

Analysis of Online Word-of-mouth of MIXUE Based on Python Web Crawler Technology

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Abstract. This paper adopts Python web crawler technology and takes Dianping as the data source to capture the representative store reviews of MIXUE brand in 10 cities, and obtains a total of 4741 review data. Through content analysis and thematic analysis, we study how consumers evaluate MIXUE's brands, products, services and marketing strategies. The study found that consumers have an overall positive attitude toward the MIXUE brand, believing that its products are affordable and taste good. The main motives of consumers are habitual purchase, passing purchase, summer thirst quenching and so on. MIXUE's IP image and theme song are deeply loved by consumers, effectively driving online traffic into offline traffic. The study suggests that MIXUE continue to enrich its product line, improve product quality, strengthen standardized management of chain stores, and optimize marketing strategies to better meet consumer needs.

Keywords: MIXUE, Online reputation, Python web crawler, Content analysis, Topic analysis.

1. Introduction

In the era of high Internet popularity, social media has become a part of People's Daily life, and consumers' attention has gradually shifted from traditional media to online platforms. They increasingly rely on word of mouth and reviews on the Internet to make purchasing decisions [1, 2]. At the same time, consumers will also share their consumption experience and evaluation on social platforms after consumption. This user-generated content (UGC) spreads across social platforms, creating a powerful online word-of-mouth effect [3-5].

For catering brands, online word-of-mouth has an important impact on their brand image and sales. Therefore, for catering enterprises, understanding consumers' real feedback on their brands, products and services, analyzing word-of-mouth trends, and insight into consumers' cognition of brand image are of great significance for developing more accurate marketing strategies and enhancing brand awareness.

As a well-known tea brand in China, MIXUE has attracted wide attention from the industry due to its rapid rise and popularity among young consumers. With MIXUE as the research object, this study aims to capture its online comments through web crawler technology, deeply understand consumers' evaluation and attitude through content analysis and theme analysis, summarize consumers' concerns, find potential new trends, and provide references for MIXUE to develop more accurate marketing strategies and further enhance brand awareness and reputation.

This paper first introduces the research methods, including Python web crawler technology, content analysis and topic analysis. Then the selection of research samples and data collection are explained. Finally, we preprocessed the captured review data, including word segmentation, word stop, word frequency statistics, etc., which laid a foundation for subsequent analysis.

2. Study Method Design

2.1. Study Methodology

2.1.1. Analysis of Python Web Crawler Technology

Web crawlers can simulate the browser to access the Internet through programs, and automatically crawl information data on the Internet according to the set rules and Algorithms [6]. Python has a wealth of crawler-related libraries and frameworks and can provide powerful network support. Web crawler technology based on the Python programming language is simple in terms of operation and language; no IDE is required, and only a text editor can satisfy most needs. Web crawler function development [7].

In the era of the internet, freedom of speech prevails. Online comments feature interactive functions such as liking, commenting, and sharing. The desire of users to express their innermost thoughts has reached an unprecedented level. Various brand products and services elicit a wide array of views and insights from diverse users. As opinions clash, the landscape of user comments resembles "a hundred flowers bloom"[8].

The use of Python web crawler technology to capture real user comments related to MIXUE can objectively and comprehensively reflect consumers' evaluation of the brand's products and services.

2.1.2. Content analysis and topic analysis

Content analysis is a method of studying and understanding text or media content. The goal of this method is the systematic and methodical collection and interpretation of textual data or other meaningful materials, from which replicable and valid inferences can be drawn. To understand and reveal trends in specific topics or phenomena [9].

Thematic analysis is often used to analyze written texts, oral expressions or other forms of language text materials. It aims to identify key themes and patterns from text data in a transparent, trustworthy and efficient way. It is very suitable for large training dataset and suitable for team research [10].

This article will use content analysis and thematic analysis. Analyze user comments, messages and other text data related to MIXUE to gain an in-depth understanding of consumers' opinions on MIXUE. Emotional attitude and focus of attention, identify and summarize topics and feedback issues that are highly discussed by consumers, and discover emerging topics or trends that users are concerned about to help accurately adjust future strategies.

2.2. Study Subject

Dianping, an O2O platform fueled by consumer evaluations and word-of-mouth, stands as China's premier urban consumption guide and the world's first independent third-party review site. Utilizing this platform, consumers can discover high-quality merchants, access exclusive deals, and share their own reviews, which in turn serve as valuable guides for others. With its extensive database of merchant information, years of accumulated UGC reviews, and a substantial, devoted user base, Dianping offers robust data support for this research.

