LEX LOCALIS-JOURNAL OF LOCAL SELF-GOVERNMENT
ISSN:1581-5374 E-ISSN:1855-363X
VOL. 23, NO. S4(2025)

EXPLORING THE EFFICACY AND MARKET DEMAND FOR SILICON-FREE HERB-BASED COSMETICS IN THE BEAUTY INDUSTRY

Lan Anh Nguyen[1], Hoang Minh Vu[2]

[1]Finance Trade University, Vietnam;
[2]Marie Curie Hanoi School

lanh89.ftu@gmail.com[1]
hoangminhvu02082008@gmail.com[2]

CORRESPONDING AUTHOR: Lan Anh Nguyen ,
Finance Trade University, Vietnam;
lanh89.ftu@gmail.com

ABSTRACT
Silicon-free herb-based cosmetics have gained significant traction in the beauty industry due to increasing consumer awareness regarding health, sustainability, and natural formulations. These solutions focus on plant-based chemicals with medicinal and dermatological benefits rather than synthetic silicones, which are frequently associated with long-term residue buildup. The goal is to assess these cosmetics' functional effectiveness as well as the changing customer demand for them in today's marketplaces. Data was gathered from 487 participants in urban and semi-urban settings, aged 18 to 45, using standardized questionnaires. Using IBM SPSS statistics version 26, the research included a variety of statistical techniques, including exploratory factor analysis, linear regression, paired sample t-test and ANOVA. Key variables examined were perceived effectiveness, skin compatibility, brand transparency, eco-conscious preferences, pricing, and repeat usage intent. A multi-step strategy was employed in the research, starting with the assessment of consumer preferences and ending with a four-week product testing phase in which participants used specific silicon-free herb-based skincare products. Efficacy was evaluated based on skin hydration, irritation reduction, and overall satisfaction, all measured using a Likert scale. Indicators like purchase frequency, word-of-mouth effect, and interest in herbal cosmetic growths were used to evaluate market demand concurrently. Results exposed that 78% of users reported improved skin feel and reduced irritation. The lack of artificial ingredients was mentioned as a major motivation. The results highlight how herbal cosmetics without silicon could satisfy consumer demand and performance values in the age of clean beauty.

Keywords: Silicon-Free Cosmetics; Herb-Based Formulations; Consumer Preference; Market Demand Analysis; Cosmetic Efficacy.

1. Introduction

The beauty industry has perceived a significant transformation over the past decade, driven by a stream in consumer awareness of immediate product ingredients, ethical sourcing, and environmental sustainability [1]. The growing desire for plant-based and natural skincare products lacking artificial chemicals, particularly silicones, is one of the most observable trends [2]. Silicones have historically been generally used in cosmetic products because they offer a smooth texture, quick absorption, and the brief appearance of perfect skin. Anxieties regarding these artificial ingredients' long-term safety and effects on the environment, however, are becoming more prevalent [3]. Due to their known lack of biodegradability, silicones can build up in waterways and present ecological threats. Their use is commonly criticized for creating a barrier on the skin that can trap oil and materials, which can cause irritation or acne, especially in sensitive people. As a result, a certain group of ecologically reliable and health-sensitive consumers is currently actively seeking substitutes that support clean beauty and sustainable living standards [4, 5]. A growing trend in customer preferences for safer, more natural skincare decisions has made silicon-free, herb-based cosmetics a profitable market position in the beauty business. Botanical extracts, essential oils, and other plant-based substances are commonly used in these formulations instead of synthetic silicones, which have been disapproved for the possibility of residue accumulation and long-term skin issues. The well-established therapeutic, anti-inflammatory, and antibacterial qualities of herbs like chamomile, aloe vera, neem, turmeric, and tea

tree, which have their roots in traditional medical practices, make them popular [6,7]. Through the integration of these components, these cosmetics not only capitalize on the effectiveness of traditional medicines but also satisfy contemporary consumer desires for eco-friendly formulas, clean-label products, and transparency [8]. Although with their growing appeal and alleged health advantages, several herbal cosmetics have not undergone thorough scientific testing. Instead of clinical trials or dermatological investigations, a significant number of commercially accessible formulations are marketed on the basis of anecdotal claims or historical use [9, 10]. This disparity emphasizes the necessity of empirical studies to confirm product efficacy in a range of skin types and environmental circumstances. It is crucial to investigate whether consumers find herb-based products more effective than traditional chemical-based cosmetics and which aspects, like cost, ingredient transparency, eco-certifications, or brand reputation, have a significant influence on their decision to buy [11,12]. Addressing these questions offers valuable insights for researchers aiming to validate product claims, marketers seeking to position their brands effectively, and manufacturers striving to meet the evolving expectations of health-conscious consumers [13, 14]. A dual focus on both functional efficacy and consumer demand not only bridges the gap between tradition and science but also situates silicon-free, herb-based cosmetics as potential frontrunners in the clean beauty movement. Understanding this niche's commercial and therapeutic viability is crucial for determining its sustainable role in the rapidly transforming global beauty landscape [15].

Research Aim

The aim is to analyze the market demand and functional effectiveness of silicon-free herb-based cosmetics by examining consumer perceptions, product performance, and purchasing patterns, with an emphasis on eco-friendly, health-conscious preferences and the effects of natural formulations on skin outcomes and intent to repurchase.

Key contributions

- Data collection involved gathering responses from 487 participants (aged 18–45) in urban and semi-urban areas using structured questionnaires;
- Questionnaire development included a pre-tested, 5-point Likert scale focusing on efficacy, preferences, and purchase behavior;
- Selection criteria ensured that participants were cosmetic users aged 18–45, excluding those with allergies, incomplete responses, or industry affiliations.
- Statistical analysis was conducted using SPSS v.26, applying descriptive statistics, factor analysis, ANOVA, t-tests, and linear regression.

