socializing with friends and family, particularly in urban areas [1]. The act of unwinding in cafes has become a customary practice among Indonesians, reflecting the evolving lifestyles of society. Moreover, with the substantial growth of the middle-class consumer segment, the

contemporary beverage and cafe business is poised for continued growth in the country. As a result, entrepreneurs in this field are compelled to compete for market share by incessantly innovating and offering products that are distinct, appealing, and diverse, catering to the unique desires and needs of individual consumers [2]. One notable company capitalizing on the business opportunities within the contemporary cafe-based beverage sector is Mixue.

Mixue is an esteemed contemporary beverage and cafe business with its origins in China. Their Boba-Sundae stands out as one of their best-selling menu items, featuring a delightful combination of ice cream topped with soft boba. Additionally, Mixue's other offerings, such as Mi-Shakes, Fresh Squeezed Lemon, and Ice cream, have garnered considerable praise from consumers, evident from the positive feedback expressed in the comments section on Mixue's social media platforms. In addition to delivering high-quality products, Mixue places great emphasis on creating a welcoming cafe atmosphere. They manage to strike a fine balance between competition and affordability, making their prices relatively accessible to young customers. The average product price remains just below Rp. 30,000.00. While Mixue may not hold the title of the most popular brand in the market due to the presence of numerous competitors offering similar products, the quality of Mixue's offerings plays a pivotal role in influencing consumer purchasing decisions, alongside the attractive pricing strategy. Recognizing that consumers in Indonesian urban areas are financially capable but often price-sensitive, Mixue has strategically positioned itself by offering both exceptional product quality and competitive pricing. This approach has effectively piqued consumer interest, ensuring sustainable purchasing decisions and propelling Mixue's rapid growth in Indonesia.

However, when developing a business, it is crucial to consider not only consumer needs and desires but also to enhance consumer confidence in the products being sold. One effective way to achieve this is by providing a halal label. Indonesia, with its majority Muslim population, presents a significant market segment. According to data from the Directorate General of Population and Civil Registration (Dukcapil) of the Ministry of Home Affairs, Muslims make up 86.88% of the country's total population. This substantial figure underscores the fact that Muslim consumers constitute a significant customer base, and the demand for halal products continues to rise in accordance with Islamic teachings and values, which emphasize the consumption of halal products [3]. Hence, it is imperative for companies to obtain halal certification for their business and every product they offer. By doing so, they can fulfill the needs of Muslim consumers and provide the necessary assurance regarding the halal status of their products. This certification not only aligns with Islamic principles but also serves as a means to cultivate trust and confidence among Muslim consumers, contributing to their decision-making process when choosing products.

Sentiment analysis is a text mining process that involves extracting and analyzing information from texts to classify them into positive, neutral, or negative categories [4]. Its purpose is to uncover the underlying sentiments expressed in documents, such as public comments, and classify them accordingly. Considering the purpose of sentiment analysis, it can prove highly valuable in addressing challenges related to halal certification in the food and beverage industry in Indonesia. By leveraging sentiment analysis, it becomes possible to analyze and categorize comments and sentiments shared by Indonesian individuals on the Twitter social media platform. This, in turn, allows for an assessment of the brand's perception and identification of any positive, neutral, or negative market trends. This research purpose to identify the community responses Previous studies have inadequately examined the role of public opinion and the challenges faced in the context of halal certification. To address this gap, our study focuses on Indonesia as a case study, considering its substantial Muslim population. regarding halal certification of mixue Indonesia. The research conducted relies on the utilization of previous studies as a basis for comparison and reference. These studies encompass the topic of halal certification within businesses or companies, as well as research on sentiment analysis systems utilizing data from the social media platform Twitter. The purpose of this research is to identify the perspective of Muslim population about food halal certification. By explaining consumer attitudes and preferences, these findings can empower businesses to adapt their strategies to meet the demands of the halal market effectively. In addition, regulatory bodies and policy makers can benefit from insight into the challenges faced in halal certification, enabling them to refine existing frameworks and improve compliance measures.

