Demand Analysis of Children's Sunscreens Based on User Reviews

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Abstract. This paper provides an in-depth analysis of the demand for children's sunscreens based on user reviews. With increasing UV radiation and the popularization of scientific parenting concepts, the market for children's sunscreens has grown rapidly. This study primarily investigates the actual demand and preferences for children's sunscreens among consumers, including sun protection effectiveness, product safety, skin feel, and brand selection. The goal is to provide sunscreen manufacturers with insights for product improvement and market positioning based on user feedback. The research method involves collecting and analyzing user reviews from major e-commerce platforms, focusing on consumers who have purchased and used children's sunscreens. Through content analysis, key demand points are identified to offer references for industry development. The study finds that consumers place high importance on the sun protection effectiveness and safety of children's sunscreens, preferring gentle, non-irritating, and easy-to-apply products, with brand loyalty significantly influenced by the user experience.

Keywords: User Reviews; Sunscreen; Market Positioning.

1 Introduction

With increasing awareness of children's skin protection and more outdoor activities, the market for children's sunscreen has seen significant growth in recent years. Sunscreen, as a crucial part of daily skin care, is especially emphasized in the context of protecting children's skin. The sunscreen market is mainly divided into two categories: hard sunscreens (such as sun-protective clothing, hats, and other physical barriers) and soft sunscreens (such as topical products like sunscreen creams) [1]. Among these, sunscreen creams dominate the children's sunscreen sector due to their convenience and effectiveness.

The market for children's sunscreen is highly competitive, with not only well-known international brands such as L'Oréal, Lancôme, and Shiseido, but also emerging domestic brands like Turtle Daddy, Red Elephant, and Winona Baby. These brands focus not only on the effectiveness of sun protection but also on the safety and gentleness of the ingredients to meet parents' demands for high-quality children's sunscreen products.

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This study will analyze user reviews from a particular online platform to explore trends in the children's sunscreen market, product preferences, and potential demands. By examining user feedback on aspects such as sun protection factor (SPF), ingredient safety, and skin feel, the study aims to reveal changes in market demand and consumer preferences. Additionally, the research will assess the performance of children's sunscreen in various usage scenarios, such as outdoor play and daily school activities, to provide comprehensive market insights and strategic recommendations for businesses.

Understanding the demand for children's sunscreen is not only beneficial for promoting healthy market development but also provides practical purchasing guidance for parents, thus holding significant market value and social importance.

2 Literature Review

2.1 Theoretical Framework

This paper applies various theories, including consumer behavior theory, market demand analysis theory, product characteristics and market positioning theory, and service quality theory. This section introduces these theories.

Consumer Behavior Theory. Consumer behavior theory explores the psychological, social, and cultural factors influencing consumer purchase decisions. Core theories include psychological drivers (such as motivation, perception, and learning), social influences (such as family, social roles, and culture), and individual characteristics (such as age, occupation, and lifestyle). This study will particularly focus on:

Consumer behavior theory investigates the psychological, social, and cultural factors influencing consumer purchase decisions. Core theories include psychological drivers (such as motivation, perception, and learning), social influences (such as family, social roles, and culture), and individual characteristics (such as age, occupation, and lifestyle). This study will emphasize consumers' concerns regarding product effectiveness, safety, and user experience when selecting children's sunscreen. These factors play a crucial role in consumer purchase decisions, affecting satisfaction and repurchase rates.

In this study: By analyzing user reviews, the study reveals key consumer concerns when purchasing children's sunscreen, such as sun protection effectiveness, product safety, and user experience, helping businesses better understand consumer needs and behavior patterns.

Market Demand Analysis Theory. Market demand analysis theory focuses on how to identify and meet consumer needs in the market. Common methods include demand forecasting, demand elasticity analysis, and market segmentation. Demand forecasting predicts future market demand based on historical data and trends. Demand elasticity analysis helps understand how factors like price and income affect demand. Market segmentation involves dividing the market into different groups and analyzing each group's demand characteristics and purchasing behavior.