The research [16] focused on brand familiarity, purchase frequency, and knowledge of natural certifications to investigate consumer behavior and preferences for natural cosmetic products. Using a structured questionnaire and an anonymous online survey approach, 807 valid responses were obtained. The results showed that consumers' growing self-awareness and preference for quality over price were driving up demand for natural cosmetics. Personal referrals and influencer marketing become important advertising elements. The examination was constrained, nevertheless, by its dependence on self-reported data and narrow geographic emphasis. It was suggested that further extensive and varied researches be done to authorize the trends found. The purpose of the research was to examine how consumer participation and social media affect consumers' intentions to buy organic beauty products.

Data from 213 online replies were analyzed using the Structural Equation Modeling (SEM) framework [17]. The results showed that purchase intention was significantly impacted by social media and consumer contribution, with the latter acting as a mediating factor. Nonetheless, there was no noticeable moderating influence of generativity. The examination emphasized the value of social media investment for organic beauty industry marketers. The sample size and necessity of self-reported online data were its limitations, indicating the need for more extensive validation.

Using Theory of Planned Behavior (TPB), research employed the Belief Decomposition Approach (BDA) to explore the factors influencing men's intentions to buy green cosmetic goods. 322 responses that were purposefully sampled were analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method. The results indicated that purchasing intentions were certainly impacted by Attitude (ATT), Perceived Behavioral Control (PBC), and Subjective Norm (SN) [18]. ATT was well correlated with environmental consciousness, health, and nutritional content but not with animal welfare. Self-efficacy affected PBC, while family and the media affected SN.

The experiment [19] aimed to investigate girls' inclination and purchasing patterns for flavored cosmetics, emphasizing the rising demand for aromatized beauty goods. Structured interviews for primary data and secondary sources such as magazines, the internet, and libraries were used in a descriptive research approach. Using convenience sampling, 150 individuals were chosen at random. The analysis's modest sample size and non-probability sampling strategy can have an impact on its wider application.

Sentiment analysis (SA) of internet reviews was used in the research [20] to help consumers select natural skincare products. The recommended approach used Python and RapidMiner to analyze 10,000 reviews collected from an e-commerce site using five classifiers: Naïve Bayes (NB), K-Nearest Neighbors (KNN), Support Vector Machine (SVM), Decision Tree (DT), and Deep Learning (DL). According to the findings, DL and DT performed the best, with an F1 score of 60% and an accuracy of about 80%. The restricted dataset size and lack of data diversity delayed the research, indicating that larger and more stable data will be needed for future developments.

The investigation's goal [21] was to discover the variables affecting women's purchasing decisions for herbal cosmetics. To perceive women's purchasing patterns, a descriptive study approach was used, with an emphasis on factors including cost, marketing, and promotional campaigns. Purchase decisions were found to be vastly impacted by psychological and promotional elements. The research's lack of greater demographic or geographic diversity and its regional focus disadvantaged its generalizability.

The efficiency of silicone-free conditioner designs in restoring the physical properties of lightened Mongolian hair was evaluated [22]. A multi-technique approach comprising Optical Microscopy, Atomic Force Microscopy (AFM), X-ray Photoelectron Spectroscopy (XPS), Inverse Gas Chromatography (IGC), and a biomimetic friction system was used to assess structural and sensory changes. Results showed that silicone-free formulations restored hydrophobicity, gloss, and softness comparably to silicone-based products. Limitations included the focus on a single hair type and laboratory-controlled conditions, which could not fully represent diverse real-world usage scenarios.

The purpose of the research [23] was to determine whether a serum formula could support the repair of the skin barrier after different types of external aggressions. Five trials comparing serum-treated and untreated skin following rigorous cleansing, abrasion, or tape stripping under extreme temperatures were conducted utilizing a single-blind, intra-individual clinical approach. Transepidermal Water Loss (TEWL) and pH recovery were shown to be much improved, and skin treated with serum demonstrated increased resilience. The short-term observation period and controlled clinical setting were limitations that might not accurately represent long-term effects under various real-world circumstances.

To investigate how safety and sustainability viewpoints impacted the post-COVID-19 beauty industry's transition [24], the research suggested using a narrative review methodology. Evaluating market trends toward clean beauty methods due to increased health consciousness was the goal. 36 pertinent researches were examined from large databases, and the results showed a rise in consumer desire for ethical production methods and safe, sustainable ingredients. The findings showed that eco-friendly sourcing, lower emissions, and low-impact packaging are becoming increasingly important. The use of secondary data, which can restrict the generalizability and relevance of market activities in real-time, was a significant drawback.

To determine the operational strategies of cooperatives manufacturing organic cosmetics, the research [25] used a mixed-methods approach that included surveys, interviews, and laboratory investigations. Its objectives were to assess consumer preferences, product quality, and market placement. The findings revealed that 66% of cooperatives were dependent on private funding, encountered difficulties obtaining certification, and catered to customer demands for retail locations and dermatological assurance. Financial constraints that impacted certification and limited online consumer reach were two of the limits that had an effect on total sales and growth prospects.

The author of [26] used a quantitative investigation framework to assess how consumers' intentions to purchase cosmetics were influenced by perceived product quality, perceived brand image, and perceived product price. The goal was to identify the main elements influencing consumer behavior in the ruthless beauty sector. The findings indicated that purchase intent was significantly influenced by apparent quality and brand image. Its relatively small and narrow sample size was one of its limitations, which could have an impact on generalizability.