2. RELATED WORK

Halal certification holds significant importance for companies. Halal products have emerged as a prominent trend in international business. The growth of halal products extends beyond their

business value and impacts various other domains. With the increasing number of Muslim consumers, along with advancements in their economic and educational levels, the demand for halal products continues to rise. This development presents both opportunities and challenges for business owners and producers who must adhere to halal standards in order to meet this escalating demand [5].

Halal certification in the food industry is a necessary requirement for Muslim consumers to ensure that they consume and utilize only halal products and services, thus maintaining their innocence [6]. It is considered an ethical obligation for all production companies to implement halal certification as a means of providing assurance to their customers or consumers. From a business standpoint, obtaining halal certification and labels can yield several economic benefits. These include boosting consumer confidence, serving as a unique selling point (USP), facilitating entry into the global halal market, enhancing product marketability in destination markets, and offering cost advantages compared to the potential revenue growth [7].

Sentiment analysis is a comprehensive process of analyzing and categorizing textual data, particularly from online sources, to identify and classify expressed viewpoints. The outcomes of this analysis are typically classified as positive, negative, or neutral [8]. This sentiment analysis system holds significant relevance in various sectors, such as business, politics, and public opinion. In the business sector, sentiment analysis plays a crucial role as it can significantly impact important decision-making processes [9]. The approach to sentiment analysis encompasses various techniques, including social media-based sentiment analysis. Leveraging sentiment analysis from social media platforms, such as Twitter, provides a valuable source of information and data [8]. Twitter has emerged as a prominent social media platform and has attracted considerable interest among researchers for conducting sentiment analysis [10]. Twitter Sentiment Analysis (TSA) research is an active subfield within the text mining domain, focusing on leveraging computer-based processing to analyze the subjective nature of Twitter data, including opinions and sentiment. Studies on halal certification that have been conducted previously have overlooked the perspectives of the general public or consumers concerning the significance of a product's halal status. Moreover, the challenges and multifaceted issues encountered in this context have not been addressed in prior research. In response to this gap, the present study aims to delve into public opinion, particularly in countries with sizable Muslim populations, such as Indonesia, in order to ascertain their perceptions and attitudes towards halal products.

3. THEORITICAL BACKGROUND

3.1. *Mixue Ice Cream & Tea*

Mixue Ice Cream & Tea, known as 蜜雪冰城 (Pinyin: Mìxuě Bīngchéng) in its original name, is a food and beverage business based in Henan, China, operating under PT Zhisheng Pacific Trading. The company specializes in offering a wide range of products, including ice cream and various tea drinks. With its establishment in 1997, Mixue has expanded its presence to 12 countries across Asia and currently operates over 21,500 outlets. The vision of Mixue is focused and ambitious, aiming to become a respected business that thrives for over 100 years. The company's mission is centered around strengthening the Mixue brand, empowering its partners, and delivering high-quality and affordable products to customers worldwide. Presently, Mixue has achieved significant success in realizing its brand vision and mission [11].

3.2. Halal Food & Halal Certification

In Islamic food laws, it is generally permissible to consume or trade all types of food under normal conditions, except for specific categories of food mentioned in the holy book Quran and the Hadith (records of the Prophet Muhammad's sayings and actions). These prohibited or forbidden foods are referred to as haram. In modern food production, Halal food can be classified into various categories, including meat and poultry, dairy products, fish and seafood, cereals and confectionery, nutritious food supplements, and substances like gelatin and enzymes. Among these categories, meat and poultry are particularly susceptible to cross-contamination with non-Halal products. Even the slightest contact between Halal and non-Halal products can render the Halal products non-Halal or haram [12].

