

## Sentiment analysis on social media using VADER and LSTM to optimise the marketing strategy for SOE energy products

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### CHRONICLE

Received May 8, 2025  
Received in revised format June 14, 2025  
Accepted October 13 2025  
Available online October 13 2025

#### Keywords:

Energy Products  
LSTM  
Marketing Strategy  
Sentiment Analysis  
Social Media Marketing  
State-Owned Enterprises  
VADER

### ABSTRACT

Sentiment analysis, a key component of natural language processing and data mining, plays a pivotal role in extracting subjective insights from textual data, particularly on social media platforms. In response to the growing importance of digital engagement, understanding public sentiment has become essential for formulating effective marketing strategies. This study aims to enhance the marketing strategy of energy products in subsidiaries of State-Owned Enterprises (SOEs) by employing a hybrid sentiment analysis model that integrates the Valence Aware Dictionary and Sentiment Reasoner (VADER) with Long Short-Term Memory (LSTM) neural networks. Utilizing a mixed-method approach that combines both quantitative and qualitative analyses, the study collects and processes data from multiple social media sources to identify and classify consumer sentiment. The results demonstrate that the hybrid VADER-LSTM model achieves an accuracy rate of up to 84%, enabling a more nuanced interpretation of consumer opinions. These insights inform the development of data-driven, responsive, and targeted marketing strategies. Furthermore, the study highlights the significance of fostering interactive communication between companies and consumers to enhance the impact of digital marketing efforts. Theoretical implications include a contribution to the academic discourse on information systems and digital marketing, while practical outcomes offer valuable guidance for SOEs in adopting adaptive, sentiment-informed marketing approaches within the energy sector.

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## 1. Introduction

Technology continues to evolve, and social media platforms continue to change. Therefore, it is important for companies to continue to adapt to the latest trends and innovate in their social media marketing strategies (Assimakopoulos et al., 2017). According to Nobre et al. (2014), The phenomenon of social media strategy marketing is the use of social media as a primary tool in a digital marketing strategy, which aims to increase brand awareness, engagement, and sales. This involves planning and implementing promotional activities on social media platforms such as Instagram, Facebook, TikTok, and others, to reach a wider target market. Social media has evolved into one of the primary means of communication in the modern digital era. Beyond its communicative function, it also serves a strategic role in marketing activities. Digital marketing strategies actively leverage various digital resources, including social media platforms, to reach and engage consumers (Malesev & Cherry, 2021). State-owned enterprises (SOEs) that operate in the energy industry also use these platforms to sell their products. However, the success of such strategies is largely contingent upon the extent to which companies understand consumer sentiment and perception regarding their products. In order to address customer complaints in a fair and proportionate manner, companies must also take into account internal perspectives, including those of employees, as well as the quality of the products offered (Yılmaz & Altunay, 2023). Therefore, a carefully designed, data-driven digital marketing strategy can serve as a critical instrument for building a sustainable competitive advantage in today's business environment. According to Saravanakumar and SuganthaLakshmi (2012), social media is a new phenomenon that plays an important role in marketing a company's products or services. This phenomenon occurs in companies and businesses which shows that companies use social media as part of their online marketing strategy. The development of social media use is no longer just a form of individual

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ISSN 2561-8156 (Online) - ISSN 2561-8148 (Print)

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doi: 10.5267/j.ijds.2025.10.011

self-existence, but has penetrated as a promotional medium in the business world. Social media has made searching for information and purchasing goods using traditional methods no longer relevant and has resulted in new social and economic consequences. In today's digital era, companies need to adopt activities related to social media to build new ways to interact with customers. Marketing activities on social media are one of the company's strategies and the values contained can be conveyed to customers. The efficiency of social media has attracted many companies that aim to improve company performance and revenue through social media. According to Li et al. (2021), the development of social media today makes it very possible for companies or business owners to market their products or services with a new approach, namely social media marketing. Social media marketing is a form of marketing used to create awareness, recognition, memory and even action towards a brand, product, business, individual, or group either directly or indirectly by using tools from the social web such as blogging, microblogging, and social networking. Because of the creation of marketing activities through social media applications, business can be done in a more flexible way, such as conducting product or service marketing activities online, creating and introducing new businesses at more affordable prices, and also simple. Social media marketing increases trust and brand loyalty of a company, in addition social media marketing makes it easier for consumers to obtain information about a company's products. Social media marketing is used to build brand equity by companies.