The impact of digital marketing tactics on business performance in the beauty industry was explored using a mixed-methods methodology [27]. The goal was to measure the effects of data-driven approaches, influencer marketing, and social media on sales, loyalty, and return on investment. The results showed that social engagement and sales were strongly positively correlated and that influencer businesses and tailored content increased customer loyalty and confidence. Furthermore, omnichannel tactics improved brand perception and consumer satisfaction. Though, there were drawbacks as well, like privacy issues and digital overload, which could affect the strategy's long-term efficacy.

To explore optimization tactics for influencer marketing in the beauty sector [28], the research used a case analysis methodology. Identifying significant influencer selection factors is necessary to increase brand efficacy. The findings were that when influencer marketing was matched with the target audience, brand value, and influencer type, it critically increased consumer trust and brand awareness. Strategic influencer alignment improves brand image and competitiveness, according to the research's results. It was controlled, nonetheless, by the lack of systematic empirical validation and suggested more general commercial applications for additional analysis.

The investigation [29] employed a quantitative research proposal using descriptive statistics and PLS-SEM to examine the effect of influencing factors on customer expectations toward beauty brands. The objective was to assess how inclusive marketing affects consumer expectations. Based on data from 307 respondents, the results revealed that all influencing factors, mostly multi-ethnic marketing communication, positively affected customer expectations. It underscores the significance of integrating ethnic individuality in brand communication. Nevertheless, the research was limited by its focus on a specific demographic and dependence on self-reported data.

A self-reported questionnaire and statistical analysis based on SPSS were used in this research to examine how changes in the workplace environment affect organizational commitment and job satisfaction in the cosmetics sector [30]. The goal was to evaluate how the COVID-19 epidemic and the fourth industrial revolution affected the intention of employees to leave their jobs. The findings showed that organizational commitment was more certainly impacted by job satisfaction than by environmental changes. According to the research's results, enhancing job satisfaction can decrease income. Broader generalization is, but, controlled by its restricted reach and dependence on self-reported data.

The research is divided into the following sections: Section 1 delivered the Introduction and review of relevant researches. Section 2 covers the Materials and methods, Section 3 describes the Results and Discussions, and Section 4 provides the Conclusion.

2. Materials and Methods

The analysis used a quantitative research design to evaluate market demand and consumer attitudes on silicon-free herb-based cosmetics. Data were collected through designed questionnaires from 487 participants across urban and semi-urban areas. Statistical analyses, including EFA,

regression, paired t test, and ANOVA, were conducted using IBM SPSS Statistics version v26 to understand the results. Figure 1 depicts the flow of the methodology.

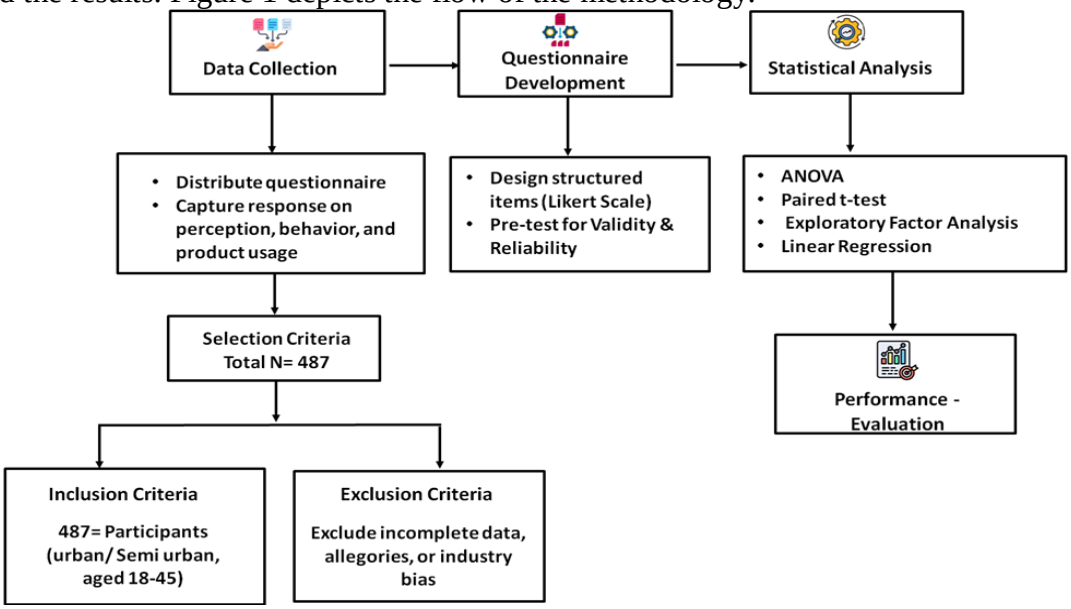

Figure 1. Methodology Flow.

2.1. Data collection

Data collection was shown using structured questionnaires distributed to 487 participants aged between 18 and 45 years from both urban and semi-urban areas. The participants were selected to represent a diverse consumer base concerned with skincare products. The questionnaire collected information on perceptions of product effectiveness, skin compatibility, ethical concerns, and purchase behavior. This approach ensured comprehensive insights into both user experiences and market preferences for silicon-free herb-based cosmetics. **Table 1** and **Figure 2** illustrate the demographic dataset.

Table 1. This is a table. Tables should be placed in the main text near to the first time they are cited.

