

# Modeling Brand Engagement in Social Media (Based on Sentiment Analysis and Customer Data)

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### ABSTRACT

**Objective:** The primary aim of this study is to develop a comprehensive model that can identify and analyze the factors influencing customer engagement with brands.

**Methodology:** A mixed-methods approach was utilized for this purpose. In the qualitative section, interviews were conducted with managers and experts in the field of digital marketing at a dairy company. These interviews aimed to identify and gain a deeper understanding of the key factors that could impact brand engagement on social media. The results of these interviews facilitated the identification of initial and main codes using MaxQDA software. In the quantitative section, a dataset comprising 50,525 user-generated content in response to 505 promotional posts by a dairy brand on Instagram was used. By employing the BERT model and Natural Language Processing (NLP) techniques, the sentiments of users in their comments were analyzed and identified. After sentiment analysis, the K-means clustering technique was employed to organize the sentiments into distinct topics. Subsequently, these clusters were compared and analyzed with expert opinions to identify the most critical factors influencing brand engagement.

**Findings:** The findings of the research indicated that cognitive factors such as brand awareness, emotional factors such as positive emotions and emotional attachment, and behavioral (social) factors such as participation and social interaction each play a vital role individually and interactively in customer engagement and loyalty.

**Conclusion:** This research demonstrated that creating positive emotional experiences and encouraging active participation in social activities can significantly contribute to positive interactions and customer loyalty to the brand.

**Keywords:** Brand Engagement, Social Media, Sentiment Analysis, Customer Loyalty.

## 1 Introduction

The way consumers and companies interact on social media and other online platforms today represents a paradigm shift in marketing (Saprikis et al., 2023; Sun et al., 2023). While in previous decades, online brand managers used push or pull strategies to grow their brands, today's challenge for companies is to create brand engagement and consumer participation. In other words, companies are striving to establish an interactive relationship with customers to enhance brand engagement (Tahmasebifard, 2022; Yu & Zhang, 2023). This new era of marketing, in fact, emphasizes the need for companies to retain customers and convert them into advocates or what are termed "brand evangelists" (Aljuhmani et al., 2023; Hernani-Merino et al., 2023).

In reality, the customer's intention to achieve utilitarian, hedonic, or social goals through active engagement with the brand facilitates smoother brand engagement, which in turn reduces perceived risk and builds trust (Atf & Lewis, 2023). Therefore, the core of brand engagement is something that distinguishes it from other relational concepts, such as involvement and commitment. With today's growing consumer participation and the associated bargaining power related to the brand, brand engagement is more critical than ever (Hernani-Merino et al., 2023; Hung et al., 2023).

Over the past few years, interest in the concept of brand engagement has rapidly expanded, leading to the introduction of several sub-forms of engagement, including customer engagement, customer brand engagement, and customer engagement behavior (Cheung et al., 2023; Daoud et al., 2023), highlighting the increasing importance of the brand engagement concept. Brand engagement, in fact, is defined as a psychological state that occurs through the customer's creative and engaging experiences with a focal agent/object (e.g., a brand) in service relationships (Atf & Lewis, 2023).

According to studies conducted in 2021, companies with strong brand engagement benefit from lower acquisition costs and higher customer lifetime value, both of which are critical for long-term organizational success. Moreover, during the pandemic, more than half of the companies that ranked high on the customer engagement index exceeded their revenue targets, indicating the competitive advantage that customer engagement with the brand offers to companies (Turner, 2021).

In today's world, social media plays a crucial role in the interaction between brands and their customers. These

platforms serve as venues for expressing customers' opinions, experiences, and emotions regarding products and services. Sentiment analysis of comments and feedback on social media can provide companies with valuable insights to better understand how customers engage with their brand. Since effective interaction with customers can lead to increased loyalty and ultimately improve business performance, understanding the key factors that influence brand engagement on social media is essential (Atf & Lewis, 2023).

Modeling brand engagement on social media using sentiment analysis and customer data allows us to comprehend the complexities and dynamics of customer interactions. This process enables us to identify the positive and negative impacts on brand image and offer strategies to strengthen the bond between the customer and the brand. Research in this area can assist companies in shaping and improving their marketing strategies based on actual customer experiences, leading to the optimization of advertising campaigns and increased return on investment. Therefore, this research aims to develop a comprehensive model for brand engagement on social media, with an emphasis on analyzing customer sentiments. The proposed model will be capable of identifying the factors that influence customer engagement and offering strategies to enhance positive customer interactions. This knowledge will not only enable companies to use the large and complex data from social media more effectively but will also help them to adjust their long-term strategies for better and more effective communication with customers. Thus, the question this research seeks to answer is: What factors influence brand engagement on social media, and how can sentiment analysis of customer comments help identify and model these factors?