Indonesia, with its majority Muslim population (87.18%)[7], places great importance on consuming products that are obtained in a halal manner, as it is an obligation for Muslims [12]. Halal, in Arabic, means permissible or acceptable for food, drinks, objects, behavior, and actions that are mandatory for all Muslims. Therefore, it is crucial to ensure the halal status of food and beverage products circulating in Indonesia. Halal certification involves a comprehensive inspection process that covers various stages such as preparation, slaughter, cleaning, handling, disinfection, storage practices, transportation, and management [13]. In Indonesia,

the government regulates the halal guarantee through statutory regulations. Initially, halal certification was overseen by the Indonesian Ulema Council (MUI), but it has now been transferred to the Halal Product Guarantee Agency (BPJPH) following the enactment of the Halal Law[7]. Currently, halal certification holds significant legal validity and is a requirement for business operators in the country.

3.3 Data Mining & Text Mining

Data is a collection of information that has been formatted and stored neatly with a specific purpose [8]. Several things are included in the data, namely numbers, text, and multimedia that can be processed by a computer. While data mining is one stage of the knowledge discovery process which consists of seven stages. This data mining includes the whole process of finding interesting patterns and knowledge from a number of existing data [8]. Data mining can be divided into four types, namely classification which organizes data into predetermined groups, clustering which organizes data into unspecified groups, regression which tries to find a function that models data with the smallest error, and association which learns the rules. and look for relationships between variables [13].

Data can be described as a well-organized collection of information, encompassing numbers, text, and multimedia, that is stored and formatted for a specific purpose [14]. Within the realm of knowledge discovery, data mining is a crucial stage that involves extracting valuable patterns and knowledge from a vast amount of existing data. Data mining encompasses the entire process of identifying meaningful insights and patterns from data. It can be categorized into four main types: classification, which involves grouping data into predefined categories; clustering, which involves organizing data into unspecified groups; regression, which aims to find a function that accurately models the data with minimal error; and association, which uncovers relationships and patterns between variables [14].

Text mining entails the extraction of meaningful patterns and valuable knowledge from various textual data sources, with the objective of identifying representative terms that capture the essence [16]. Furthermore, text mining enables the discovery of insightful patterns within unstructured or semi-structured data. Its outcomes encompass descriptive and summarized data representations, as well as predictive capabilities through classification and association methods [17]. The stages involved in text mining are as follows:

1. Tokenization: During this initial stage, all words appearing in the document are collected. Subsequently, punctuation marks and non-letter symbols are removed.
2. .Filtering: This stage involves the retrieval and retention of significant words from the tokens, utilizing an algorithm to discard irrelevant or less important terms. One such algorithm is the stop list, which involves the removal of stopwords.
3. Stemming: Words are categorized to form derivatives with similar or identical word forms.
4. Tagging: This stage involves identifying the base form of each word or the outcomes derived from the stemming stage.
5. Analysis: The frequency of documents is computed to ascertain the level of similarity between the entered keywords and the existing documents

3.4 Sentiment Analysis & Naïve bayes

Sentiment analysis is a text mining technique employed to analyze subjective sentiment expressed in various sources. It encompasses individuals' social sentiments towards specific brands, products, or services offered by individuals or groups. In essence, sentiment analysis enables the identification and categorization of positive and negative sentiments towards a particular object. For conducting sentiment analysis experiments, the utilization of RapidMiner software is recommended, as it facilitates sentiment extraction from Twitter [18].

Naive Bayes is a machine learning algorithm that plays a crucial role in addressing text classification challenges through probabilistic calculations. The theoretical foundation of this algorithm traces back to the pioneering work of Thomas Bayes, a renowned British scientist who formulated a method for predicting future probabilities based on past experiences. Bayes' theory finds applications in statistics, enabling the computation of probabilities corresponding to various hypotheses. The notable advantage of the naive Bayes algorithm lies in its ability to estimate the necessary parameters solely from the provided training data, thereby minimizing the computational complexity [19].