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	159	32.6
	Female	328	67.4
Age Group	18–25 years	164	33.7
	26–35 years	189	38.8
	36–45 years	134	27.5
Location	Urban	273	56.1
	Semi-Urban	214	43.9
Education Level	High School	72	14.8
	Undergraduate Degree	218	44.8
	Postgraduate and above	197	40.4
Marital Status	Single	211	43.3
	Married	276	56.7
Employment Status	Employed	309	63.5
	Unemployed	178	36.5
Cosmetic Usage Frequency	Regular User	295	60.6
	Occasional User	192	39.4
Awareness of Herbal Products	Aware	362	74.3
	Not Aware	125	25.7
Willingness to Try Herbal Products	Willing	378	77.6
	Not Willing	109	22.4

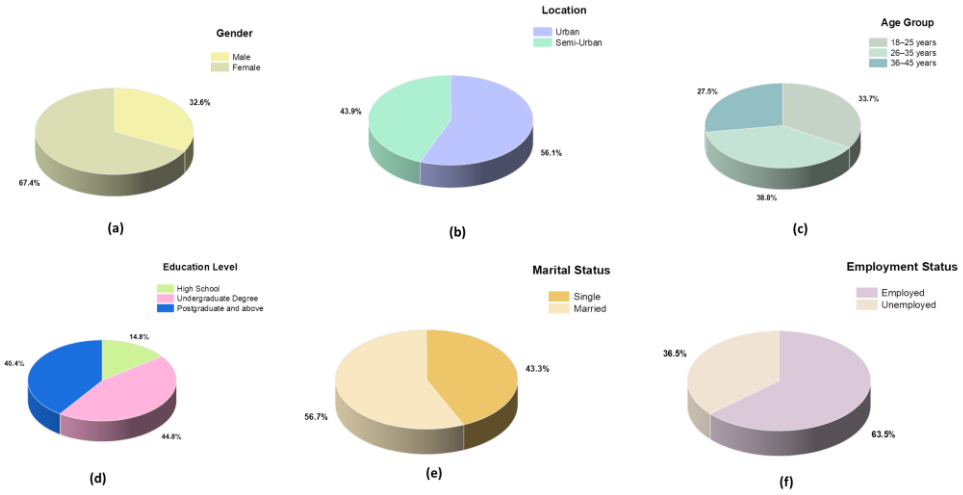

Figure 2. Demographic Pie-chart representation **(a)** Gender, **(b)** Location, **(c)** Age, **(d)** Education level, **(e)** Marital status, **(f)** Employment status

2.2. Questionnaire Development

The questionnaire was formed to collect both user experience and behavioral data to support the research's goal of assessing the functional efficacy and market demand for silicon-free herb-based cosmetics. It contained sections on usage habits, demographic information, and past knowledge of herbal cosmetics. Important concepts were turned into quantifiable products, including perceived efficacy, skin compatibility, brand transparency, eco-conscious choices, pricing, and repurchase intent. For uniformity and ease of analysis, the majority of replies were on a 5-point Likert scale. Before its widespread implementation, the questionnaire underwent a small-scale pre-test to ensure its content validity, clarity, and reliability. **Table 2** represents the consumer perception questionnaire items.

Table 2. This is a table. Tables should be placed in the main text near to the first time they are cited.

S. No.	Questionnaire Items
1	How familiar are you with the concept of silicon-free cosmetics and their benefits?
2	To what extent do you believe herbal ingredients enhance skincare product effectiveness?
3	How significant do you think the absence of synthetic additives is in your cosmetic choices?
4	Have you ever used any silicon-free herb-based skincare products before this study?
5	What product features (e.g., ingredient transparency, eco-friendliness) do you find most important when selecting cosmetics?
6	How would you rate the effectiveness of the product you tried in terms of skin hydration and irritation reduction?
7	How compatible was the product with your skin type and existing skin conditions?
8	How likely are you to repurchase silicon-free herb-based products based on your trial experience?
9	To what extent does brand transparency influence your purchase decision for skincare products?
10	What factors (price, recommendations, packaging, and ethics) most influence your decision to switch to or stay with herbal cosmetic products?

2.3. Selection Criteria

The selection criteria were established to assure the accuracy and pertinence of participant answers while assessing cosmetics made from herbs without silicon. Specific inclusion and exclusion criteria that matched the goals of the research were used to choose participants.

2.3.1. Inclusion Criteria

- Participants aged between 18 and 45 years;
- Individuals residing in urban or semi-urban areas;
- Participants who regularly use or have shown interest in cosmetic or skincare products;
- Willingness to use silicon-free herb-based products for a 4-week trial;
- Provided well-versed consent and accomplished the entire questionnaire.

2.3.2. Exclusion Criteria

- Individuals with severe skin conditions or allergies to herbal ingredients;
- Those currently using prescription dermatological treatments;
- Participants who did not complete the full duration of the product trial;
- Respondents with incomplete or inconsistent questionnaire responses;
- Individuals with professional affiliations to cosmetic companies to avoid bias.

2.3.3. Statistical Analysis

IBM SPSS Statistics version 26 was used for statistical analysis in order to assess the market demand for silicon-free herb-based cosmetics as well as their functional effectiveness. Frequency, percentage, mean, and standard deviation were among the descriptive statistics used to compile participant responses and demographic information. The association between these consumer perception factors and their intention to buy silicon-free items was investigated using linear regression analysis. Group-level differences across variables, such as age, education level, and frequency of cosmetic use, were compared using a one-way ANOVA. Based on demographic traits, this investigation found notable differences in customer responses. When combined, these techniques offered a thorough grasp of the elements influencing customer happiness and interest in the herbal cosmetics market.

