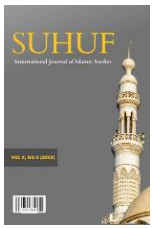
SUHUF

Vol. 38, No. 1, 2026

International Journal of Islamic Studies

journal homepage: https://journals2.ums.ac.id/index.php/suhuf/index



Mapping Ethical Consumption Patterns in Halal Cosmetics Using Data-Driven Clustering

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https://doi.org/10.23917/suhuf.v38i1.17148

ARTICLE INFO

ARTICLE HISTORY
Received Month 04, 2026
Revised Month 04, 2026
Accepted Month 05, 2026

KEYWORDS
Halal Cosmetics
Ethical Consumption
Consumer Segmentation
K-Means Clustering
B2B Marketing

ABSTRACT

Background: The growing demand for halal cosmetic products reflects increasing ethical awareness among Muslim consumers. Understanding how ethical consumption patterns are formed is essential for businesses operating along the halal value chain, particularly in the era of artificial intelligence (AI)-driven decision-making. **Objective:** This study aims to map ethical consumption patterns in halal cosmetic products using a data-driven clustering approach and to examine their implications for B2B marketing strategies. **Methodology**: Survey data were collected from halal cosmetic consumers in Indonesia using a Likert-scale instrument. Ethical consumption scores were constructed by integrating halal awareness, halal literacy, attitudes, subjective norms, perceived behavioral control, social influence, intention, and behavior. An exploratory K-Means clustering analysis, supported by the Elbow Method, was applied to identify optimal consumer segments based on data patterns. **Results**: The findings reveal three distinct clusters reflecting varying levels of ethical orientation. The first cluster demonstrates strong internalization of halal values and consistent alignment between intentions and behavior. The second cluster highlights the influence of cognitive and normative factors, while the third cluster is characterized by relatively weaker ethical commitment and greater external influence. **Implications**: Ethical consumption in halal cosmetics is primarily driven by internal values rather than social pressure. These insights support the development of targeted segmentation and distribution strategies, as well as AI-based supply chain collaboration aligned with Islamic ethical principles.

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1. Introduction

The halal cosmetics industry has become one of the fastest-growing segments within the global halal ecosystem. Halal cosmetics are no longer perceived merely as products that comply with sharia requirements regarding ingredients and production processes, but also as representations of ethical values, safety, cleanliness, and corporate moral responsibility toward Muslim consumers [1]. In this context, halal cosmetic consumption reflects muamalah practices that integrate religious, ethical, and economic dimensions [2].

Business decisions in halal industries are influenced not only at the business-to-consumer (B2C) level but also through interactions among firms in business-to-business (B2B) relationships, including suppliers, manufacturers, distributors, retailers, and certification institutions. Decisions regarding partner selection, distribution channel governance, and halal value communication directly affect consumer trust and market legitimacy [3], [4]. Consequently, understanding ethical consumption patterns becomes an important strategic input for B2B marketing decision-making.

Consumers increasingly frame halal cosmetic consumption as an ethical choice rather than merely an act of religious compliance. Prior studies indicate that halal cosmetics are commonly perceived as safer, more transparent, and more aligned with manufacturers' ethical commitments [1], [5]. Ethical awareness strengthens governance expectations across the halal value chain and influences inter-firm collaboration structures [4].

From a theoretical perspective, consumers develop their understanding of halal principles through halal awareness and halal literacy, which guide evaluations of sharia compliance and product integrity [6]. These constructs shape attitudes toward halal products and, together with subjective norms, become central determinants of purchase intention within the Theory of Planned Behavior (TPB) framework [7], [8]. Perceived behavioral control further reflects consumers' perceived capability to engage in halal consumption behavior [9], while contextual self-efficacy strengthens behavioral consistency [10]. Social influence operates as an external mechanism that reinforces or weakens consumption intentions [11], [12]. Intention ultimately serves as a proximal predictor, bridging cognitive and normative factors with actual purchasing behavior [9], [13].

Halal literacy has evolved into an evaluative competence shaping how consumers assess corporate credibility [6]. Research shows that halal literacy reinforces positive attitudes and religiosity-based norms in purchasing decisions [3]. From a B2B standpoint, halal literacy compels firms to enhance transparency and communication across the supply chain.