In this study: By analyzing user reviews and conducting demand structure analysis, insights into the main needs in the children's sunscreen market can be obtained, including product effectiveness, user experience, and service quality. Identifying these needs helps businesses develop more targeted market strategies and product improvement plans.

Product Characteristics and Market Positioning Theory. Product characteristics and market positioning theory focuses on how product functions, quality, design, and brand image affect market positioning. Product characteristics include sun protection effectiveness, ingredients, and safety, while market positioning involves determining the target market and competitive advantages. Successful market positioning strategies combine product characteristics with consumer needs to meet differentiated market demands.

In this study: By analyzing user reviews through term frequency statistics and LDA clustering analysis, key product characteristics (such as sun protection effectiveness and convenience) and key points of market positioning for children's sunscreen can be identified. This helps businesses clarify their competitive advantages and shortcomings in product development and market promotion, meeting differentiated consumer needs.

Service Quality Theory. Service quality theory focuses on quality management during the service delivery process, including reliability, responsiveness, assurance, empathy, and tangibles. The level of service quality directly impacts customer satisfaction and loyalty[2-3].

In this study by analyzing feedback on logistics and customer service from user reviews, the current service quality can be evaluated. Understanding the gap between customer expectations and actual experiences helps businesses make improvements in service quality and optimize customer experience.

2.2 The Relationship Between Customer Reviews and Product Demand

In the modern business environment, customer reviews have become a crucial basis for understanding market demand and optimizing products and services. Research indicates that customer reviews not only influence potential customers' purchase decisions but also directly affect a company's brand image, market share, and long-term profitability. Positive reviews can enhance social recognition, increase business visibility, and promote sales growth, while negative reviews may trigger trust crises and lead to customer loss [4]. Therefore, companies increasingly emphasize customer review management by collecting and analyzing feedback to guide product improvements and market strategy adjustments.

2.3 The Relationship Between User Reviews and Children's Sunscreen

Studies show that over 90% of customers refer to online reviews before making a purchase. For children's sunscreen, parents are particularly cautious in their product

choices, focusing not only on sun protection effectiveness but also on product safety, gentleness, and suitability for children's skin [5]. Therefore, positive feedback in user reviews, such as "gentle and non-irritating" and "effective sun protection without being greasy," can significantly enhance potential customers' purchase intentions. Conversely, negative reviews may lead customers to abandon the purchase.

User reviews contain rich market information and consumer needs. By analyzing user reviews, companies can understand consumer satisfaction, dissatisfaction, and potential needs for existing products. For example, if parents commonly report that a particular children's sunscreen feels heavy and difficult to apply, companies can address this issue by developing a lighter, easier-to-apply version. Additionally, user reviews can help companies identify new market opportunities, such as developing children's sunscreen with specific benefits (like moisturizing or soothing) to meet diverse parental needs.

User reviews are an important aspect of market competition. In a highly transparent online environment, the strengths and weaknesses of any product are difficult to hide. A high-quality children's sunscreen can establish a reputation advantage in the market through positive user reviews, attracting more potential customers. Conversely, products with poor performance may gradually be eliminated from the market due to excessive negative reviews [6]. This market competition mechanism based on user reviews helps drive the children's sunscreen market towards higher quality, safety, and innovation.

3 Research Methods

3.1 Method Overview

Literature Review Method. The literature review method involves examining and analyzing existing literature to obtain the information needed for research. In this study, the literature review method is applied in the following ways:

Market Background: By reviewing research reports, industry analyses, and academic papers related to the children's sunscreen market, we aim to understand the current trends, competitive landscape, and consumer behavior characteristics. This provides macro-level context for the subsequent user review analysis.

User Reviews and Product Demand Relationship: Collecting research findings on the relationship between user reviews and product demand, particularly in the context of children's products or skincare, to clarify the role of user reviews in shaping and changing product demand. This offers theoretical support for the study.

Research Gaps and Innovation: Reviewing and analyzing existing studies on children's sunscreen user reviews to identify research gaps and potential areas for further exploration. This ensures the innovation and practical relevance of the study.