## 2 Methods and Materials

This research employs a mixed-methods approach. In the qualitative section, interviews were first conducted with experts (including the marketing manager, digital marketing manager, brand manager, content strategy manager, public relations manager, social media manager, advertising manager, and three senior digital marketing specialists) at a dairy company. The purpose of these interviews was to identify the factors influencing brand engagement on social media. After conducting ten interviews and reaching theoretical saturation, the initial and secondary codes, the

main category, and the central code were identified using MaxQDA software.

Subsequently, in the quantitative section, a dataset was used that included 50,525 pieces of user-generated content in response to 505 promotional posts on Instagram by a company in the dairy industry over a seven-year period (2016-2023). The process began with sentiment analysis using NLP software and the BERT model, which helped distinguish and identify the sentiments in the comments. Unlike traditional models that process text in one direction, BERT reads text bidirectionally, allowing it to understand the context of words from both before and after the word. This bidirectional approach enables BERT to grasp the nuances of language, including humor, irony, and other complexities that are often overlooked by simpler models.

After this stage, K-means clustering was applied to organize these sentiments into distinct topics. The thematic essence of each cluster was then analyzed using the TF-IDF algorithm. This algorithm is a numerical statistic that reflects the importance of a word to a document in a collection of documents. The TF-IDF algorithm is widely used in information retrieval, text mining, and user modeling to identify relevant keywords and rank documents based on their relevance to a query. Following this, the clusters were compared with expert opinions, and the most important cluster and factor that generated the highest positive sentiment among customers and increased their engagement with the brand were identified.

### 3 Findings and Results

**Table 1**

*Brand Engagement Conceptualization*

Initial Code	Subcategory	Main Category
Complete familiarity with brand name and logo	Recognition	Cognitive Factors
Complete familiarity with brand slogan		
Functionality	Usefulness	
Value		
Brand monitoring	Attention	Emotional Factors
Special attention to the brand		
Focused on content		
Enthusiasm	Excitement	
Being excited		
Strong interest		
Being eager		
Connection	Interaction	Behavioral (Social) Factors
Participation in activities		
Establishing a connection		
Engaging		
Participating in discussions		

Initially, the process of formulating interview questions was conducted with an emphasis on the grounded theory framework. These questions were designed to provide a deeper understanding of the factors influencing brand engagement on social media and the role of gamification technology in this context. Interviews were conducted with key members of the marketing team of a dairy company, including the marketing manager, digital marketing manager, brand manager, content strategy manager, public relations manager, social media manager, advertising manager, and three senior digital marketing specialists. These interviews were held in three 30-minute sessions. This approach ensures that all important perspectives and insights are available for analysis and interpretation, providing a comprehensive view of the impact of gamification technology on brand engagement in digital environments. In this study, the researcher, using a phenomenological approach and grounded theory roadmap, extracted initial concepts from semantic units. The goal of this process was to categorize the concepts and then create categories that would be continuously compared and aligned with the data obtained from previous interviews in the subsequent stages of the research. This process continued until reaching a point described by Strauss and Corbin (2015) as theoretical saturation, meaning when the addition of new data no longer adds new information to the categories. In this research, the researcher achieved theoretical saturation after conducting ten interviews.

Attracted to the brand	Attraction
Becoming interested in the brand	
Inclination towards the brand	
Customer attraction	

This study identified three main categories: Cognitive Factors, Emotional Factors, and Behavioral (Social) Factors, each of which is subdivided into subcategories. For example, in the cognitive factors section, subcategories such as recognition and usefulness are related to complete familiarity with the brand name and logo and product efficiency. Emotional factors include attention and enthusiasm, referring to special attention to the brand and excitement about it. Finally, behavioral factors focus on interaction and customer attraction, involving activities such as participation in discussions and brand-related events (Table 1).