Simultaneously, rapid advances in artificial intelligence (AI) and data analytics have transformed marketing practices in B2B environments. AI technologies enable firms to improve segmentation accuracy and strategic responsiveness [14]. However, AI implementation is not ethically neutral. Algorithmic systems optimized solely for efficiency may overlook moral considerations embedded in religion-based markets [15]. Islamic business ethics emphasize justice and moral responsibility in commercial activities [16]. Therefore, AI adoption in halal industries must remain aligned with ethical principles [17].

Data-driven clustering approaches such as K-means provide an alternative method for mapping heterogeneous ethical consumption patterns without predefined segmentation assumptions [18], [19]. Compared with linear behavioral models [9], clustering enables the identification of distinct ethical orientations that can inform adaptive distribution strategies and trust-based supply chain governance [4]. Based on this background, this study aims to map ethical consumption patterns in halal cosmetic products using a data-driven clustering approach and to examine their implications for B2B marketing decision-making in the era of artificial intelligence.

2. Method

2.1 Data and Measurement

This study adopts a quantitative, survey-based approach to map ethical consumption patterns of halal cosmetic products through data analysis. The researchers collected primary data using an online questionnaire distributed to Muslim female consumers who had purchased and used halal cosmetic products at least once. A total of 200 valid responses were included in the analysis.

The researchers developed the research instrument based on constructs widely used in halal consumer behavior studies, including halal awareness, halal literacy, attitude, subjective norm, perceived behavioral control, social influence, self-efficacy, intention, and behavior. All measurement items employed a Likert scale. For clustering purposes, construct scores were calculated by averaging the values of their respective indicators, following standard aggregation procedures commonly applied in multivariate analysis [20]. Accordingly, the construct score for respondent *i* on construct *c* is computed as follows:

$$CS_{IC} = \frac{1}{m_c} \sum_{j=1}^{m_c} x_{ij}$$

Next, all construct scores were normalized using Z-scores to eliminate scale differences across variables and ensure balanced contributions in the clustering process. Z-score normalization is a widely used standardization technique in statistical analysis [20], [21]. The normalization is defined as:

$$Z_{IC} = \frac{CS_{IC} - \mu_C}{\sigma_C}$$

Whereμ_c andσ_c represent the mean and standard deviation of the$c$ th construct, respectively.

2.2 Clustering Procedure

Cluster analysis was performed using the K-means algorithm to group respondents into several segments based on similarities in their ethical consumption patterns and behaviors. The main objective of K-means is to minimize variation within clusters (within-cluster variance) with the following objective function:

$$min_{C1 \ldots Ck} \sum_{k=1}^{K} \sum_{x_i \in C_k} \|x_i - \mu_k\|^2$$

Euclidean distance was used to measure the proximity of each observation to the cluster center (centroid). The optimal number of clusters was determined using the Elbow Method, which observes changes in the Within-Cluster Sum of Squares (WCSS) value:

$$WCSS\ (K) = \sum_{k=1}^{K} \sum_{x_i \in C_k} \|x_i - \mu_k\|^2$$

The number of clusters is selected at the point where the decline in WCSS slows significantly. After the clusters are formed, each cluster is analyzed using the average construct value to identify the dominant ethical consumption characteristics. The results of this clustering are then interpreted to

yield strategic implications for developing more sustainable, trust-based B2B relationships in the halal cosmetics industry.

3. Results and Discussion

3.1 Determination of Optimal Clusters

The number of clusters was determined using the Elbow Method by evaluating the Within-Cluster Sum of Squares (WCSS) at different cluster sizes. The visualization results, presented in Fig. 1, show a clear elbow at K = 3, where the decline in WCSS slows significantly. These results indicate that adding more than three clusters does not substantially improve the model's explanatory power, as the marginal reduction in within-cluster variance becomes minimal. Therefore, K = 3 was selected as the optimal number of clusters, balancing model simplicity and segmentation accuracy while ensuring meaningful differentiation among consumer ethical consumption patterns in the halal cosmetics industry.