Text Mining Method. Text mining involves analyzing user reviews to gain deeper insights into the market demand for children's sunscreen. This method includes col-

lecting a large volume of user review data and applying natural language processing techniques for preprocessing, such as tokenization and stop-word removal. Subsequently, techniques like word frequency analysis and Latent Dirichlet Allocation (LDA) are used to uncover user concerns, such as sunscreen effectiveness, ingredient safety, user experience, and suitable age. The results from LDA topic modeling help to summarize and establish a demand analysis framework [7]. These findings support product development and marketing efforts, assisting companies in better meeting market needs.

Quantitative Analysis Method. Quantitative analysis involves collecting and processing a specific amount of data and using statistical principles and methods to reveal underlying patterns and numerical relationships. In this study, the quantitative analysis method is applied in the following areas:

Data Collection: Gather extensive user review data for children's sunscreen from various channels, including e-commerce platforms, social media, and professional forums. Data cleaning and preprocessing ensure the accuracy and validity of the data.

Next, quantify the demand for children's sunscreen by analyzing specific descriptions in user reviews and market demand theories. By statistically analyzing mentions of factors such as SPF, ingredient safety, and skin feel, this method reveals current and potential market needs, providing companies with concrete suggestions for product improvements and market strategies [8].

This study will integrate literature research and quantitative analysis to deeply explore the relationship between market demand and user reviews for children's sunscreen from both macro and micro perspectives. Literature research will provide market background and theoretical support, while quantitative analysis will uncover specific demands and opportunities, aiming to offer comprehensive market insights and strategic guidance for businesses.

3.2 Data Analysis Process

Data Comment Collection. The data for this study primarily comes from user reviews of children's sunscreen on major e-commerce platforms, social media, and professional forums. Using web scraping technology and Application Programming Interface (API) interfaces, we collected a large volume of user review data as the basis for subsequent analysis. The study employed a well-established web scraping tool, Octoparse, to gather 15,000 user reviews, which took 1 hour and 31 minutes.

Data Preprocessing. Due to the high transaction volume on online shopping platforms, the raw data obtained through Octoparse often contains significant noise, which can severely impact subsequent text mining processes like Chinese word segmentation and word frequency statistics. Therefore, the raw data needs to be cleaned and irrelevant comments removed.

(1) Text Deduplication

The raw comment texts include two main types of duplicates: system-generated default comments and repetitive evaluations of the same content. The deduplication feature in Octoparse was used to remove identical comments.

(2) Segmentation Processing

In analyzing the comment texts, the professional segmentation tool ROSTCM6 was used to break down the comments into individual words or phrases, facilitating subsequent word frequency statistics and semantic analysis.

(3) Invalid Words Filtering

Based on the segmentation, invalid words (such as stopwords and punctuation) were filtered out, and a valid word list was established to ensure the accuracy of the analysis.

(4) Word Frequency Statistics

By performing word frequency statistics on the valid word list, high-frequency words and phrases from the user comments were identified and compiled into a word frequency table. These words and phrases reflect the main concerns and needs of users regarding children's sunscreen.

Data Analysis. (1) LDA Clustering

Latent Dirichlet Allocation (LDA) is a topic modeling technique used to identify hidden topics within a large corpus of text data. It works by analyzing the co-occurrence patterns of words through statistical methods to infer the potential topics present in each text and the distribution of keywords under these topics.

LDA clustering analysis was performed on the processed segmentation results using the LDA model to identify latent topics within the segmented texts. The results of the LDA topic analysis and topic relationship diagrams were generated.

(2) Constructing Customer Needs Framework

By analyzing the topics classified by LDA, keywords and their weights for each topic were obtained. Based on the LDA topic analysis results, topic relationship diagrams, consumer behavior theory, market demand analysis theory, product characteristics and market positioning theory, service quality theory, and related literature, similar meaning keywords were merged to observe and construct the customer needs framework. This framework includes secondary demand indicators, which correspond to different aspects of user needs and expectations regarding children's sunscreen. This demand structure provides robust data support for subsequent product improvements and market strategy development.