3. Results

The findings of this research demonstrate the market need for silicon-free herb-based cosmetics as well as their practical effectiveness. Purchase intent, customer impression, and product performance were among the variables that were thoroughly examined. The consumer's priorities were ascertained by examining the important components, such as skin hydration, brand transparency, and irritation reduction. Statistical analyses revealed important variations across demographic groups, indicating diverse consumer behavior and preferences. To process the data and evaluate important attributes such as cost, eco-conscious preferences, perceived efficacy, skin compatibility, and willingness to use again, IBM SPSS Statistics version 26 was utilized. Additionally, exploratory factor analysis, linear regression, Paired t-test and one-way ANOVA were employed.

3.1. ANOVA- test

ANOVA results validating the research's goal of assessing important consumer perception factors pertaining to herb-based cosmetics without silicon which shows in **Table 3** and **Figure 3**. Moderate relevance was indicated by statistically significant differences in skin compatibility ($F = 3.85$, $p = 0.023$), perceived effectiveness ($F = 4.76$, $p = 0.009$), and cost ($F = 3.34$, $p = 0.038$). Strong customer propensity toward ethical and ecological items was revealed by the high importance of eco-conscious preferences ($F = 5.47$, $p = 0.005$*) and repeat usage intent ($F = 6.89$, $p = 0.002$*). Conversely, brand transparency ($p = 0.098$) did not exhibit any significant change, indicating that it did not have as much of an impact on user choices in this group.

Table 3. ANOVA for Key Cosmetic Variables with Significance Levels

Variables	Sum of Squares	Degree of freedom	Mean Square	F-Value	p-Value	Significance
Perceived Effectiveness	11.24	2	5.62	4.76	0.009*	Moderate Significance
Skin Compatibility	9.37	2	4.69	3.85	0.023*	Moderate Significance
Brand Transparency	6.48	2	3.24	2.12	0.098	Not Significance
Eco-Conscious Preferences	13.05	2	6.52	5.47	0.005**	High Significance
Pricing	10.18	2	5.09	3.34	0.038*	Moderate Significance
Repeat Usage Intent	15.61	2	7.81	6.89	0.002**	High Significance

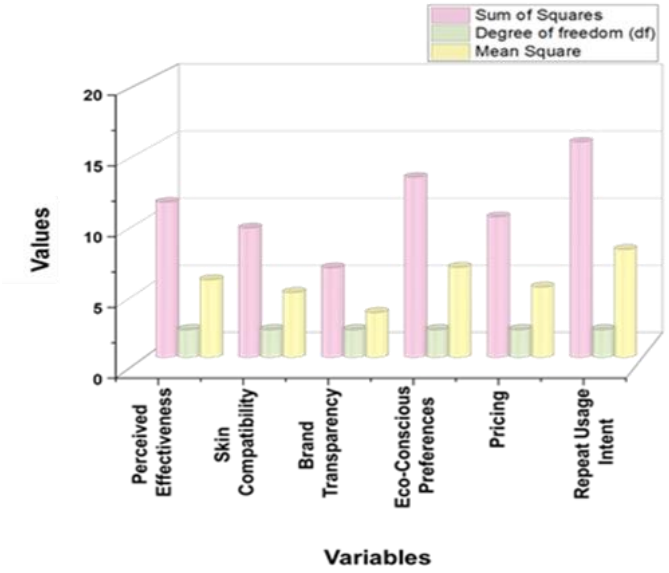

Figure 3. ANOVA Key Cosmetic Variables.

3.2. Exploratory Factor Analysis (EFA)

The exploratory factor analysis results illustrates **in Table 4**. Efficacy, brand image, and purchase intent were the three separate components identified by the EFA that matched the research's goals. Under the efficacy dimension, high factor loadings were noted for skin hydration (0.771), skin compatibility (0.786), and perceived effectiveness (0.812), confirming robust product performance. The following factors are loaded under brand image: ingredient clarity (0.755), eco-conscious appeal (0.789), and brand transparency (0.803), which represent consumer values in ethical product attributes. Recommendation to others (0.824), interest in herbal innovations (0.782), and repeat purchase intent (0.851) all supported the purchase intent factor, suggesting significant future market potential. These findings support the validity of these variables in influencing consumer behavior and validate the questionnaire's format.

Table 4. Exploratory Factor Analysis Results.

Variable	Factor 1 (Efficacy)	Factor 2 (Brand Image)	Factor 3 (Purchase Intent)
Perceived Effectiveness	0.812	-	-
Skin Compatibility	0.786	-	-
Skin Hydration	0.771	-	-
Brand Transparency	-	0.803	-
Eco-conscious Appeal	-	0.789	-
Ingredient Clarity	-	0.755	-
Repeat Purchase Intent	-	-	0.851
Recommendation to Others	-	-	0.824
Interest in Herbal Innovations	-	-	0.782

3.3. Paired Sample t-Test

The paired sample t-test results for pre and post-use ratings of cosmetic variables shows in **Table 5** and **Figure 4**. The results of the paired sample t-test verify that utilizing silicon-free herb-based cosmetics significantly improves consumer perception and product performance. There was a notable increase in skin hydration from 3.05 to 4.18 (mean difference = 1.13, t = 21.94, p <0.001) and a decrease in irritation from 2.82 to 4.01 (mean difference = 1.19, t = 20.66, p < 0.001). Both perceived effectiveness (mean difference = 1.15, t = 21.01) and overall satisfaction (mean difference = 1.10, t = 22.08) showed substantial improvements. The investigation's objective of assessing functional efficacy and consumer response was supported by statistically significant positive movements in all variables, including eco-conscious appeal and brand transparency (p < 0.001).