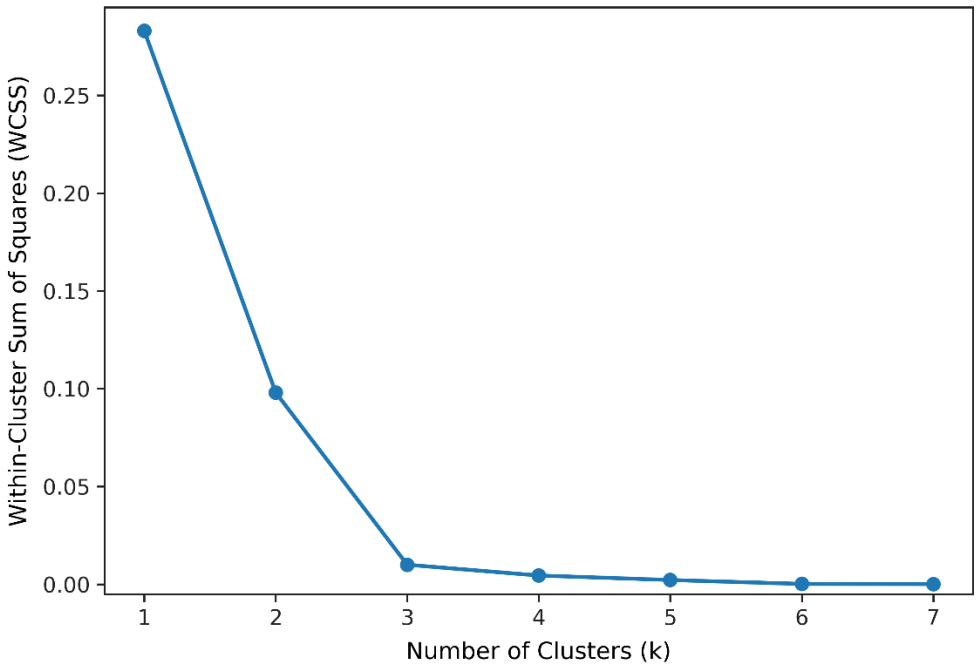

Fig.1. Elbow Method for Determining the Optimal Number of Clusters

3.2 Consumer Segmentation Using K-means

After the number of clusters was determined, the analysis continued with K-means clustering using K = 3. The clustering results showed three consumer segments with distinct ethical characteristics, based on the average scores for the constructs (awareness, literacy, attitude, subjective norm, perceived behavioral control, social influence, self-efficacy, intention, and behavior). The cluster distribution and segment separation are shown in Figure 2, which provides a visual representation of the relative positions of the groups based on the features used in the clustering process.

Table 1 presents the average values of consumption ethics constructs in each cluster. Cluster A shows the highest scores in almost all constructs, particularly halal awareness, halal literacy, attitude, self-efficacy, and consistency between intention and actual behavior. This pattern reflects a strongly

internalized ethical orientation. In contrast, Cluster B shows dominance in subjective norm and social influence, indicating that external factors and the social environment influence consumption decisions. Cluster C shows the lowest scores across almost all constructs, particularly perceived behavioral control and self-efficacy, suggesting low intention and inconsistent halal purchasing behavior.

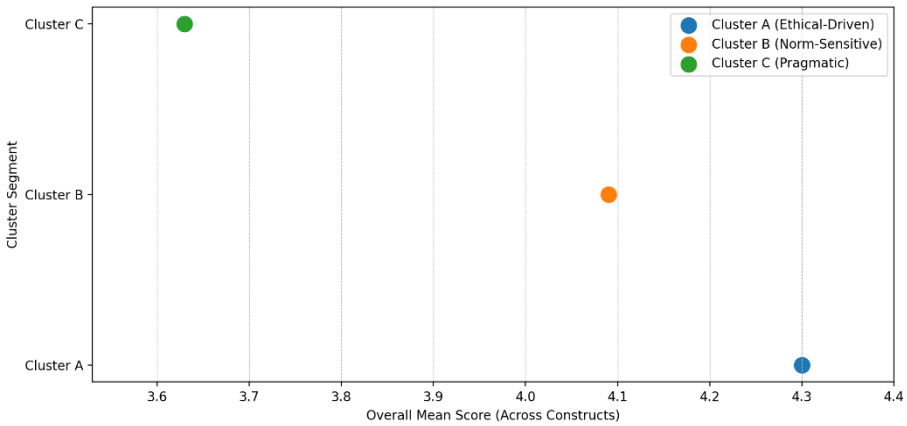

Fig.2. Visualization of K-means Clustering Results

Table 1. Mean Scores of Ethical Consumption Constructs Across Clusters

Construct	Cluster A (Ethical-Driven)	Cluster B (Norm-Sensitive)	Cluster C (Pragmatic)
Halal Awareness	4.45	4.10	3.7
Halal Literacy	4.38	4.05	3.6
Attitude	4.42	4.00	3.65
Subjective Norm	4.10	4.32	3.8
Perceived Behavioral Control	4.21	4.02	3.55
Social Influence	4.05	4.28	3.7
Self-Efficacy	4.30	3.95	3.5
Purchase Intention	4.40	4.05	3.6
Actual Behavior	4.35	4.00	3.55