Sentiment analysis has developed into a vital instrument in understanding the dynamics of public opinion, especially in digital marketing, which is heavily influenced by consumer perception on social media. With the increasing volume of textual data from various online platforms, sentiment analysis bridges unstructured information and data-driven strategic decision-making. Through this technique, companies can explore the collective sentiments of the community, evaluate dominant emotions, and identify consumer attitudes towards products, services, or brands in real-time (Ezzine, 2024). The results of this analysis provide descriptive and predictive insights, which are very useful in anticipating market trends and designing more relevant and targeted marketing campaigns (Sun & Long, 2024). Additionally, a deep understanding of customer preferences, expectations, and concerns allows companies to adopt a more personalized, adaptive, and responsive approach to market needs. As technology advances, a variety of techniques and models have been developed to support sentiment analysis, ranging from lexicon-based methods to deep learning-based approaches. One of the advanced models that stands out is the GARN (Gated Attention Recurrent Network) architecture, which is designed to capture emotional context more accurately through selective attention mechanisms that strengthen the understanding of emotional nuances in digital texts (Parveen et al., 2023). Applying these models allows for a more accurate interpretation of sentiment, especially in the face of ambiguous language or complex emotional nuances (SHEN et al., 2024). Overall, strategically applied sentiment analysis increases marketing effectiveness and strengthens the company's competitiveness by providing excellent information to respond to market dynamics quickly and precisely (Silva et al., 2022).

The low use of hybrid models in sentiment analysis in the SOE energy sector is a strategic issue that is increasingly relevant in the digital transformation era. Although state-owned energy companies have begun to adopt social media as the primary communication and marketing channel, the approach used to understand consumer opinions and perceptions of their products and services is still limited and fragmentary (Hou, 2024; Li et al., 2022). This data represents public opinion that can provide crucial strategic insights in formulating adaptive and responsive marketing policies when extracted and analyzed appropriately. The main challenge lies in the complexity of data volumes, the diversity of linguistic expressions, and the social context inherent in digital conversations, which generally cannot be optimally reached by conventional analytical approaches or single methods. A more sophisticated and comprehensive sentiment analysis model is needed in this context. A hybrid approach that combines lexicon-based techniques such as VADER with deep learning methods such as LSTM offers significant potential in improving classification accuracy and depth of understanding of consumer sentiment dynamics. Thus, applying this hybrid model is expected to answer the strategic needs in developing more effective data-based marketing strategies in the energy sector SOEs.

The lack of integration between sentiment analysis and sustainability communication is a significant strategic challenge for SOE in the energy sector. In the midst of the high intensity of consumer interaction on social media, companies are required to be able to respond to public opinions and perceptions in a timely, relevant, and contextual manner. This need arises due to the complexity of navigating large volumes of unstructured data, such as opinions, comments, and reviews spread across various digital platforms. The inability to effectively process and interpret such data can hinder companies from convincingly conveying sustainability messages, potentially reducing public trust and engagement in the initiatives being implemented. The challenge is further heightened by the subtlety of language, sarcasm, and emotional context that are difficult to understand by conventional analysis methods. This condition drives the urgency to adopt a more sophisticated and adaptive approach to sentiment analysis. One of the standout approaches is VADER, which has proven effective in analyzing informal texts on social media. VADER uses a combination of lexicon-based and rule-based approaches to assess the polarity and intensity of sentiment in a statement (Bharathi et al., 2023). However, if not strategically integrated with sustainability communication messages, this analysis has not been able to fully support the creation of a positive image and public trust in SOEs. Therefore, this research highlights the importance of synergizing sentiment analysis results with corporate communication strategies, especially in sustainability and social responsibility (Ashley & Tuten, 2015).

The reliance on statistical accuracy evaluation without strategic meaning is one of the main weaknesses in applying sentiment analysis in the business environment, including in the state-owned energy sector. Various studies and implementations that

use advanced methods such as LSTM and VADER generally focus on achieving technical evaluation metrics such as accuracy, precision, recall, or F1-score. While these metrics are essential for assessing model performance, the results are often not further contextualized to support strategic decision-making in the marketing space. This approach risks making sentiment analysis a stand-alone evaluative tool, with no real contribution to the broader communication and marketing strategy. Consumer sentiment mapping should be the basis for formulating marketing interventions or campaigns that are more responsive, personalized, and oriented to market needs and perceptions. Therefore, an analytical approach is needed that emphasizes the algorithm's performance and integrates the results into the business strategy framework to provide real added value in improving brand image and consumer loyalty.