4. METHOD

This research employs sentiment analysis as the chosen methodology. Specifically, sentiment analysis is utilized to assess the level of customer satisfaction regarding electronic products purchased through the Amazon e-commerce platform. To

process the available data, the RapidMiner application is employed. Within the sentiment analysis process, the Naïve Bayes algorithm is utilized as a classification method based on probability. Several steps were undertaken in utilizing the sentiment analysis method in RapidMiner, as illustrated in the accompanying figure.
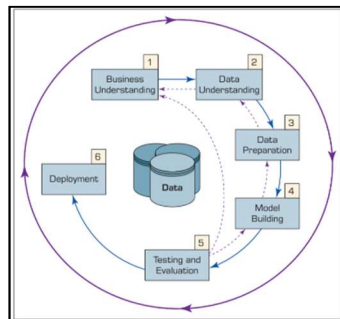

Fig 1. *CRISP-DM Process*

CRISP-DM (Cross Industry Standard Process for Data Mining) is a widely recognized framework utilized for the implementation of data mining projects. Although CRISP-DM remains the de-facto standard in the field of data mining, there are certain challenges associated with the implementation phase that have not received adequate attention [20]. The CRISP-DM framework encompasses six distinct stages, outlined as follows:

1. Business Understanding: During this initial stage, the description of the resources under investigation is sought and comprehended. Clear goals and project plans are also established.
2. Data Understanding: Data collection is conducted from the acquired data sources, followed by exploration, description, and assessment of the quality of the available data.
3. Data Preparation: Data selection commences by defining relevant criteria and eliminating erroneous or redundant data. This process is contingent upon the chosen model.
4. Modeling: The appropriate modeling technique is selected to build test cases and develop data models. The choice of model is contingent upon the specific business problems and the available data, ensuring suitability for evaluating existing models.
5. Testing and Evaluation: The outcomes of the implemented model from the previous stage are evaluated. The obtained results must align with the predetermined objectives. If the objectives

are not met, further interpretation or action may be necessary.
6. Deployment: This stage involves the implementation of various components, such as final reports, software components, user guides, and other relevant deliverables.

5. RESULT AND DISCUSSION

A. Business Understanding

Mixue's company upholds a business principle centered around the idea of "Those who are close are happy, those who are far are close, those who are far are the founders, and the customer is the center." This principle reflects Mixue's commitment to providing warmth and happiness to their valued customers. However, it appears that there are challenges in effectively implementing this principle, particularly in the context of Indonesia. One significant issue pertains to the lack of halal certification for Mixue products in Indonesia.

Despite Mixue's assurance that their products are free from alcohol, rum, and pork, many Muslims in Indonesia remain hesitant to consume Mixue products without a valid halal certificate. Mixue Indonesia has acknowledged the importance of obtaining a halal certificate and initiated the certification process in 2021. However, due to the constraints imposed by the Covid-19 pandemic, the certification process remains pending. The Indonesian Ulema Council has confirmed that the halal certification inspection for Mixue in Indonesia is still ongoing. Regrettably, the full implementation of Mixue Indonesia's business principles has yet to be achieved in the Indonesian market. Consequently, this research aims to investigate the public's response to the halal certification of Mixue Indonesia's products

B. Data Understanding

To gauge the public's response, it is essential to gather data encompassing customer and prospective customer feedback, including criticisms and suggestions concerning the halal status of Mixue Indonesia products. This data can be collected from various sources, and in this case, a social media platform such as Twitter will be utilized. The process of data collection and analysis will be facilitated by the RapidMiner software.

Through RapidMiner, relevant data from Twitter can be extracted and analyzed to identify tweets and discussions related to Mixue Indonesia's halal certification. By employing text mining techniques

and sentiment analysis, it becomes possible to categorize the collected data into positive, negative, and neutral sentiments. Additionally, specific topics and themes emerging from the discussions can be identified, enabling a comprehensive understanding of the public's perception and concerns regarding Mixue Indonesia's halal certification.

Fig 2. *Process of data crowling*

For this study, the required data consists of comments and feedback from Indonesian individuals regarding the halal status of Mixue products. To obtain relevant data related to the research topic, the query parameter "Halal Mix" can be used to perform data crawling or web scraping. The results of the data crawling process indicate that a total of 1,120 comments have been collected.