For the analysis in this study, a dataset comprising 50,525 pieces of user-generated content in response to 505 promotional posts on Instagram by a company in the food

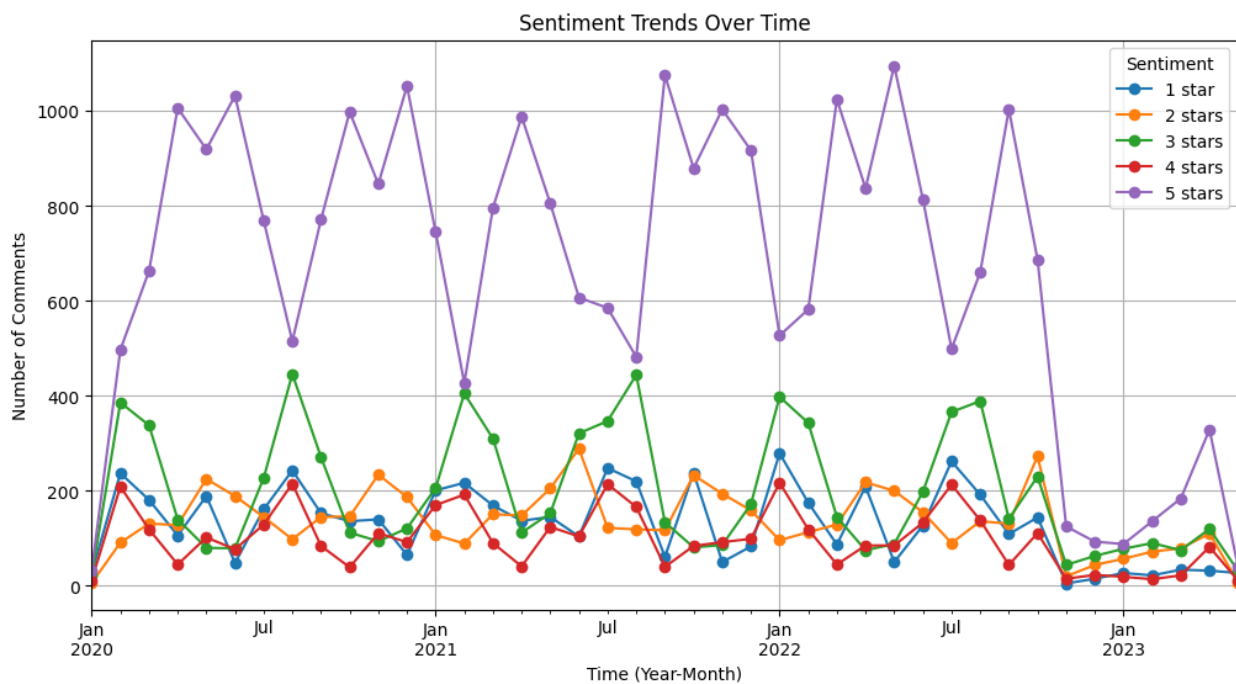
industry over a seven-year period (2016-2023) was used. The components of this dataset include:

- Post ID: A unique identifier for each post.
- Comment ID: A unique identifier for each comment.
- Parent ID: The ID of the comment to which this comment is a response. If a comment is not a response to another comment, then the parent ID is empty.
- Comment: User-generated content.
- Number of Likes: The number of likes the comment received.
- Creation Time: The time when the comment was created.

In the first stage, several key factors, such as the number of likes and the timing of the comments concerning the sentiments of the comments, were analyzed.

Figure 1

Sentiment Trends Over Time from January 2020 to January 2023



The data show that 5-star comments are consistently dominant, with relatively stable frequencies that exhibit high fluctuations, including significant peaks and troughs. In contrast, 1-star, 2-star, 3-star, and 4-star comments are less frequent and have more regular, lower frequencies. Notably, 3-star comments show periods of increase, indicating

occasional spikes in moderate feedback. Towards the end of the period, there is a significant decline in all sentiment categories, suggesting a potential decrease in overall comment activity.