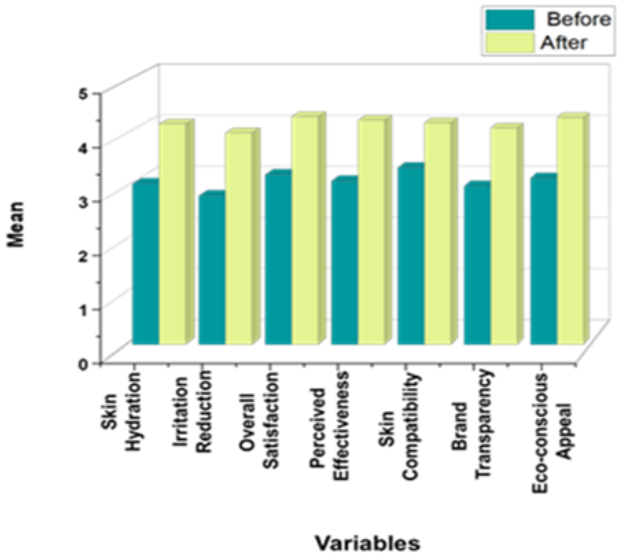

Figure 4. Paired T-test for Pre- and Post-Use Ratings of Cosmetic Variables

Table 5. Paired Sample t-test Results for Pre- and Post-Use Ratings of Cosmetic Variables

Variable	Mean (Before)	Mean (After)	Mean Difference	Std. Deviation of Difference	t-value	df	p-value
Skin Hydration	3.05	4.18	1.13	0.83	21.94	486	< 0.001 **
Irritation Reduction	2.82	4.01	1.19	0.91	20.66	486	< 0.001 **
Overall Satisfaction	3.22	4.32	1.10	0.81	22.08	486	< 0.001 **
Perceived Effectiveness	3.10	4.25	1.15	0.87	21.01	486	< 0.001 **
Skin Compatibility	3.35	4.20	0.85	0.76	19.52	486	< 0.001 **
Brand Transparency	3.00	4.10	1.10	0.88	20.09	486	< 0.001 **
Eco-conscious Appeal	3.15	4.30	1.15	0.84	21.60	486	< 0.001 **

3.4. Linear Regression

The linear regression results for predictors of repeat purchase intent which represents in **Table 6** and **Figure 5**. All seven variables strongly predict the intention to make additional purchases of silicon-free herb-based cosmetics, according to the linear regression analysis. The best predictors were eco-conscious appeal (β = 0.298, t = 6.49), skin hydration (β = 0.312, t = 7.57), and overall satisfaction (β = 0.327, t = 6.71). While brand transparency (β = 0.202) had the lowest but substantial contribution ($p < 0.001$ for all), perceived efficacy (β = 0.289) and irritation reduction (β = 0.278) also showed notable influence. These results demonstrate that both ethical principles and product performance are important factors in determining customer retention.

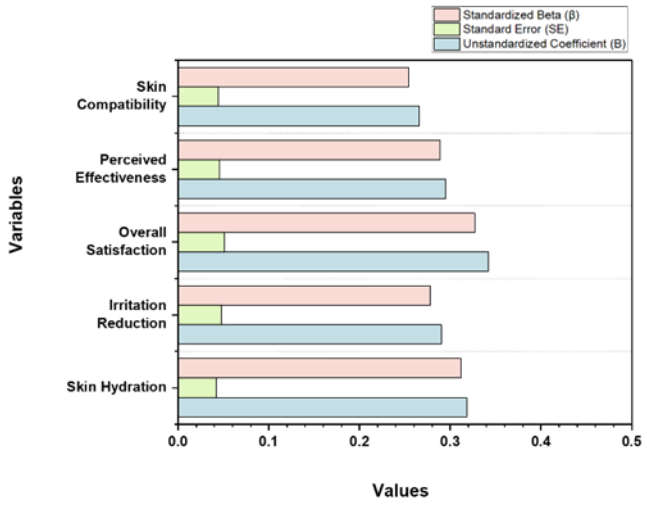

Figure 5. Linear Regression for Predictors of Repeat Purchase Intent.

Table 5. Linear Regression Results for Predictors of Repeat Purchase Intent.

Independent Variable	Unstandardized Coefficient (B)	Standard Error (SE)	Standardized Beta (β)	t-value	p-value	Significance
Skin Hydration	0.318	0.042	0.312	7.57	< 0.001	**
Irritation Reduction	0.290	0.048	0.278	6.04	< 0.001	**
Overall Satisfaction	0.342	0.051	0.327	6.71	< 0.001	**
Perceived Effectiveness	0.295	0.046	0.289	6.41	< 0.001	**
Skin Compatibility	0.266	0.044	0.254	6.05	< 0.001	**
Brand Transparency	0.214	0.039	0.202	5.49	< 0.001	**
Eco-conscious Appeal	0.305	0.047	0.298	6.49	< 0.001	**

4. Discussion

Through statistically validated consumer data, this research aimed to assess the functional efficacy and market demand for silicon-free herb-based cosmetics. Compared to earlier research, this investigation aimed to offer a comprehensive and equitable understanding of user perception, product performance, and purchasing behavior across a wider range of demographics. Consumer behavior toward natural cosmetics was the subject of the research [11], which solely employed online self-reported data from a limited geographic area. As a result, the replies were not as representative, and the results were less generalizable. The credibility of the data was further undermined by the absence of systematic triangulation. A small sample of 213 participants limited the research [12], which examined the impact of social media on the intention to purchase organic beauty products. Additionally, the research relied on online self-reported responses, which could introduce biases and restrict the research's generalizability. Furthermore, no significant geographical or demographic diversity was provided. The Theory of Planned Behavior served as the foundation for [13], which focused on male consumers and their preferences for eco-friendly cosmetics. Despite being theoretically solid, it left out important customer groups including women and younger users. As a result, behavioral insights into environmentally responsible cosmetics were less thorough. Women's preferences for flavored cosmetics were the main subject of the research [14], which used qualitative interviews and descriptive methodologies. Statistical rigor was reduced due to the convenience sampling method and the small sample size of 150 respondents. Furthermore, statistical testing was not used to provide further analytical confirmation for its findings. Sentiment analysis in [15] provided insight into consumer opinion by utilizing classifiers such as SVM and deep learning to analyze online product reviews. Nevertheless, the validity of its conclusions was impacted by the restricted dataset diversity and the absence of direct user engagement. Long-term use and real product experience were not taken into consideration in the results. This proposed research, in comparison, used a structured questionnaire and included 487 people from urban and semi-urban areas who were chosen based on predetermined inclusion criteria. To ensure empirical correctness, it employed SPSS v.26 for factor analysis, paired t test, linear regression, and ANOVA.