According to online data, as of the first half of 2023, the top ten cities with the most stores in MIXUE were Zhengzhou, Chongqing, Xi'an, Chengdu, Wuhan, Guangzhou, Shanghai, Hefei, Beijing and Tianjin. This study targeted the above ten cities on Dianping.com, searched for "Mixue Ice City" and sorted according to "popularity priority", screening the best stores in the city, and finally taking the consumer evaluation of the best stores in 10 cities as the crawling target.

2.3. Data collection

This crawler uses a personal computer, and the configuration environment is: Win10 system (64-bit), Intel Core i5 processor, and 16G running memory. The programming language version used by the crawler is Pycharm 3.7.6, and the Selenium library is used for automatic operation, importing libraries and modules such as time, webdriver, WebDriver Wait, expected_conditions, and Options.

This study follows the crawler design idea of “determining crawling targets, obtaining network resources, data analysis, and data storage”. The crawling targets are shown in Table 1, and the remaining operations are as follows.

2.3.1. Determine the crawl target

See Table 1 for the most popular MIXUEstores in the ten cities screened, and write the URLs of the 10 stores into the URL list.

Table 1. The most popular MIXUEstores in the ten cities

City	Store
Zhengzhou	MIXUE(China World Brand Flagship Store)
Chongqing	MIXUE(Three Gorges Plaza Store)
Xi'an	MIXUE(Wulukou Store)
Chengdu	MIXUE(Jiaoda Road Branch)
Wuhan	MIXUE(Optics Valley Tiandi Store)
Guangzhou	MIXUE(Victoria Plaza Store)
Shanghai	MIXUE(Tianzifang Store)
Hefei	MIXUE(Guanting Road Store)
Beijing	MIXUE(Sanlitun Store)
Tianjin	MIXUE(Xiyuehui Store)

2.3.2. Access to network resources

Open the specified store link in the URL list through WebDriver, wait for the page to load, and then use a loop code to continuously scroll to the bottom of the page, click the "Next Page" button, and then wait for the page to be loaded, and write the evaluation data of the current page into the Excel file. This loop will continuously turn pages, obtain the evaluation data of each page, and write it into the Excel file until there is no next page.

The key codes are as follows:

while True:

```
    driver.execute_script("window.scrollTo(0, document.body.scrollHeight);")
```

```
    time.sleep(1)
```

```
    try:
```

```
        Next_page_element = driver.find_element(By.XPATH, "//*[contains(text(), 'Next')]")
```

```
        next_page_element.click()
```

```
        time.sleep(1)
```

```
        time.sleep(2)
```

```
        write_to_excel(driver)
```

```
        time.sleep(2)
```

2.3.3. Parsing data

Locate all elements with the class name "fold" through 'fold_elements', and then click these elements in turn to expand the comment. This is to simulate that the user clicks to expand the comment, because sometimes the web page only displays part of the comment by default, and click "expand" to see all the content of the comment. Locate all elements with the category name "review-words" through 'review_words_elements', which contain the user's evaluation content, and then iterate through each element in 'review_words_elements' to obtain the text content of the element.

The key codes are as follows:

```
fold_elements = driver.find_elements(By.CLASS_NAME, "fold")
```

```
for fold_element in fold_elements:
```

```
    fold_element.click()
```

```
    time.sleep(1)
```

```
review_words_elements = driver.find_elements(By.CLASS_NAME, "review-words")
```

2.3.4. Data preservation

Use the openpyxl library to open the existing xlsx file named reviews, obtain the active worksheet, determine the number of rows in the last row, then iterate through the evaluation element list, add the text content of each evaluation to the last row of the Excel sheet, and finally save the spreadsheet file.

The key codes are as follows:

```
last_row = sheet.max_row + 1
for element in review_words_elements:
    Text = element.text.replace("Collapse evaluation", "")
    sheet.cell(row=last_row, column=1).value = text
    last_row += 1
```

2.4. Data processing

As of December 15, 2023, this crawler has captured a total of 4,741 consumer reviews related to MIXUEon Dianping.

First, analyze the captured review data: use the Chinese word segmentation tool jieba to divide each evaluation text into words, remove 65 nonsense words such as "yes", "de", and "in" and perform word frequency statistics to obtain the top 50 words with the highest word frequency. After obtaining high-frequency words, use the graph analysis library networkx to build a semantic network of high-frequency words and finally visualize them through the matplotlib library. Second, form a classification of each topic according to the high-frequency vocabulary and co-occurrence semantic network graph, which helps to intuitively understand the relationship between words in the review, to more comprehensively analyze consumers' evaluation of Mixue Ice City.