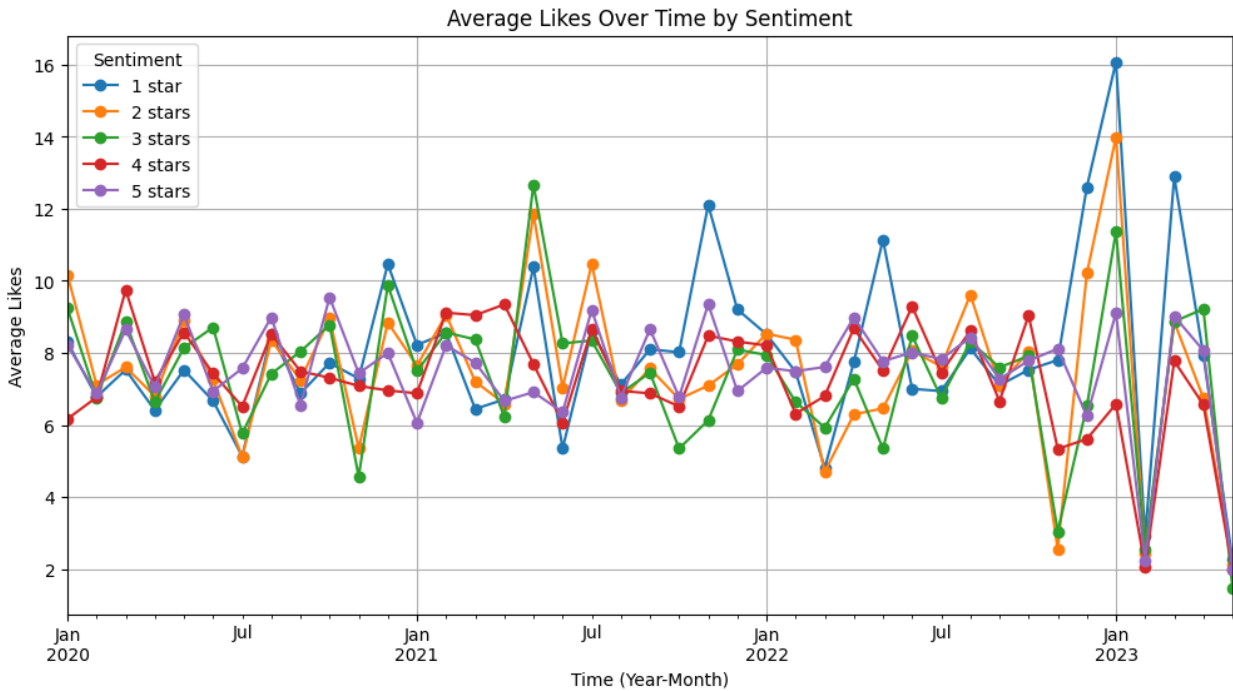
This chart illustrates that while positive feedback remains dominant, fluctuations in other sentiment categories also

play an important role over time. Based on these results, the sustained dominance of positive feedback, along with periodic variations in other sentiment categories, indicates that user-generated content reflects a genuine and dynamic

representation of user experiences. This diversity and stability enhance the credibility of the content, as it reflects an authentic display of varied user sentiments.

Figure 2

Average Number of Likes for Comments in Different Sentiment Categories



The line chart shows the average number of likes for comments in different sentiment categories (from 1-star to 5-star) over time from January 2020 to January 2023. During this period, the average number of likes for all sentiment categories experiences significant fluctuations. Notably, there are periods when 1-star comments receive the highest average number of likes, particularly in late 2022 and early 2023, indicating increased engagement with negative feedback during these times. Conversely, other sentiment categories, particularly 4-star and 5-star comments, show more consistent but lower peaks. The data suggest that while positive comments generally maintain a stable level of likes, negative comments occasionally attract more attention, leading to an increase in their average number of likes.

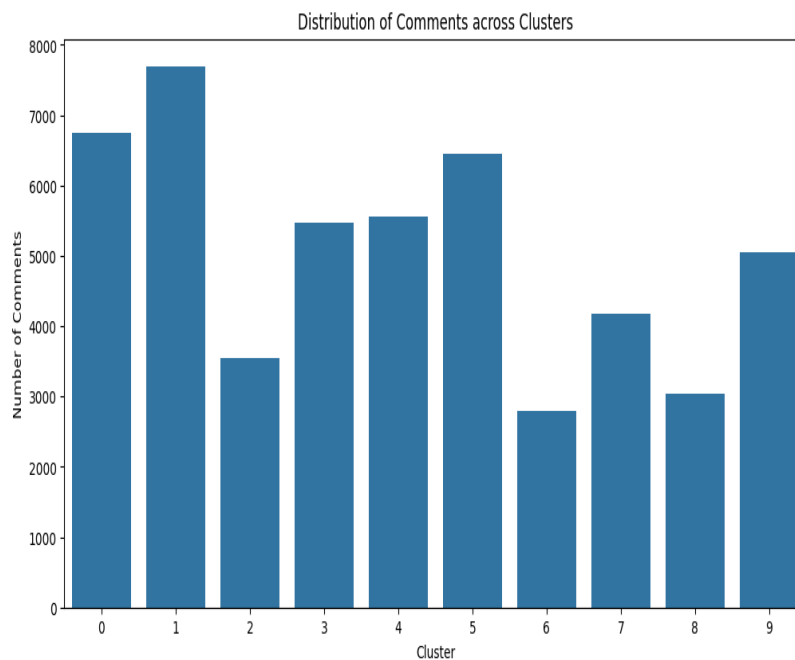
This trend indicates dynamic user interaction with comments of different sentiments over time. Based on these results, the fluctuations in the average number of likes across