Note: Values represent mean construct scores based on Likert-scale responses

Cluster A – Ethical-Driven Consumers

As shown in Figure 2, Cluster A has the highest mean score (around 4.3–4.4). This cluster shows the highest average scores in almost all constructs, including halal awareness, halal literacy, attitude, self-efficacy, purchase intention, and actual behavior. The consistency between Figure 2 and Table 1 confirms that the ethical orientation in this cluster is internalized and relatively stable. This segment reflects consumers who make halal values the primary basis for their consumption decisions.

Cluster B – Norm-Sensitive Consumers

Cluster B falls within the middle of the mean score range (around 4.1–4.2), indicating that this cluster has moderate scores on cognitive constructs but relatively higher scores on subjective norm and social influence. This consistency indicates that consumption behavior in this cluster is more influenced by the social environment and external legitimacy, reflecting dependence on social norms and external references in shaping purchasing decisions.

Cluster C – Pragmatic Consumers

Cluster C appears distinct, with the lowest mean score (around 3.7–3.8), indicating the lowest scores across almost all constructs, especially perceived behavioral control, self-efficacy, and purchase intention. This cluster reflects a more pragmatic consumption orientation, less driven by ethical values. This segment is more sensitive to utilitarian factors such as price, product availability, and ease of access than to the narrative of halal values.

3.3 Discussion

The clustering results confirm that ethical consumption in the halal cosmetics market is heterogeneous, reflecting varying levels of value internalization and social influence across segments.
Importantly, these findings provide empirical evidence that extends the Theory of Planned Behavior by demonstrating that consumer behavior is driven not solely by linear relationships among variables but also by distinct configurations of cognitive, normative, and behavioral factors.

Cluster A (Ethical-Driven Consumers) demonstrates consistently high scores across key constructs, including halal awareness, halal literacy, attitude, self-efficacy, intention, and actual behavior. This pattern indicates strong internalization of halal values, with ethical considerations as the primary driver of consumption decisions. Within the TPB framework, this cluster reflects a fully aligned structure in which attitude, perceived behavioral control, and intention consistently translate into behavior. The alignment between intention and behavior supports prior findings that ethical commitment enhances behavioral consistency in religious consumption contexts [9], [13]. From an ethical consumption perspective, this cluster illustrates value-driven consumption, in which moral considerations are embedded in decision-making. From a B2B perspective, this segment underscores the importance of transparency, compliance with certification standards, and supply chain integrity, as ethically driven consumers indirectly exert governance pressure on upstream partners [4].

Cluster B (Norm-Sensitive Consumers) exhibits relatively higher scores in subjective norm and social influence while maintaining moderate levels in cognitive constructs. These results suggest that purchasing behavior is more strongly shaped by external legitimacy and social influence than by deep ethical internalization. This finding extends TPB by showing that normative pressure can act as a dominant driver when attitudinal commitment is less pronounced. From an ethical consumption perspective, values in this segment are socially reinforced rather than internally embedded. These findings align with prior studies indicating that social norms mediate the relationship between awareness and behavior in religion-based markets [8], [11], [12]. In B2B contexts, firms should prioritize institutional collaboration, including partnerships with certification bodies and community stakeholders, to strengthen market legitimacy.

Cluster C (Pragmatic Consumers) records the lowest scores across most constructs, particularly perceived behavioral control, self-efficacy, and purchase intention. This segment reflects a utilitarian orientation, where halal attributes play a complementary rather than dominant role in decision-making. From a TPB perspective, this cluster highlights the limitations of perceived behavioral control and intention in translating ethical awareness into actual behavior. From an ethical consumption standpoint, this finding confirms that situational and economic factors moderate ethical decision-making. Consumption behavior in this group is more sensitive to price, accessibility, and product availability. For firms, operational efficiency and effective distribution strategies remain critical for engaging this segment [22], [23].

These findings demonstrate that clustering provides a more comprehensive understanding of ethical consumption patterns than linear behavioral models. While the Theory of Planned Behavior explains causal relationships among attitude, norms, and intention [9], clustering captures how these constructs interact simultaneously to form distinct consumer profiles. These results represent a shift

from a variable-based to a pattern-based segmentation approach, thereby extending TPB's explanatory power in complex, value-driven markets.