5. Conclusions

The incorporation of multiple statistical methods ensured that the research findings were both robust and insightful. Descriptive statistics provide a fundamental overview and make it easier to analyze participant demographics and replies. The construct structure of the questionnaire was validated using Exploratory Factor Analysis (EFA), which also confirmed the reliability of grouped variables like effectiveness and brand perception. One-way ANOVA discovered significant differences across demographic groups, allowing for meaningful comparisons in consumer behavior. Linear regression analysis additionally identified key predictors of purchase intent, such as skin hydration and satisfaction, representing a direct influence on consumer decisions. The combined use of these tools improved the analytical depth and interpretive clarity of the research. Eventually, this comprehensive approach provided a nuanced understanding of both the functional efficacy and market demand for silicon-free herb-based cosmetics. The ability of the research is constrained by its dependence on self-reported data and a particular regional sample. The long-term effects of a product could not be reflected in short-term testing. Further research can examine longitudinal effects, use objective skin tests, and broaden to cover a variety of demographics. Relevance could be improved by using digital tools for tailored cosmetic advice. Long-term customer loyalty and skin advantages can also be confirmed by larger product trials.

Financing

The authors did not receive financing for the development of this research

Conflicts of Interest

The authors declare that there is no conflict of interest.

References

1. Pal, M.O.H.I.T., Pushpendra, R.S., Kanyal, R.I.M.P.A.L., Singh, D.H.A.R.M.E.N.D.R.A., Diwakar, D.I.K.S.H.A., Chauhan, A.S. and Sharma, A.N.S.U.L., 2022. A Detailed Analysis of Herbal Cosmetics. Neuro anthology, 20, p.15. Doi: 10.48047/NQ.2022.20.15.NQ88637
2. Sharma, N., Sharma, M. and Rami, E., 2023. Impact of an herb-based nano-emulsion on the sensory, chemical, and microbiological characteristics of rainbow trout fillets under ice preservation. International Journal of Chemical and Biochemical Sciences, 23(2), pp.11-17. https://doi.org/10.1016/j.lwt.2016.10.009
3. Gęca M, Wiśniewska M, Nowicki P. Simultaneous removal of polymers with different ionic character from their mixed solutions using herb-based biochars and activated carbons. Molecules. 2022 Nov 4;27(21):7557.https://doi.org/10.3390/molecules27217557
4. Suhendra, E.A., 2022. Introducing Traditional Herb-based Medicine 'Boreh'on Wellness Tourism in Bali. Bali Tourism Journal, 6(2), pp.21-24.https://doi.org/10.36675/btj.v6i2.75
5. Singh, S. and Maury, S., 2022. FORMULATION AND EVALUATION OF POLYHERBAL ANTIDANDRUFF POWDER SHAMPOO USING POMEGRANATE SEED AND GUAVA LEAVE. World Journal of Pharmaceutical Research, 11(6), pp.276-291. Doi: 10.20959/wjpr20226-24088
6. Narayana, D.A., Brindavanam, N.B. and Shirsekar, S., 2024. History of safe use of herbs-approaches for documenting evidence. Journal of Ayurveda and Integrative Medicine, 15(1), p.100849. https://doi.org/10.1016/j.jaim.2023.100849
7. Sarpaneswaran, S., Chandran, V.G.R., Suntharalingam, C. and Ng, B.K., 2022. Surviving the storm: Synergistic partnership of knowledge management, marketing and innovation strategies in the cosmetic industry. African Journal of Science, Technology, Innovation and Development, 14(5), pp.1215-1226.https://doi.org/10.1080/20421338.2021.1943606
8. Dhillon, R., Agarwal, B. and Rajput, N., 2022. Experiential marketing strategies used by luxury cosmetics companies. Innovative marketing, 18(1), pp.49-62. Doi: 10.21511/im.18(1).2022.05
9. Abraham, J.S.E., Floreto, S.J.L., Pagkalinawan, M.I.B. and Etrata, A.E., 2022. Consumer perception on influencer marketing efforts of brands in the beauty and cosmetics industry.