all sentiment categories and the occasional higher engagement with negative comments suggest that users dynamically interact with content based on its relevance and context. This diversity in engagement increases the credibility of user-generated content, reflecting genuine feedback and real user experiences over time.

To determine the priority of the identified indicators, the Fuzzy Analytic Hierarchy Process (FAHP) technique was employed. In the first step, the main criteria were pairwise compared based on the objective. Ten pairwise comparisons were performed from the perspective of a group of experts, and their opinions were quantified using a fuzzy scale. To aggregate expert opinions, it was preferable to use the geometric mean of each of the three triangular fuzzy numbers. The pairwise comparison matrix was constructed based on the fuzzy geometric mean of the experts' opinions, and this matrix, denoted as  $\tilde{X}$ , is presented in Table 2.

**Table 2***Summary of Sentiment Analysis Using BERT*

Percentage of User Comments	Type of Sentiment in Comments
59.19%	Positive Comments
20.30%	Neutral Comments
20.51%	Negative Comments

**Figure 3***Distribution of Comments across Clusters*

According to [Table 2](#), the results of the analysis using the BERT technique indicate that 88.1% of the comments were positive, 7.7% were neutral, and 4.0% were negative. This distribution shows that most users are satisfied with the subject matter, while only a small percentage are dissatisfied. This data can be used for further analysis of consumer behavior and to improve marketing strategies, focusing on increasing the percentage of positive comments and reducing negative and neutral comments.

In the second stage of analysis, the comments were organized into 10 distinct clusters using the K-means algorithm and then analyzed for themes within each cluster using the TF-IDF technique.

According to the results, Cluster 1, with 7,698 comments, has the highest number of comments, indicating the highest level of activity or discussion on that particular topic. This could indicate a topic that holds the most interest or importance among users.

Cluster 6, with 2,790 comments, has the lowest number of comments, possibly indicating the least interest or

importance of that particular topic. This cluster may relate to topics that have received less attention or require further investigation to determine why they have attracted less attention. The fluctuations in the number of comments across clusters are also noteworthy. Clusters 0, 1, and 5 have more than 6,000 comments, while Clusters 2, 6, and 8 have fewer than 4,000 comments. These differences could indicate varying levels of topic appeal or possibly differences in the extent of discussability among users. Analyzing the clusters to understand why some clusters attract more comments while others attract fewer can help organizations or brands adjust their content strategies. For example, analyzing the content in clusters with the highest and lowest numbers of comments can help identify hot topics and those that are less popular.

The TF-IDF technique helped identify keywords and emphasized the words that are important and frequently appear in the clusters, highlighting the main themes while filtering out common and less informative words. The findings are summarized in [Table 3](#):

**Table 3**

Summary of User Comment Clusters (Label 2: Positive Sentiment, 0: Negative Sentiment, 1: Neutral Sentiment)