This research aims to optimize the marketing strategy of energy products in subsidiaries of SOEs through the application of sentiment analysis with a combined approach between the VADER and LSTM methods on data obtained from social media. By deeply examining the dynamics of consumer sentiment, this research is expected to produce strategic recommendations that can increase brand awareness and encourage more positive and constructive interactions between companies and consumers. The significance of this research lies in its contribution to broadening the understanding of public perceptions of state-owned energy products, which can be used as a foundation in designing more effective, adaptive and data-driven marketing strategies. Therefore, the findings of this study not only provide practical added value for the development of marketing communication strategies of state-owned energy companies, but also contribute to enriching the scientific treasury in the field of information systems and digital marketing.

## 2. Literature review

### 2.1 Social Media

According to Nobre et al. (2014), social media is a medium for socializing with each other and is done online. Social media allows people to interact with each other without being limited by space and time. Simply put, social media is a digital platform that allows users to create, share, and interact with content online. According to Saravanakumar and SuganthaLakshmi (2012), social media is an online media that supports social interaction. Social media uses web-based technology that turns communication into interactive dialogue. Some popular social media sites today include: Whatsapp, BBM, Facebook, Youtube, Twitter, Wikipedia, Blog. Social media provides and forms a new way of communicating. As is known before the emergence and popularity of social media, most people communicated face to face and greeted each other directly. But now with social media, people tend to communicate via chat services or send messages via services available on social media. According to Rosário and Dias (2023), social media is a communication or information tool that allows users to have conversations, exchange information or express ideas on a website. However, social media is included in the category of cyber media which if not using an internet connection cannot be connected. Every year internet users always increase both nationally and internationally.

According to Öztamur and Karakadıla (2014), The main function of social media is to allow users to communicate and interact with others. With social media, users can connect with friends, family, coworkers, and people around the world. Users can share their thoughts, information, and ideas with others, as well as keep up with the latest news and events. Social media allows users to easily expand their social networks. With social media platforms, users can connect with people they have not met before, such as business partners, potential customers, or new friends. This allows users to build communities and increase their visibility in cyberspace. Social media also serves as an effective marketing and promotional tool. According to Nobre et al. (2014), with social media, businesses can promote their products and services for free or at a relatively low cost. This allows businesses to reach a wider audience and attract new customers. Social media also has an important entertainment function. Users can find entertaining content such as funny videos, memes, and online games on these social media platforms. This allows users to relax and relieve stress by accessing content they like. Social media can be an important source of information for users. Users can access news, information about current events, and the latest trends on social media (Kurniawan et al., 2022).

### 2.2 Marketing Strategy

According to Öztamur and Karakadıla (2014), a marketing strategy is a well-thought-out and structured plan to achieve business goals through market understanding, positioning, and effective communication. It enables businesses to beat the competition, reach target markets, and increase sales. The main objectives of a marketing strategy are to achieve competitive advantage, increase sales, expand market share, build brand awareness, and increase customer loyalty. In general, a marketing strategy aims to create added value for customers and achieve business goals. An effective marketing strategy helps companies increase the number of products or services sold. With the right strategy, companies can reach more customers and expand market share. A consistent marketing strategy helps build brand awareness among consumers, making it easier for consumers to remember the company's products or services. A marketing strategy that focuses on customer satisfaction and building long-term relationships can increase customer loyalty. A marketing strategy helps companies identify and reach the right customer groups, so they can optimize marketing efforts. A good marketing strategy creates added value for customers through unique products, services, or experiences. According to Rosário and Dias (2023), An effective marketing strategy can create

market demand for new products or services. By achieving the above goals, a marketing strategy can help companies increase profits. A good marketing strategy helps companies meet consumer expectations and create customer satisfaction. An effective marketing strategy can help companies build a positive product image and strengthen the brand.