It should be noted that the crawler data in this study are only used for scientific project research, and do not involve commercial use, personal privacy and other legally protected information.

3. Analysis of Study Results

3.1. Content of analysis comments

In this study, the captured review data were segmented, word frequency was counted, co-occurrence semantic network was constructed, and co-occurrence network diagram was drawn, to understand the association between words more intuitively. The top 50 high-frequency feature words are shown in Table 2.

Table 2. The top 50 high-frequency feature words

Serial number	Keywords	Word frequency	Serial number	Keywords	Word frequency
1	Ice cream	1435	26	Summer	403
2	Milk tea	1344	27	Drinks	396
3	Taste	1317	28	Queuing	392
4	Yes	1222	29	Always	391
5	Cheap	1135	30	Now	382
6	Nice	1101	31	Sundae	362
7	Like	1022	32	Pearl	361
8	Delicious	1019	33	Location	349
9	Cost performance	983	34	Square	341
10	Lemonade	971	35	Sugar cone	322
11	Price	945	36	Taste	319
12	Service	826	37	Four Seasons Spring	302
13	Delicious	652	38	Passion fruit	296
14	Very	610	39	Brittleness	296
15	Drinks	571	40	Coffee	269
16	Special	549	41	Business	268
17	Milkshake	516	42	Snow King	267
18	Taste	505	43	Century	265
19	Recommended	493	44	Mint	253
20	Environment	489	45	Chilled	253
21	Affordable	451	46	Friends	245
22	Strawberry	434	47	Cost-effective	229
23	Super	422	48	General	218
24	Ice cream	412	49	Group purchase	215
25	Shake	405	50	Passing by	212

After obtaining the top 50 high frequency word list, a high frequency word semantic network was constructed using networkx, in which nodes represent high frequency words and edges represent co-occurrence relationships between these words. The layout of the graph was using the Spring layout algorithm, and finally visualized through matplotlib. The final high frequency word semantic network graph is shown in Figure 1.

Observe that the words "milk tea", "ice cream", "price" and "cost performance" are densely connected.

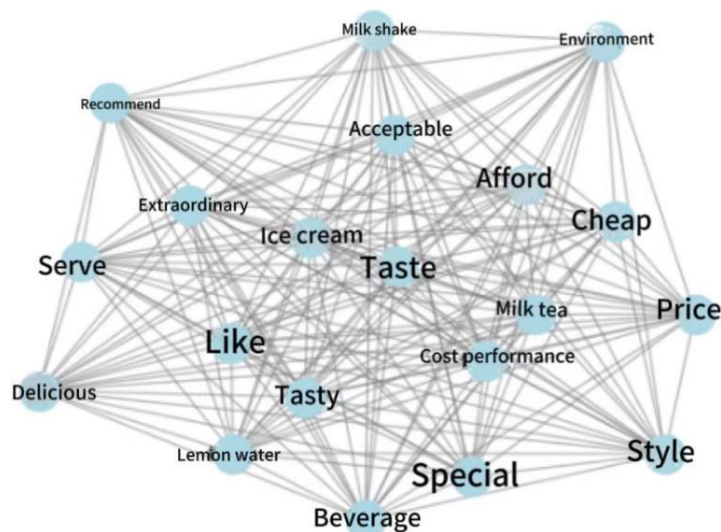


Figure 1. Semantic network diagram of high frequency words

3.2. Category Comment Topics

Combined with the high-frequency word list and the semantic network map of high-frequency words, it is found that the two major themes involved in the store reviews of MIXUEon Dianping are brand and consumer. The high-frequency words related to brand are product overview, store situation, and product marketing. The high-frequent words related to consumers are consumer behavior, product evaluation, and consumer psychology. Based on the two major themes, this study summarizes all the review data captured, and finally forms the topic category table, as shown in Table 3.