Cluster	Label	Count	Main Theme	Marketing Aspect	Keywords
0	0	72	This cluster focuses on expectations, quality, and flavor.	Brand Experience	Flavor, lucky, expectations, satisfied, fulfilling, disappointed, quality, shortage, calm, taste, time, high, delays, resolved, consistent, like, seems, dark, shot, program
	1	164			
	2	4270			
1	0	32	This cluster mainly focuses on flavors and various snack and drink options.	Product Experience	Drinks, strawberry, banana, sweet, sometimes, flavor, berry, wild, seems, like, beverage, chocolate, melon, summer, heavy, appears, snacks, can, value, options, slightly, taste, may, lemon, cream
	1	66			
	2	1304			
2	0	2038	This cluster focuses on ice cream, yogurt, probiotics, and summer fruits.	Product Features	Ice, probiotic, cream, chocolate, treat, yogurt, flavor, lemon, cheesecake, ice cream, seems, berry, wild, fruity, probiotic, option, fruit, summer, blueberry, lucky, soda
	1	4880			
	2	2099			
3	0	1229	This cluster focuses on the delightful and unique nature of flavors.	Prestige Appeal	Completely, delightful, divine, flawless, amazing, culinary masterpiece, pure delight, discovery, impressive, incredible, satisfying, truly, always, perfect, truly, perform, love, breakfast
	1	788			
	2	3504			
4	0	874	This cluster focuses on quality, flavor, trust, and brand nostalgia.	Brand Nostalgia	Childhood, memories, classic, timeless, homemade, tradition, heritage, pleasant, familiar, comforting, unique, always, every time, satisfaction
	1	792			
	2	4652			
5	0	831	This cluster mainly focuses on brand, trust, quality, loyalty, and satisfaction.	Brand Equity	Brand, trust, quality, every, loyalty, try, satisfaction, yogurt, creamy, milk, enriched, children, nutrition, kids, chicory, cheese, food, culinary, delicious, always, perfect, cheese, summer, satisfied
	1	782			
	2	3959			
6	0	3389	This cluster focuses on satisfaction with flavors and enjoyable experiences.	Product Experience	Satisfaction, completely, love, delicious, breathtaking, flavor, tasty, satisfying, always, excellently, satisfying, culinary, taste, delight, happiness, good, incredible, temptingly, stunningly, deliciously
	1	1170			
	2	2705			
7	0	1079	This cluster focuses on mistakes, the right path, focus, and strategy.	Growth & Improvement	Thin, ice, behavior, skate, mistakes, plate, caught, too much, right, stepping, not, focus, important, good, music, bark, tree, mistake, strategy, approach
	1	952			
	2	4807			
8	0	414	This cluster focuses on updates, competitors, quality, loyalty, and customer commitment.	Brand Loyalty	Keeping, eyes, updates, competitors, quality, loyal, commitment, customer, thanks, never, doesn't disappoint, disappointed, brand, fail, brand, trust, loyalty, gained, every, always, products, satisfied, excellent, expectations
	1	417			
	2	1488			
9	0	404	This cluster focuses on real issues and planning tactics.	Strategic Problem-Solving	Talking around, real issue, dodging, need, going, drawing, return, board, crossing, coming, wing, time, doing, brass tacks, budget, sorting, allowing, gathering, calling, thinking, covering
	1	245			
	2	1116			

By clustering user feedback, deeper insights into their satisfaction and dissatisfaction with products or services can be gained. The predominance of positive feedback is related to quality, flavor, and meeting user expectations, emphasizing the product's effectiveness in these areas. On

the other hand, a significant volume of negative feedback is also observed, which requires attention and improvement, particularly regarding satisfaction with flavors and overall experiences. These clusters and related analyses can be useful in guiding product and service quality improvements.

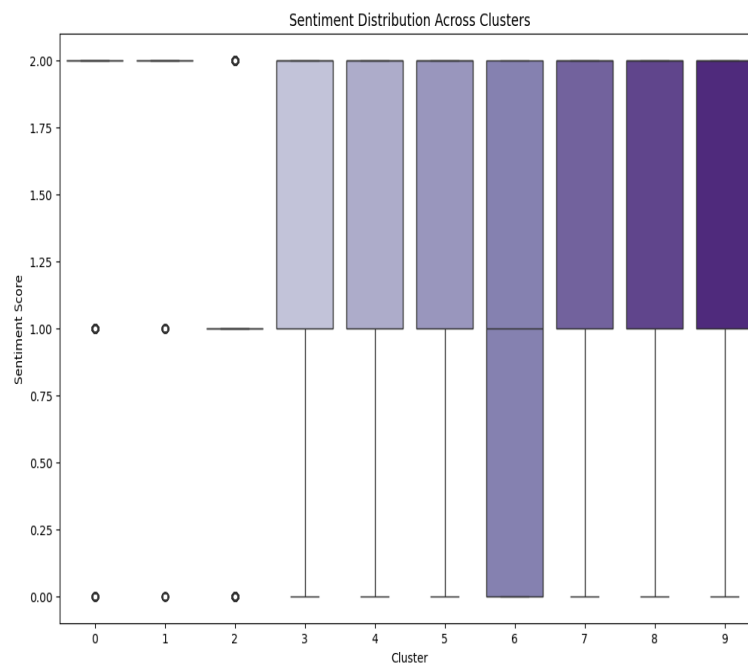
Addressing identified shortcomings and strengthening strengths can increase user satisfaction and enhance their loyalty.