According to Dubbelink et al. (2021) and Praditya and Purwanto (2024) marketing strategy is a comprehensive, integrated, and unified plan in the field of marketing that provides guidelines on activities to be carried out in achieving company goals through advertising, promotional programs, sales, product programs, and distribution. According to Movsisyan et al. (2016), Marketing strategy is choosing and analyzing the target market which is a group of people that the company or business wants to reach and creating a marketing mix that is suitable and can satisfy the target market. Marketing strategy is a series of goals and objectives of policies and rules that provide direction to the company's efforts and marketing from time to time, at each level and reference and location, especially as a response to the company's ever-changing environment.

### 3. Research methods

This study employs a mixed-method approach. Based on empirical data, the methodology allows for a thorough investigation of how sentiment analysis might improve SOE energy product marketing efforts (Koupidis et al., 2022). Secondary data are utilized, including documentation from Indonesian SOEs in the energy sector, peer-reviewed journal articles, and relevant literature sourced primarily from Scopus-indexed databases. Indonesia was selected due to the availability of data and the distinctive characteristics of its SOE energy sector, providing contextual relevance for the study. To find patterns, themes, and connections in the data, an inductive analytical method was used (Sheuly et al., 2021). This involved systematic coding and categorization to extract meaningful insights into how sentiment analysis supports social media-based marketing strategies. The methodological framework emphasizes validity and reliability through a rigorous literature review, triangulation of data sources, and comprehensive qualitative analysis (Kondraganti et al., 2022). The overall objective is to offer both theoretical contributions and practical recommendations for optimizing digital marketing in SOEs using sentiment analysis.

### 4. Result and discussion

Secondary data obtained from the company amounted to 3,244 entries for the 2023 period. The data is then processed through a series of pre-processing stages, which include tokenization, stemming, and lemmatization processes to eliminate redundancy and harmonize the linguistic structure of the data. After the preprocessing stage is completed, the data is then analyzed using a deep learning approach with the Long Short-Term Memory (LSTM) model and a lexical method based on Valence Aware Dictionary and Sentiment Reasoner (VADER). The results of data processing from both approaches are presented in the next section as the main findings of this study.

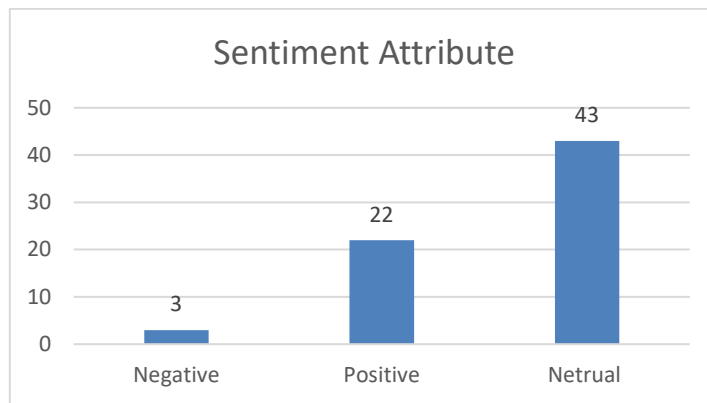


Fig. 2. Sentiment Attributes of the research results

Visualization Text - WordCloud Positif :



Fig. 2. Positive Word Cloud Results

Visualization Text - WordCloud Negatif :



Fig. 3. Negative Word Cloud Results

In this study, the binary classification system was used as a mechanism to determine the final category of sentiment contained in each text analyzed. This model serves to classify text data into two main categories, namely positive and negative sentiment, based on the results of a thorough evaluation of the input content. This classification process is not carried out alone, but through a combined approach that utilizes two sentiment analysis methods, namely Valence Aware Dictionary and Sentiment Reasoner (VADER) as a lexicon-based approach, and Long Short-Term Memory (LSTM) as a deep learning approach that is able to capture the context of the sequence of words in the text. The collaboration of these two methods is designed to complement each model's weaknesses and produce more accurate and contextual outputs. To measure the performance of each model in classifying data, tests were carried out using separate test data. The results of the performance evaluation, which include accuracy metrics from both models, are presented in detail in Table 1 as a basis for comparing the effectiveness of the approaches used.