Table 3. Comment topic category list

Subject	Main category	Subcategory	High-frequency words	
Brand	Product overview	Price	Cheap (1135), cost-effective (983), price (945), affordable (451), yuan (251), cost-effective (229), affordable (112), people-friendly (104)	
		Taste	Taste (1317), Taste (505), Mouthfeel (319)	
		Product name	Ice cream (1435), milk tea (1344), lemonade (983), drink (571), milkshake (516), ice cream (412), shake (405), drink (396), sundae (362), cone (322), crisp (296), coffee (269), chilled (253), Ferris (222), fruit tea (106), tea (56)	
		Product material	Strawberry (434), pearl (361), four seasons spring (302), passion fruit (296), mint (253), lemon (229), fresh orange (127), blueberry (121), bun (86), oreo (86), mango (84), cheese (84), milk cap (79), oats (57),	
	Store conditions	Store location	Location (349), Square (341), Nearest (255)	
		Store environment	Environment (489), attitude (310), store (249), shop assistant (229), enthusiasm (135)	
		Product marketing	Marketing means	Snow King (267), Sweet Honey (167), Activity (157), Peripheral (130), Doll (53)
			Marketing effect	Queue (392), Business (268), Know (268), Century (265), Cute (77), Hot (58)
	Consumer behavior	Consumption motivation	See (406), summer (403), frequent (219), group purchase (215), passing (212), before (199), discount (174), student (167), shopping (98), winter (87), experience (78)	
Consumer	Consumption evaluation	Positive evaluation	Good (1101), tasty (1019), tasty (652), recommended (493), convenient (152), good-looking (96), inexpensive (89), love (61)	
		Neutral evaluation	General (218), General (64)	
		Negative evaluation	Disappointed (66), Unpleasant (53)	
	Consumer psychology	Curiosity	New (196), Taste (90)	
		Herd mentality	Friends (245), punching in (130), taking photos (51)	
		Satisfaction psychology	Likes (1022), quenches thirst (172), deserves (126), happy (80), satisfied (70), happy (61)	

3.2.1. Brand theme analysis

(1) Product overview

In terms of product profile, price and product name are mentioned more by consumers.

Mixue Ice City's product positioning emphasizes both high quality and affordability. Consumers perceive the brand's offerings as economical, accessible, and providing good value for money. This affordability is attributed to Mixue Ice City's highly efficient supply chain, which minimizes the use of fresh fruits and primarily utilizes powdered ingredients for its beverages. This approach significantly cuts down on cold chain transportation and storage expenses, enabling the company to maintain low product prices while optimizing cost savings.

According to the store reviews, the two most popular and favorite products purchased by consumers are Ferris Crunchy Ice Cream (RMB 3) and Frozen Lemonade (RMB 4). Both are popular products of Mixue Ice City, which can attract other series of products and drive the sales of other types of products. Few consumers mention other products such as milkshakes, mainly because MIXUE uses tea and ice cream as its main products, and other products lack innovation and publicity.

(2) Store conditions

In terms of store location, the ten selected stores are all open in streets, squares or shopping malls with high traffic, which are easy to be reached by consumers, which is also an important reason for the high popularity of the stores.

After studying the detailed comments of consumers, we found that many consumers were dissatisfied with the service attitude of the store staff, mentioning incidents such as indifference, unresponsiveness, and failure to meet their needs in time. Some of the stores selected in this study provided in-store dining service. According to consumer comments, it was learned that the overall dining space was small, the environment was not clean enough, and the store staff did not clean up the desktop garbage in time. These complained stores were almost franchise stores. Mixue Ice City's requirements for franchise are not strict. According to the official website franchise information, it is known that franchisees can open stores when they reach a net usable area of 12 square meters, and how to staff them is all decided by the franchisees themselves, which will inevitably lead to different service quality of each store to a certain extent, and the hygiene environment is difficult to meet the standard.

(3) Product marketing

The two marketing magic weapons of MIXUE are the Snow King IP and the theme song.

MIXUE does not invite celebrities to make endorsements. The IP image of Snow King, born in 2018, is the lifelong spokesperson of Mixue Ice City. This white fat Snow King wearing a crown and cape and holding an ice cream scepter also fits well with the brand tonality. MIXUE has also deepened the image of Snow King on different social platforms and short video platforms, and netizens have also created two new ones, making Snow King a super symbol of the brand. The theme song of Mixue Ice Town is adapted from the American classic ballad "Oh! Suzanna". The phrase "You love me, I love you, MIXUE is sweet" is repeated 16 times in just 104 seconds, which is magical and brainwashing. By the end of 2023, the Chinese-English bilingual version of the theme song MV has been played more than 21 million times on the Bili Bili website.

It can be seen from the store reviews that consumers are extremely receptive to such marketing methods. Consumers have very positive emotions towards the lovely Snow King and are also willing to chant and spread "You love me, I love you, MIXUE is sweet", which indicates that MIXUE has established a certain degree of trust with consumers through more effective marketing methods. Viral brand communication has also led to long queues and booming business in many stores, which means that Mixue Ice Town has successfully converted online traffic into offline customer flow.