Using ANOVA allows for robust comparisons between multiple groups by evaluating the variance between group means and within individual groups. This is particularly useful in our analysis, where the distribution of sentiments significantly varies across clusters, as shown in Figure 4. Different clusters represent distinct groups of comments

with significantly different emotional levels. A very high F-value (1095.419) indicates strong variability between cluster means relative to variability within each cluster, suggesting that different clusters indeed have different emotional levels. A P-value of 0.0 strongly rejects the null hypothesis that all cluster means are equal and confirms that the observed differences in sentiment scores are statistically significant and not due to random chance.

**Figure 4**

*ANOVA Results: Sentiment Distribution Across Clusters*



This chart of sentiment distribution across different clusters shows significant variability in sentiment scores among the ten clusters. Clusters 4 through 9 exhibit higher average sentiment scores, indicating generally more positive sentiments in these groups. The range (the difference between the minimum and maximum sentiment scores) in these clusters is relatively compact, indicating consistency of positive sentiments within each of these clusters. In contrast, clusters 0 through 3 show much lower average sentiment scores with greater variability, as indicated by the presence of outliers (represented by circles). These outliers indicate that while most sentiments in these clusters may lean towards neutral or slightly negative tones, there are a few extreme cases of sentiments, both positive and negative, that significantly deviate from the overall trend in these clusters.

#### 4 Discussion and Conclusion

This research focused on examining and modeling brand engagement on social media, with a particular emphasis on sentiment analysis of customer-generated content. Utilizing both qualitative and quantitative methods, including interviews with digital marketing experts and analysis of user comments, this study aimed to identify the factors that influence customer interactions and engagement with brands. In the qualitative section, interviews were conducted with managers and experts from a dairy company to identify their perspectives and experiences regarding the factors affecting brand engagement on social media. Subsequently, in the quantitative section, data from Instagram comments in response to promotional posts by a dairy brand were analyzed. Using the BERT model for sentiment analysis and



clustering techniques, various factors that influence customer engagement were identified and categorized.

The results demonstrated that cognitive, emotional, and behavioral (social) factors each influence customer interactions in different ways. Cognitive factors, such as brand recognition and awareness of its features, help customers form a clear and consistent image of the brand in their minds. Emotional factors, such as positive emotions and emotional attachment to the brand, enhance customers' experiences and encourage them to engage more and recommend the brand to others. Additionally, behavioral (social) factors, including participation in activities and social interactions, help strengthen the sense of belonging and connection with the brand.

According to the results, each cluster appears to be associated with specific factors of brand engagement extracted from the qualitative section, summarized as follows:

**Cluster Zero:** This cluster is primarily associated with factors such as "strong interest," "excitement," "eagerness," "connection," and "establishing connections." These factors indicate deep emotional and relational engagement with the brand.

**Cluster One:** The elements of this cluster seem more related to "participation in activities," "engagement," "participation in discussions," "being attracted to the brand," and "developing an interest in the brand." This cluster points toward active engagement and increased interest in the brand.

**Cluster Two:** This cluster is associated with "complete familiarity with the brand name and logo," "complete familiarity with the brand slogan," "functionality," "value," and "brand monitoring." These elements represent fundamental recognition and functional appreciation of the brand's features and monitoring of the brand's performance and presence.

**Cluster Three:** This cluster is mainly associated with factors such as "participation in discussions," "engagement," "participation in activities," "being attracted to the brand," and "establishing connections." These factors represent active participation and involvement in discussions and activities related to the brand.

**Cluster Four:** The elements of this cluster appear to be more related to "connection," "excitement," "strong interest," "eagerness," and "brand inclination." This cluster points to strong and exciting emotions and an emotional connection with the brand.

**Cluster Five:** This cluster is associated with "complete familiarity with the brand name and logo," "complete familiarity with the brand slogan," "functionality," "value," and "brand monitoring." These factors represent fundamental recognition and functional appreciation of the brand's features and monitoring of the brand's performance and presence.