**Table 1**  
Accuracy Evaluation Results

Model	Test Accuracy	Recall	Precision	F1 Score
Previous research results: LSTM	83%	83%	82%	83%
The results of the research conducted: LSTM	85%	93%	86%	89%

Based on the results of the study, the evaluation of the model's performance showed a significant improvement compared to previous research. Model accuracy increased by 2%, while recall values increased by 10%, accuracy improved by 4%, and F1 scores increased by 6%. This improvement reflects the advantages of the hybrid approach applied in this study. This analysis's primary goal is to use social media data to determine and assess consumer opinion regarding energy items sold by SOE subsidiaries. The approach used combines the VADER method as a representation of a lexicon-based approach, as well as LSTM as a deep learning model that is able to dynamically capture the context and sequence of words in the text. The integration of these two methods aims to produce a more accurate classification of sentiment, as well as gain a deeper understanding of public perception and response to SOE energy products in the digital space. The study's key conclusions show that using social media data to identify and analyze consumer sentiment towards energy products in SOE is considerably more successful when VADER and LSTM sentiment analysis techniques are combined. Rapid and effective first sentiment analysis is made possible by the use of VADER, which was created especially for social media messages (Mujahid et al., 2021). In the meantime, the use of LSTM, which can comprehend the context and word order in texts, offers a more profound level of analysis to discern the subtleties and intensity of sentiment (Bagastio et al., 2023; Chiny et al., 2021). Combining these two techniques effectively improves sentiment classification accuracy, indicating that a hybrid strategy can get over the drawbacks of using only one sentiment analysis technique to understand the intricacies and dynamics of social media sentiment expression (Kaur & Sharma, 2023; Mujahid et al., 2021). An unexpected outcome of this study was the observation of a higher-than-anticipated positive sentiment in social media discussions concerning state-owned enterprises (SOEs) and their energy products, despite the presence of controversial issues within the energy sector. An analysis of the state-owned company's sustainability activities and successful marketing campaigns shows that these factors are primarily responsible for this good perception (Ciekankowski & Wyrębek, 2020; Yan et al., 2022). This research highlights the importance of marketing tactics that highlight sustainability and corporate social responsibility in influencing public opinion (Akimova et al., 2023). Furthermore, these findings offer insightful information about the need to incorporate sustainability messaging into marketing communication strategies, especially in industries where social and environmental concerns are paramount (Dash et al., 2023; Mahrukh & Malik, 2023). Interpreting these findings in the context of the research currently in publication indicates that using sentiment analysis technologies—specifically, the hybrid technique that combines VADER and LSTM—is a useful way to understand the intricacies of customer sentiment in social media settings (Balaji & Haritha, 2023; Mahrukh & Malik, 2023). By illustrating how consumer sentiment is used in the promotion of energy goods from state-owned enterprises (SOEs), this study contributes to a broader knowledge of consumer sentiment and highlights the crucial role that social responsibility and sustainability play in influencing customer attitudes. In the energy industry, where social and environmental concerns frequently take center stage, it is clear that how businesses convey their objectives may have a big impact on consumer perception (Berestova et al., 2022).

The results of this study show that proactive communication about sustainability and efficient marketing techniques can mitigate the possible drawbacks of contentious issues. In this regard, the findings highlight how crucial it is to incorporate sustainability messaging into marketing plans. As a fundamental technique within the domains of natural language processing (NLP) and data mining, sentiment analysis serves a critical function in extracting and interpreting subjective opinions embedded in textual data (Liu, 2023; Ray et al., 2021). Its importance has grown significantly with the proliferation of user-generated content on digital platforms, particularly social media, where vast amounts of unstructured data are continuously produced (Jacobson et al., 2020; Lakon et al., 2024; Wang et al., 2020; Xu et al., 2024). Through sentiment analysis, organizations can systematically decode public emotions, opinions, and attitudes expressed in online discourse, thereby enabling more informed and strategic decision-making in various fields, including marketing, public relations, and customer engagement. This study opens the door for further investigation and useful applications in the sector by emphasizing the relationship between sustainability and customer attitude (Shonubi, 2024; Shubita, 2023; Zgarni & Gharbi, 2021). It is an advancement in sentiment analysis application that bridges the gap between theory and practical use in marketing tactics.