(3) Quantitative Analysis

According to the established needs framework, keywords were manually selected based on their relevance and importance and incorporated into the customer needs framework table. Subsequently, the weight of each keyword was calculated based on its frequency. These weights reflect the importance of keywords in the needs framework and help businesses better understand customer demands, allowing them to optimize their product or service strategies accordingly.

4 Results

4.1 Descriptive Explanation

After performing text deduplication, word segmentation, and stopword filtering on the review data, a word frequency table was generated (see Table 1). This table details the main topics of interest to customers. Analyzing these word frequencies allows for a deeper understanding of customer concerns and preferences, providing a foundation for the subsequent LDA clustering analysis and final quantitative analysis.

Table 1. Word frequency statistics of online reviews

Participle vocabulary	Word frequency number	Participle vocabulary	Word frequency number
sunscreen	11411	spray	2267
effect	5767	satisfactory	2262
convenient	3095	kids	2042
greasy	2967	worth	1968
summer	2413	skin	1887
package	2397	speed	1814
logistics	2382	repurchase	1771
soon	2370	refreshing	1673
buy	2332	baby	1519
quality	2310	taste	1442

First, during the data preprocessing phase, a word frequency table was generated. Subsequently, the LDA (Latent Dirichlet Allocation) algorithm was applied to cluster the word frequency data. Through LDA, we obtained the topic analysis results (see Table 2) and a topic relationship diagram displaying the relationships between topics. These analyses revealed the underlying topic structure within the data, providing a data foundation for summarizing and synthesizing the customer needs structure.

Table 2. LDA cluster analysis results

Subject key-words and weights	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
Key words 1	Summer (0.035010)	Speed (0.053035)	Child (0.084167)	Cost performance ratio (0.060026)	Texture (0.031700)
Key words 2	Activity (0.024934)	Fast (0.052789)	Taste (0.032388)	Price (0.037452)	Fat Fat (0.027959)
Key words 3	Fat Fat (0.024860)	Soon (0.052434)	Moisture (0.019420)	Quality (0.033091)	Fresh (0.021587)
Key words 4	Price (0.023298)	Logistics (0.050929)	Spray (0.014208)	Brand name (0.029131)	Apply (0.017328)
Key words 5	Spray (0.021717)	Shipping (0.033657)	Fat Fat (0.014133)	Packaging (0.022175)	Skin (0.015599)
Key words 6	Brand name	Packaging	Summer	Benefit (0.021568)	Cost performance

	(0.013492)	(0.032830)	(0.012655)		ratio (0.014206)
Key words 7	Fresh (0.010544)	Express delivery (0.024824)	Light touch (0.012212)	Cheap (0.012826)	Thin and light (0.013586)
Keywords 8	Cost-effective (0.009519)	Quality (0.021095)	Composition (0.011947)	Good quality and cheap price (0.012513)	Push open (0.012414)
Key words 9	Sample size (0.009271)	Delivery (0.016828)	Fragrance (0.010542)	Logistics (0.011560)	Absorption (0.011778)
Keywords 10	Cheap (0.008363)	Service Attitude (0.016404)	Carry-on (0.009625)	Customer Service (0.009934)	Ultraviolet light (0.011212)
Keywords 11	Good good (0.008133)	Self-operated (0.015571)	Good News (0.009338)	Authentic product (0.009867)	Waterproof (0.010074)
Key words 12	Brand name (0.008007)	Day 2 (0.012559)	Comfortable (0.008794)	Offer rate (0.007974)	Sensitive (0.008833)
Key words 13	Benefit (0.007821)	Strict (0.012300)	Push open (0.007790)	Quality (0.007927)	Membrane-forming (0.008424)
Keywords 14	Push off (0.007490)	Service (0.010343)	Application (0.007379)	Domestic goods (0.007774)	Water Sense (0.008348)
Keywords 15	Gift (0.007441)	Careful (0.009825)	Fresh (0.007016)	Soon (0.007092)	Water (0.007936)

Based on the LDA topic analysis results, the topic relationship diagram, consumer behavior theory, market demand analysis theory, product characteristics and market positioning theory, service quality theory, and related literature, similar meaning keywords were merged and analyzed to construct the customer needs framework. The resulting demand structure for children's sunscreen is detailed in Table 3. This demand structure includes secondary demand indicators, which correspond to various aspects of user needs and expectations regarding children's sunscreen. This framework provides robust data support for subsequent product improvements and market strategy development.