International Journal of Social and Management Studies, 3(2), pp.105-118.https://doi.org/10.5555/ijosmas.v3i2.122

10. Wang, H., Chen, Y., Wang, L., Liu, Q., Yang, S. and Wang, C., 2023. Advancing herbal medicine: enhancing product quality and safety through robust quality control practices. Frontiers in pharmacology, 14, p.1265178.https://doi.org/10.3389/fphar.2023.1265178
11. Alnuqaydan, A.M., 2024. The dark side of beauty: an in-depth analysis of the health hazards and toxicological impact of synthetic cosmetics and personal care products. Frontiers in Public Health, 12, p.1439027. https://doi.org/10.3389/fpubh.2024.1439027
12. Asori, M., Odei, J., Katey, D., Abuosi, T.A. and Gyasi, R.M., 2022. Impacts of endocrine disruptors on reproductive health in the era of increased personal care and beauty products usage. Bulletin of the National Research Centre, 46(1), p.61.https://doi.org/10.1186/s42269-022-00732-0
13. McDonald, J.A., Llanos, A.A., Morton, T. and Zota, A.R., 2022. The environmental injustice of beauty products: toward clean and equitable beauty. American journal of public health, 112(1), pp.50-53.https://doi.org/10.2105/AJPH.2021.306606
14. Garg, M. and Bakshi, A., 2024. Exploring the impact of beauty vloggers' credible attributes, parasocial interaction, and trust on consumer purchase intention in influencer marketing. Humanities and Social Sciences Communications, 11(1), pp.1-14. https://doi.org/10.1057/s41599-024-02760-9
15. Rathnayake, R.A.S.D. and Lakshika, V.G.P., 2022. Impact of social media influencers' credibility on the purchase intention: reference to the beauty industry. Asian Journal of Marketing Management, 2(01).https://doi.org/10.31357/ajmm.v2i01.6254
16. Ratajczak, P., Landowska, W., Kopciuch, D., Paczkowska, A., Zaprutko, T. and Kus, K., 2023. The growing market for natural cosmetics in Poland: Consumer preferences and industry trends. Clinical, Cosmetic and Investigational Dermatology, pp.1877-1892.https://doi.org/10.2147/CCID.S411032
17. Gani, M.O., Roy, H., Rahman, M.S., Faroque, A.R., Gupta, V. and Prova, H.T., 2023. Effect of social media influence on consumer's purchase intention of organic beauty products: the role of customer's engagement and generativity. International Journal of Spa and Wellness, 6(1), pp.54-77.https://doi.org/10.1080/24721735.2022.2096292
18. Ali, S., Usama Javed, H.M., Ali, W. and Zahid, H., 2023. Decoding men's behavioral responses toward green cosmetics: An investigation based on the belief decomposition approach. Journal of Environmental Planning and Management, 66(13), pp.2640-2667.https://doi.org/10.1080/09640568.2022.2081137
19. NADU, I.D.D.O.T., 2022. Factors influencing customers buying behaviour towards herbal cosmetic products. NeuroQuantology, 20(10), pp.5880-5888.Doi: 10.14704/nq.2022.20.10.NQ55588
20. Marlina, D., Tri Basuki, K., Mohd Zaki, Z. and Siti Farahnasihah, A., 2022. Sentiment Analysis on Natural Skincare Products. Journal of Data Science, 2022(12), pp.1-17.
21. Ghorpade, P. and Kulkarni, A., 2023. A study of factors affecting Women Consumer Behaviour with special reference to Herbal Cosmetic Products. MARKETI NG, FINANCE & HRM, p.92. Doi: 69. 10.24018/ejeng.2022.7.5.2888.
22. Liu, Z., Graf, K., Hub, J. and Kellermeier, M., 2022. Effects of cosmetic emulsions on the surface properties of Mongolian hair. ACS omega, 7(13), pp.10910-10920.https://doi.org/10.1021/acsomega.1c06526
23. Pichon, C., Mesrobian, M., De Bussy, S., Valverde, E. and Gueniche, A., 2025. Efficacy in Clinical Studies of a Skin Care Serum Formula Containing 7 Short and Long Saccharides and Bacterial Fractions to Repair and Strengthen the Skin Barrier From Aggressions in Intense Conditions. Journal of Cosmetic Dermatology, 24(5), p.e70193. https://doi.org/10.1111/jocd.70193

24. Lee, J. and Kwon, K.H., 2022. Sustainable changes in beauty market trends focused on the perspective of safety in the post-coronavirus disease-19 period. Journal of cosmetic dermatology, 21(7), pp.2700-2707.https://doi.org/10.1111/jocd.14493
25. El-Otmani, N., Zeouk, I., Hammani, O. and Zahidi, A., 2024. Analysis and Quality Control of Bio-actives and Herbal Cosmetics: The Case of Traditional Cooperatives from Fes-Meknes Region. Tropical Journal of Natural Product Research, 8(5). https://doi.org/10.1186/s41702-020-00062- 9
26. Othman, A.S., Abd Rahman, I., Teoh, N., Omar, A.R.C. and Osman, L.H., 2022. An empirical study on the factors influencing consumers' purchase intention of cosmetic products. Malaysian Journal of Social Sciences and Humanities (MJSSH), 7(6), pp.e001512-e001512. Doi:10.47405/mjssh.v7i6.1512.
27. Bakri, Z.F., 2023. Analyzing the influence of digital marketing strategies on business performance in the beauty industry: a comprehensive analysis of social media engagement and influencer collaborations. Journal on Economics, Management and Business Technology, 2(1), pp.37-48. https://doi.org/10.35335/jembut.v2i1.187
28. Xin, T., 2024. Optimizing Influencer Marketing Strategies in the Beauty Industry: Case Analysis. Advances in Economics, Management and Political Sciences, 110, pp.34-38. https://doi.org/10.54254/2754-1169/110/2024ED0109
29. Nadhirahastri, N., 2022. Transformation of beauty industry: how inclusive marketing-communication escalate customer's expectation towards Indonesian beauty brands. Asian Journal of Research in Business and Management, 4(3), pp.595-606. https://doi.org/10.55057/ajrbm.2022.4.3.51
30. Shin, E.J. and Kwon, K.H., 2023. The structural relationship between job satisfaction and organizational commitment of beauty industry employees. Journal of Cosmetic Dermatology, 22(3), pp.980-1000. https://doi.org/10.1111/jocd.15479