In addition to the main line products, some stores also sell Snow King dolls, mugs, tea bags and other peripheral products marked with Snow King, which further strengthens the recognition of Snow King, expands the brand influence and deepens the impression of Snow King in the minds of consumers.

3.2.2. Analysis of consumer themes

(1) Consumer behavior

After analyzing the details of the store reviews, we find that consumers have consumption motivations such as "passing by", "seeing relevant publicity on the Internet", "buying out of habit", "quenching thirst in summer", and "buying for group purchase discount". Most consumers believe that the pricing and products of MIXUE are very consistent with the consumption level and taste of the student population. Some consumers buy because of online publicity, which further reflects the success of Mixue Ice Town marketing. Some consumers have the habit of buying frequently. Some consumers take a cup of Mixue Ice Castle or an ice cream as a standard for shopping or walking, and even take a

cup when passing by. This is the success of Mixie Ice City's low price, high output and store location, which also reflects the high status of Mixue Ice Village in the hearts of most consumers.

(2) Consumption evaluation

Most consumers believe that drinks and ice cream meet or even exceed consumer expectations, and give positive comments on the products such as "good", "delicious", "delicious" and "good-looking". Some consumers believe that Mixue Ice City's products are truly inexpensive, and some consumers are willing to recommend them to their relatives and friends. A small number of consumers think that the product quality is not satisfactory. This reflects the successful implementation of "high quality and parity" by Mixue Ice City, and reflects the strong influence of MIXUE brand.

In general, consumers have a positive evaluation of MIXUE's products and are more tolerant of the taste and flavor. Many consumers believe that MIXUE can be used at a price lower than one-third or even two-thirds of other tea brands, and it is very difficult to ensure medium and high quality and taste stably, and they do not expect Mixue Bing Cheng to provide more excellent quality on the basis of parity.

(3) Consumer psychology

Nowadays, products not only have functional value for consumers, but also should provide emotional and spiritual value. After sorting out and summarizing the comments, we believe that the consumer psychology here is mainly manifested as "curiosity", "herd mentality" and "satisfaction". Specifically, consumers will have a certain curiosity when they learn about the new products of MIXUE or popular products (ice cream, chilled lemonade, shake milkshake) on the Internet or from their relatives and friends, and finally the actual purchase behavior of these products satisfies the consumer's curiosity. MIXUE has a very high popularity on the Internet, no matter the theme song, IP image or products, and many relatives and friends around are buying, people will also consume and punch in out of the mentality of following hot spots and catching up with trends, which is the herd mentality of consumers buying Mixue Ice City. With the price far lower than other tea brands in the market, MIXUE allows consumers to easily and unaffordably buy a cup of cold drink to quench their thirst in summer and take a cup of hot drink to warm up in winter. It can also satisfy consumers' simple desire for desserts and sweet drinks in daily life with stable and guaranteed product quality. Most consumers think that the product is worthwhile and feel happy and satisfied.

4. Research Conclusions and Implications

4.1. Study conclusion

In this study, Python crawlers were used to crawl representative store reviews of MIXUE on Dianping, and content analysis and thematic analysis were used to explore the crawled review content. The online reviews crawled by Python crawlers are consumer reviews, which can objectively reflect the true emotions of consumers from multiple dimensions. Through analysis, the high-frequency words related to brands in reviews are product overview, store situation and product marketing, and the high-frequency word types related to consumers are consumer behavior, product evaluation and consumer psychology.

According to the summary of the crawled reviews, the overall attitude of consumers towards MIXUE is relatively positive.

In terms of products, most consumers believe that store products are cost-effective. Consumers talk more about price than taste. Ferris ice cream and frozen lemonade are the products most mentioned by consumers.

In terms of stores, the stores selected in this study are often located in places with a large flow of people. Many consumers believe that the service attitude of store assistants needs to be improved. For some stores that provide on-site meals, many consumers complain that the environment is not hygienic and tidy, which affects the consumer experience.

In terms of marketing, consumers are not repelled by the existing marketing methods. They are happy to interact with Snow King and think that the theme song is magical and interesting. The existing

marketing methods have deepened the brand image of MIXUE in the minds of consumers and successfully converted online traffic into offline sales.

In terms of consumption behavior, many comments come from consumers who frequently repurchase, and their consumption motivations are mostly "habitual purchase", "passing by", "summer thirst quenching", "group purchase discount", etc.