**Cluster Six:** This cluster is primarily associated with factors such as "being attracted to the brand," "developing an interest in the brand," "eagerness," "excitement," and "enthusiasm." These factors indicate strong emotions and deep attraction to the brand.

**Cluster Seven:** The elements of this cluster seem more related to "participation in discussions," "engagement," "participation in activities," "establishing connections," and "connection." This cluster points toward social activities and involvement in discussions and activities related to the brand.

**Cluster Eight:** This cluster is associated with "complete familiarity with the brand name and logo," "complete familiarity with the brand slogan," "functionality," "value," and "brand monitoring." These factors represent fundamental recognition and functional appreciation of the brand's features and monitoring of the brand's performance and presence.

**Cluster Nine:** This cluster is primarily associated with "customer attraction," "brand inclination," "strong interest," "content focus," and "special attention to the brand." These factors indicate a focus on customer attraction and creating special attention to the brand's content and features.

The analysis of brand clusters and related factors highlights the complexity and diversity of customer interactions with a brand. Cognitive, emotional, and behavioral (social) factors play a key role in shaping and maintaining these interactions. Based on the qualitative results of this study, these factors can be analyzed according to customer data as follows:

**Cognitive Factors:** Including complete familiarity with the brand name, logo, and slogan, these factors help customers form a clear and credible image of the brand in their minds. These factors act as the foundation for the cognitive structuring and evaluation of the brand by customers. In clusters where these factors are prominent (such as Clusters 2 and 5), the focus is on recognizing and understanding the brand's characteristics and features, which can lead to establishing a meaningful and lasting connection with customers.

**Emotional Factors:** Such as enthusiasm, excitement, and strong interest, are emotions that customers experience in their interactions with the brand. Clusters related to these factors (such as Clusters 0 and 4) point to strong emotional attachment, which can be very effective in attracting and retaining customers. This type of emotional engagement not only enhances customer experience but also increases the likelihood of brand recommendations to others.

**Behavioral (Social) Factors:** Including connections, participation in activities, and attraction to the brand. Clusters such as 1, 3, 7, 8, and 9 represent activities that actively engage customers, from establishing connections to participating in discussions and activities. These factors contribute to strengthening engagement and creating a sense of belonging, which can be considered an important tool for attracting and retaining customers.

In summary, understanding how these various factors interact across different clusters can help brands design more effective marketing strategies and better communicate with their customers. This analysis not only provides insights into how customers engage with a brand but also offers guidance for developing tactics that improve loyalty and increase positive interactions with the brand.

Based on the analysis of the provided data, Cluster Zero has the highest number of comments with emotional topics including enthusiasm, excitement, strong interest, and eagerness. This indicates the strong impact of these emotional factors on attracting and retaining customers. The increase in the number of comments in this cluster indicates that customers have had strong emotional experiences with the brand, prompting them to respond more.

Cluster Six includes behavioral (social) factors focused on brand attraction, developing an interest in the brand, brand inclination, and customer attraction. Given the high number of comments in this cluster, it is clear that activities and social interactions play an important role in fostering loyalty and attracting new customers. Clusters One and Three also have a high number of comments and include behavioral (social) factors such as connection, participation in activities, establishing connections, engagement, and participating in discussions. This indicates that participation and direct interaction with the brand are important in strengthening relationships and positive interactions with customers. Overall, clusters focusing on emotional and behavioral (social) factors seem to have the most significant impact on customer engagement and loyalty to the brand. These clusters have effectively generated strong emotions and meaningful interactions, leading to positive and active

customer responses. This information can help brands adjust and optimize their marketing and customer engagement strategies based on the factors that have the greatest impact.

For future research, it is recommended that similar studies be conducted across different industries and brands to gain a comprehensive understanding of the factors influencing customer engagement with a brand. Additionally, examining the impact of various cultural, social, and economic elements on brand engagement can help better understand consumer behavior in different contexts. Research that explores the impact of innovations and new technologies, such as artificial intelligence and predictive analytics, on brand engagement can provide new insights for marketing and brand strategies.

### **Authors' Contributions**

All authors have contributed significantly to the research process and the development of the manuscript.

### **Declaration**

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

### **Transparency Statement**

Data are available for research purposes upon reasonable request to the corresponding author.

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### **Declaration of Interest**

The authors report no conflict of interest.

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### **Ethical Considerations**

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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