The Long Short-Term Memory (LSTM) method, an integral component of the Recurrent Neural Network (RNN) architecture, has demonstrated significant effectiveness in sentiment analysis, especially when applied to unstructured data like social media posts. LSTM is specifically designed to overcome the limitations of traditional RNN models in managing long-term dependencies within sequential data. This makes LSTM particularly well-suited for capturing emotional contexts and nuances in complex textual information. Haddaoui et al. (2022) note that variants such as Bidirectional LSTM (two-way LSTM) have emerged as the standard for developing superior predictive models, offering enhanced stability and high precision in classifying consumer sentiment. This reliability and accuracy position LSTM as one of the most valuable analytical tools, particularly within the social media landscape, which is marked by linguistic diversity, dynamic contexts, and the frequent presence of sarcasm or ambiguity (Balaji & Haritha, 2023; Sabbeh & Fasihuddin, 2023). In the realm of digital marketing strategies, implementing LSTM enables companies to gain deeper, real-time insights into consumer perception dynamics. By effectively capturing word order and the emotional nuances within digital narratives, this model significantly contributes to the creation of more personalized, adaptive, and data-driven communication strategies. Additionally, its high accuracy in sentiment classification allows companies to detect shifts in public perception patterns early, facilitating the design of proactive and targeted marketing interventions (Yin et al., 2022). This reinforces LSTM's role as a critical component in integrating artificial intelligence into marketing information systems, while also expanding opportunities for machine learning in strategic decision-making within the big data-driven business sector.

“Information Systems” focus on integrating information technology to enhance data-driven decision-making, especially in the complex energy sector. One significant application is sentiment analysis within marketing information systems, which quantitatively measures marketing effectiveness and provides real-time insights into consumer perceptions on social media (Kumar et al., 2021). By processing unstructured data like public comments, sentiment analysis allows for instant feedback, supporting quicker, relevant decisions. Additionally, it enhances predictive and prescriptive capabilities for long-term strategic planning. Technologies such as Long Short-Term Memory (LSTM) further improve this process by accurately detecting changes in consumer sentiment (Wankhade et al., 2022). In the energy sector, this integration is vital for anticipating market responses and crafting effective communication strategies, ultimately strengthening operational functions and providing strategic advantages through big data analytics. The adoption and integration of big data analytics technologies are crucial for addressing contemporary business challenges (Zhang et al., 2023). In addition to having important financial and technological ramifications, this study advances the subject of information systems by showing how sentiment analysis can improve marketing strategy decision-making. The results might open the door for further advancements in data analysis techniques in a range of sectors.

The relationship between marketing strategy and social media is crucial for businesses, as it allows them to increase brand visibility, attract new customers, and drive sales through digital platforms. According to Dubbelink et al. (2021), social media marketing helps reach a wide audience, build strong relationships with customers, and increase audience engagement. Social media helps brands increase their visibility and reach through engaging posts, ads, and content. An effective social media strategy can attract new customers by providing valuable information, attractive offers, and interactions that are relevant to their needs. Social media marketing can drive sales by providing product information, promotional campaigns, and direct communication channels with customers. With the right strategy, businesses can increase engagement with their audience through interactive content, quizzes, surveys, and relevant discussions. Social media helps build strong relationships with customers by providing personalized experiences, quick responses, and two-way communication. According to Öztamur and Karakadıla (2014), Marketing strategy using social media is understanding the characteristics, interests, and needs of the target audience to help businesses create relevant and effective content. Choosing a social media platform that suits the target audience and business goals, such as Instagram, Facebook, Twitter, or LinkedIn. Determine clear goals, such as increasing visibility, website traffic, or sales conversions, and set KPIs to measure the success of the strategy. Develop interesting, unique, and relevant content for the target audience, such as images, videos, articles, or infographics. Use social media analytics to understand content performance, audience behavior, and market trends, and make strategy adjustments. Interact with the audience through comments, messages, and discussions to build relationships and increase engagement. Use paid advertising to reach a wider audience and increase brand visibility. Movsisyan et al. (2016), Social media marketing is an essential part of a modern business' digital marketing strategy. With the right strategy, businesses can harness the potential of social media to increase visibility, attract customers, drive sales, and build strong relationships with their audiences. Social media plays a vital role in modern marketing because it offers a number of advantages that conventional marketing methods do not. First, social media allows brands or businesses to reach a wide audience quickly and efficiently. Platforms such as Instagram, Facebook, and Twitter allow direct access to consumers, without having to go through intermediaries, so that marketing messages can be received directly by the target market. Second, social media facilitates direct interaction and engagement with consumers (Sianipar et al., 2025). Through interactive features, such as comments, messages, or polling features, brands can understand consumer needs and preferences in more depth. This interaction also helps build a more personal and strong relationship between the brand and its consumers. In addition, social media provides flexibility in terms of content format. Brands can utilize various types of content such as images, videos, text, and stories to convey marketing messages in an engaging way. This makes content easier to consume and potentially viral, so it can reach a wider audience at no additional cost.