In terms of consumer evaluation, most consumers are satisfied with the product quality of the store, and some consumers are willing to recommend it to their relatives and friends. A small number of consumers think that the product quality is not as good as expected and are slightly disappointed.

In terms of consumer psychology, many consumers buy store products out of curiosity and herd mentality, and many consumers believe that store products meet their needs to a certain extent.

4.2. Implications

4.2.1. Enlightenment 1: Price and quality are the key factors of word of mouth

Mixue Ice City's popularity stems from its pricing below market levels and quality above them, key factors that drive consumer-led marketing. The brand thrives on a win-win of cost and excellence. Currently, MIXUE focuses on tea and ice cream, with a standout product but lacks in innovation and R&D. By adhering to its "high quality, affordable" ethos, MIXUE should undertake extensive market research, enhance consumer feedback avenues, and pinpoint product enhancement directions to boost market adaptability. Leveraging its innovation team, establishing incentive mechanisms, and seeking external collaborations can infuse new ideas and technologies. Expanding the product range with varied flavors, types, and seasonal offerings will appeal to a broader audience and cater to diverse tastes. Such consumer-aligned product evolution and diversification will heighten consumer satisfaction. While Mixue Ice Cream enjoys consumer leniency, quality advancements will solidify trust and confidence, bolstering online reputation and driving sales.

4.2.2. Enlightenment 2: Take various measures to standardize the behavior of franchisees

Retail outlets are crucial for tea brands, representing the culmination of all operational aspects. MIXUE's franchising approach is poised for swift growth, yet it risks management oversight issues, making it challenging for each franchise to uphold standards. To enhance customer experience and satisfaction, MIXUE must rigorously enforce an effective monitoring system. This involves establishing a dedicated oversight team or partnering with a third-party regulator tasked with regular assessments of food safety, store cleanliness, and franchise management. A system of incentives and penalties should be implemented to reward compliant franchises and discipline infractions, thereby encouraging franchisees to proactively preserve the brand's image. Additionally, an emergency protocol for food safety or managerial issues should be in place, ensuring prompt joint action from the headquarters and franchisees to safeguard consumer interests and the brand's integrity. Finally, consumer feedback channels are essential for inviting customer input, allowing franchisees to identify and rectify issues promptly.

4.2.3. Enlightenment 3: Continuously enrich and optimize marketing strategies

The Snow King IP and its catchy theme song don't always secure marketing success. Overly similar marketing materials can quickly lead to consumer resistance. High-quality content, targeted positioning, and leveraging cross-platform traffic can maximize the lifespan of IP marketing. Snow King, aligning with public taste, may resonate more than celebrity endorsements. Yet, to maintain its impact, Snow King must evolve beyond a mere symbol. By developing Snow King's character with emotional depth, crafting compelling narratives across various platforms, and fostering emotional connections with the audience, the brand's image can be ingrained in consumer memory, boosting their purchase intent. The theme song, however, should be marketed with restraint; not all "viral" content yields positive outcomes. Overplayed, catchy tunes can annoy consumers and lead to brand fatigue. MIXUE can harness live streaming to bolster online sales without compromising offline performance, continuously amplifying brand presence through new media.

4.2.4. Lesson 4: Rely on young people to drive other groups

Young people are keen to follow fashion trends and have a high dependence on various media platforms. They are the creators and disseminators of online reviews. In terms of age level, the key target group of Mixue Ice Cream & Tea is the young group aged 16-25. Consolidating the existing young audience and allowing young people to drive the topic flow and consumption to other groups can enable a wider audience to improve brand reputation through positive word of mouth. Understand the needs, interests and values of young people, and provide products and services that meet expectations; focus on creating a unique brand experience, and fit young people's pursuit of individualized; use the Snow King IP image to actively pay attention to social issues and green development issues that young people are interested in, enrich the Snow King image while bringing it closer to young people; encourage franchisees to hold appropriate online and offline interactive activities or challenges to promote young people's understanding of brand connotation through various communication channels. All these measures can help the brand to improve the loyalty of young groups.

5. Conclusion

This study uses Python web crawler technology to conduct an in-depth analysis of the online reputation of MIXUE brand, and finds that consumers hold a positive attitude toward MIXUE. Based on the research results, it is suggested that MIXUE continue to optimize products, strengthen chain store management, and enrich marketing strategies to better meet consumer needs and further enhance brand reputation and awareness. This study provides a reference for other tea brands, and provides beneficial suggestions for the development of MIXUE brand.

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