These comments can be further analyzed and processed using appropriate techniques and tools, such as text mining and sentiment analysis, to gain insights into the public's perception and sentiments concerning Mixue products' halal certification. This analysis can provide valuable information for evaluating the public's response and addressing any concerns or suggestions regarding halal certification
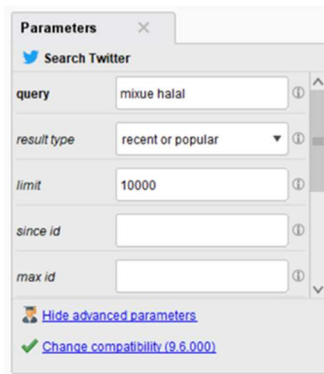
Fig 3. *The parameters of search twitter operator*

C. Data Preparation

Once the necessary data has been collected, the next step involves tidying up and cleaning the data to prepare it for further processing. In RapidMiner, several actions are performed to achieve this, including consolidating all the collected data into a single table and removing unnecessary elements such as URLs, symbols, and other irrelevant characters using the Replace operator. Through this

data cleaning process, a clean dataset is obtained, devoid of unnecessary symbols, letters, or numbers. Consequently, the original dataset of 1,120 comments is reduced to 720 comments after the cleaning process.
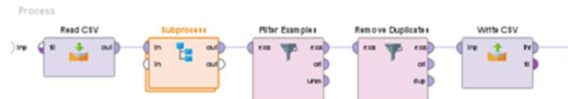
Fig 4. *Process of data cleaning*
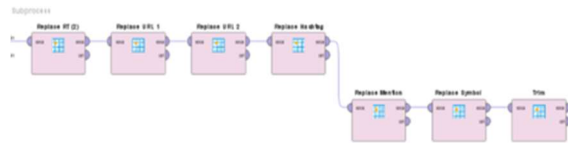
Fig 5. *Insert of Subprocess operator*

Subsequently, the cleaned data is labeled with sentiment to categorize it into either negative or neutral categories. Comments falling into the negative category represent public skepticism regarding the halal status of Mixue products, thereby deterring their consumption. On the other hand, comments categorized as neutral indicate a relatively lower level of concern regarding the halalness of Mixue products. In the labeling process, the researcher initially labels 100 comments to establish the sentiment categories.

D. Modeling

In this study, the employed methodology involves conducting sentiment analysis on the Twitter social media platform using the Naive Bayes method. Sentiment analysis, a sophisticated system, is designed to discern and analyze individuals' opinions or reactions towards a particular subject. The algorithm employed in this research is Fine-Grained Sentiment Analysis, a unique approach that places emphasis on the degree of polarity in opinions, thereby enabling the categorization of user responses into multiple groups. Specifically, the user responses in this study are classified into two distinct categories: negative and neutral responses..

Fig 6. *Process of Data Training*

Fig 7. Insert of Process Document Operator

The labeled data obtained in the previous stage is subsequently utilized for training purposes, enabling the automatic categorization of unlabeled data. During the data training process, the researchers employed a series of document processing operators, including tokenization, case transformation, stopword filtering, and token filtering. Stopwords, commonly occurring words in the language, are incorporated into the operator and utilized as reference points. Specifically, Indonesian stopwords were utilized, aligning with the language of the acquired data.

E. Testing and Evaluation

Once the methods and algorithms are established, the subsequent step involves executing the methodology using RapidMiner. The outcome of the Fine-Grained Sentiment Analysis method comprises clusters of users exhibiting neutral and negative responses. Specifically, the objective is to identify negative opinions pertaining to the halal certificate. Once all these opinions are gathered, efforts can be made to address and rectify the identified shortcomings.

The performance results of the Naive Bayes algorithm reveal a predominant negative sentiment among the public regarding the matter of Mixue Indonesia's halal certificate. Out of the 200 comments analyzed, 122 comments express negative sentiments, while the remaining 78 comments are categorized as neutral. Moreover, the data performance demonstrates a remarkably high precision level of 98.36%, ensuring the validity and accuracy of the obtained results..