Table 3. Pattern of demand

Primary index	Secondary indicators	Demand vocabulary
Product	Product effect	Sun protection, effect, quality, prevention, etc
	The use feeling	Fresh, moist, light and so on
	Product brand	Brand, not fake, genuine products, etc
	usage mode	Spray, push away, apply, etc
	Product traits	Convenient, greasy, flavor, etc
Price	-	Worth, cost-effective, affordable, cheap, etc
Service	Logistics services	Packaging, logistics, very fast, speed, etc
	Customer service	Attitude, sellers, merchants, stores, etc

4.2 Data Weight Calculation

Based on the constructed demand framework, the word frequencies were manually screened and classified. The filtered vocabulary was then incorporated into the demand framework table, and the weight of each category was calculated based on the word frequencies of the terms within each category (see Table 4).

Table 4. Index Weight

	Primary index	Secondary indicators	Sum total	Percentage rate
	Product	Product effect	21426	23.58%
		The use feeling	21964	24.17%
		Product brand	3231	3.56%
		usage mode	4695	5.17%
		Product traits	8750	9.63%
	Price	-	8149	8.97%
	Service	Logistics services	16653	18.33%
		Customer service	5995	6.60%
Sum total			90863	100%

5 Discussion

This study, through word frequency statistics, LDA clustering analysis, and weight analysis, reveals the primary demands and concerns of customers regarding children's sunscreen. The analysis first validates the high concern for product efficacy and user experience as stated in consumer behavior theory. Customers' focus on "sun protection effectiveness," "freshness," and "moisturizing sensation" indicates that product performance and user experience are key factors influencing purchase decisions. This finding further supplements the analysis of consumers' needs for product functionality and sensory experience.

Additionally, price and service quality also occupy significant positions in the demand structure, validating the impact of price and service on customer buying behavior as described in market demand analysis theory. Data show that "cost-performance ratio" and "delivery speed" are important indicators for evaluating product and service quality. This aligns with the cost-benefit considerations and service satisfaction theory in market demand analysis, suggesting that there is room for optimization in pricing and logistics services.

The thematic relationship diagram revealed from the LDA analysis further uncovers potential links between different demand dimensions. For example, the association between "brand" and "sun protection effectiveness" shows the impact of brand trust on product efficacy evaluation, validating the influence of brand power in product characteristics and market positioning theory.

New findings from this study also include the relationship between "usage mode" and "product characteristics." The preference for "spray type" is closely related to the demand for "convenience," indicating that businesses should consider designing

products to better match actual usage scenarios. Through these analyses, this study not only enriches the understanding of the children's sunscreen market but also provides data support for future product improvements and the development of appropriate market strategies.

6 Conclusion

This paper mainly discusses the need for children's sunscreen based on user reviews and analyzes in detail consumers' concerns, satisfaction, and potential needs in the purchase and use of child sunscreen. By digging deeper and analyzing user reviews, a more comprehensive understanding of the actual needs of the pediatric sunscreen market has been achieved.

The conclusion drawn by the study shows that the most important thing when consumers choose childhood sunscreen is the sunscreen effect and safety of the product, while the skin feeling and brand reputation are also important factors to consider. This provides a clear direction of product improvement and market orientation for sunscreen manufacturers.

However, this paper needs to be strengthened in consumer behavioral theory and in-depth analysis of skin properties in children. Future research could further incorporate consumer behavioral theory to explore the multiple factors influencing sunscreen purchasing decisions for children. At the same time, examining the specific needs of children's skin would provide a scientific basis for developing more suitable sunscreens. Through the in-depth discussion of these aspects, it can provide a more comprehensive support for the sustainable development of the pediatric sunscreen market.

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