#### 4.1 The Role of social media marketing on marketing strategies

The influence of social media marketing on consumer behavior and purchasing decisions is a frequently explored theme in the literature, social media is not only a marketing tool, but also plays a significant role in shaping consumer preferences and decisions (Fahmi et al., 2022). Online interactions on social media platforms have a significant impact on how consumers form their perceptions of brands and products. In addition to influencing purchasing decisions, the analysis also shows that brands can use interactions on social media to influence consumer perceptions and attitudes. By actively engaging consumers and providing direct feedback, brands can build a positive image and strengthen consumer engagement. Through this two-way dialogue, brands can create more personal and meaningful relationships with their consumers. An effective social media marketing strategy must be able to keep up with changing consumer trends and preferences. In this study, emphasis is placed on the need to be responsive to changes in consumer behavior and market dynamics (Prayuda, 2024). Strategies that are designed to understand and respond to these trends have a greater chance of successfully building consumer engagement. The importance of continuous evaluation is also emphasized in the literature, highlighting the need to monitor the performance of social media marketing strategies (Khiong et al., 2022). By engaging in continuous evaluation, companies can identify the successes and weaknesses of the strategies adopted. This evaluation includes not only quantitative aspects, but also qualitative aspects to understand the impact of the strategy on consumer perception of the brand. Thus, the literature presents a picture of the complexity and dynamics involved in implementing a sustainable social media marketing strategy. By adopting a responsive and open attitude to consumer feedback, companies can optimize their marketing strategies to achieve long-term goals.

#### 5. Conclusion

This study concluded that the marketing strategy of energy products in State-Owned Enterprises (SOEs) through social media platforms can be optimized through the use of sentiment analysis through the integration of Valence Aware Dictionary and Sentiment Reasoner (VADER) and Long Short-Term Memory (LSTM) techniques. The findings indicate that this hybrid analytical approach offers a more accurate and nuanced understanding of consumer sentiment. As a result, companies are better equipped to develop marketing communication strategies that are not only data-driven but also more personalized, responsive, and aligned with public expectations. Such improvements can enhance audience engagement and foster a more positive perception of the energy products being promoted. From a theoretical standpoint, the research contributes to the growing body of literature in information systems and digital marketing by demonstrating how sentiment analysis technologies can be leveraged to process and interpret unstructured data from social media. Practically, the study offers actionable insights for state-owned energy enterprises seeking to integrate sentiment analysis into their marketing information systems, with the aim of improving communication effectiveness particularly in relation to sustainability initiatives and corporate social responsibility (CSR) efforts. Nevertheless, the study is subject to certain limitations, most notably the restriction of data sources to social media platforms. This constraint may limit the representativeness of the overall consumer sentiment landscape. Furthermore, the potential for sentiment misclassification or interpretative bias presents an inherent challenge that must be acknowledged. To address these limitations, future research is encouraged to incorporate a broader range of data sources, including but not limited to customer surveys, online discussion forums, and product review platforms. Additionally, the exploration of more sophisticated analytical models and the implementation of cutting-edge machine learning technologies may further enhance the precision and interpretability of sentiment analysis outcomes. The creation and implementation of a hybrid sentiment analysis framework in the context of social media marketing for energy-related products in SOEs—a field that is still understudied in the present academic discourse—is, all things considered, the study's key contribution. As a result, this study not only shows how sentiment analysis may be used practically to create data-driven marketing plans, but it also provides insightful theoretical material that advances the multidisciplinary domains of marketing management and information systems. Marketing strategy requires continuous measurement and evaluation to see how far the implemented strategy has succeeded in achieving marketing objectives. By measuring performance, companies can identify the strengths and weaknesses of the strategy being implemented and make improvements if necessary. Through these functions, marketing strategy helps companies plan, direct, and manage marketing efforts to achieve competitive advantage, sales growth, and customer satisfaction.

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