Following the performance testing phase, the labeled final data undergoes another round of testing to determine the most frequently occurring words, which are then visualized in the form of a word cloud. The word cloud visually represents the frequency of words by displaying them in varying font sizes. Words that appear more frequently will be depicted in larger font sizes, while words with lower frequencies will be displayed in smaller font sizes. This visualization technique provides an intuitive representation of the prominent words within the analyzed data.

Fig 8. Result of wordcloud

The image above is the result of the wordcloud process that has been executed. Based on the results of the Word Cloud process above, it can be seen that there are several words that often appear, namely the words 'buy' and 'certify'. In the word 'buy', the average community discusses their desire to buy Mixue products, but they are hesitant due to not having a halal certificate and people who do not want to buy Mixue products because according to their religious teachings they are not allowed to consume products whose halal status is not clear. Whereas in the word 'certification', the public discusses about Indonesian Mixue which does not yet have halal certification and protests about halal certification which has not yet been owned by Indonesian Mixue. In addition, there are several other words that are written quite often, namely the word 'ingredient' which refers to the unclear halal raw materials for Mixue products, the word 'muslim' which refers to Muslims who cannot consume Mixue, and the word 'boycott' which indicates that there is a potential for the Mixue company to be boycotted by the community due to halal certification.

F. Deployment

Based on the findings from the previous stages, it is evident that Mixue Indonesia faces challenges concerning their halal certification. Consequently, it becomes imperative to develop and implement a comprehensive plan to address these issues effectively. The aim is to align the practices of Mixue Indonesia with their core principles of providing warmth and happiness to the community, ensuring they are upheld and achieved appropriately.

The matter of halal certification in Indonesian Mixue companies, as highlighted in this research, can serve as a valuable reference for other businesses, particularly those operating in the food and beverage industry, when establishing their presence in Indonesia. Acquiring a halal certificate not only instills confidence in consumers but also

demonstrates the company's commitment to upholding sound and ethical business practices. By prioritizing the attainment of a halal certificate, companies can foster trust among consumers and showcase their dedication to catering to the specific needs and preferences of the target market. This not only contributes to the growth and success of the company but also highlights their respect for cultural and religious considerations in the local context.

6. CONCLUSION

Indonesia, as a predominantly Muslim country, places significant importance on the consumption of halal products in accordance with Islamic teachings. Muslims are required to consume and utilize products that adhere to halal standards throughout the entire manufacturing process. The presence of a halal certificate serves as a crucial indicator to determine the halal status of a product. By obtaining a halal certificate, companies provide assurance to Muslim consumers, instilling confidence in them to consume such products.

Mixue Indonesia, a Chinese company offering various ice cream and tea products, has gained popularity in Indonesia. However, it has come to light that Mixue Indonesia currently lacks halal certification. Consequently, many Indonesian Muslims have expressed doubts about the halal status of Mixue products. Based on research conducted using RapidMiner and employing the Naive Bayes sentiment analysis method, two significant conclusions have emerged. Firstly, approximately 98% of Indonesian respondents hold negative opinions regarding Indonesian Mixue's lack of halal certification. Secondly, the word 'buy' is frequently mentioned in relation to Mixue. This word indicates the reluctance of Indonesian consumers, particularly Muslims, to purchase Mixue products due to the absence of a halal certificate. These findings underscore the pivotal role of halal certification for culinary companies operating in Indonesia. It is crucial for Mixue Indonesia to expedite the halal certification process to alleviate concerns and hesitations among Indonesian Muslim consumers. Similar considerations should also be applied by other companies intending to establish culinary businesses in Indonesia. By prioritizing the acquisition of halal certification, companies not only cater to the needs and preferences of Muslim consumers but also demonstrate their commitment to respecting cultural and religious considerations. This will ultimately enhance consumer trust and expand market opportunities for these companies.

This research is based on a case study on Mixue as a food brand in Indonesia which at the beginning of its popularity had problems with halal certification. This research has not explored how these opinions affect the quantity of product sales, as long as they are published. Future research can examine the influence or relationship between public opinion and product sales to fill this gap.

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