From an AI-driven marketing perspective, the use of clustering reflects a transition from hypothesis-driven segmentation to data-driven pattern recognition and aligns with recent developments in artificial intelligence, where segmentation is increasingly based on behavioral patterns rather than predefined assumptions [18], [19]. However, the findings also highlight that AI applications in halal markets must remain ethically grounded. Although AI enhances segmentation accuracy and strategic responsiveness [14], it may reduce ethical considerations to efficiency-driven variables if not properly governed [15]. Islamic business ethics emphasize accountability, fairness, and responsibility [16], requiring firms to balance technological optimization with value-based decision-making.

Managerially, firms should adopt differentiated strategies based on segment characteristics. For Ethical-Driven Consumers, the emphasis should be on strengthening traceability systems and ensuring certification transparency. For Norm-Sensitive Consumers, firms should focus on building legitimacy through institutional partnerships and community engagement. For Pragmatic Consumers, efficiency-oriented strategies, including optimized distribution networks and demand forecasting systems, can be implemented without compromising halal compliance standards.

4. Conclusion

This study aimed to map ethical consumption patterns in halal cosmetic products using a data-driven clustering approach and to examine their implications for B2B marketing decision-making in the era of artificial intelligence (AI). The findings reveal three distinct clusters (Ethical-Driven, Norm-Sensitive, and Pragmatic), each reflecting varying configurations of ethical orientation. These results demonstrate that ethical consumption in the halal cosmetics market is inherently heterogeneous and cannot be fully explained through linear intention-based models alone. By applying K-means clustering, this study provides a more comprehensive understanding of how multiple ethical constructs interact simultaneously to form distinct consumption patterns.

From a theoretical perspective, this study extends the Theory of Planned Behavior by demonstrating that ethical consumption is better understood as a set of patterned configurations rather than linear relationships among variables. The findings show that cognitive, normative, and behavioral dimensions do not operate independently, but interact in specific combinations across consumer segments. This pattern-based perspective enhances the explanatory power of TPB in complex, value-driven markets, particularly in religion-oriented contexts. Furthermore, this study contributes to the ethical consumption literature by highlighting that value internalization varies across segments, ranging from deeply embedded ethical commitment to socially influenced and pragmatic orientations.

In addition, this research advances the literature on AI-driven marketing by positioning clustering as a data-driven segmentation approach that complements traditional behavioral models. Rather than relying solely on predefined theoretical assumptions, clustering enables the identification of empirical patterns that reflect real-world consumer heterogeneity. This integration of ethical consumption theory, halal literacy discourse, and AI-driven segmentation provides a unified analytical framework for understanding value-based market dynamics. From a practical perspective, the findings offer strategic guidance for halal industry players in designing differentiated B2B marketing strategies, strengthening supply chain governance, enhancing certification transparency, and utilizing AI as a value-supporting decision tool rather than merely an efficiency-driven mechanism.

Despite these contributions, this study has several limitations. The sample was limited to halal cosmetic consumers in a specific geographic area, which may restrict generalizability. Additionally, the clustering approach identifies patterns but does not establish causal relationships among variables. Future research may expand the sample across countries, compare different halal product categories, or adopt longitudinal designs to examine the stability of ethical segments over time. Further studies

could also explore hybrid AI models that combine clustering with predictive analytics to enhance strategic decision-making.

Author Contribution: Prita Prasetya: Conceptualization, research design, methodology development, data analysis, writing, original draft preparation, and supervision. Mukhamad Najib: Conceptualization, methodological validation, data interpretation, writing, review, and editing. Febrina Mahliza: Data collection, instrument development, statistical analysis, and writing review and editing. Teuku Fajar Akbar Darmawan: Analytical framework refinement, validation of clustering methodology, writing, review, and editing, and critical revision of the manuscript. All authors have read and approved the final version of the manuscript. The author contribution statement follows the CRediT (Contributor Roles Taxonomy) guidelines to ensure transparency and accountability.

Acknowledgment: The authors would like to express their sincere gratitude to all respondents who participated in this study and to colleagues who provided valuable feedback during the development of the research framework. The authors also acknowledge institutional support from their respective universities, which facilitated the research process.

Conflicts of Interest: The authors declare no conflict of interest.

Declaration of Generative AI: Generative AI was used only for language and formatting support; the authors reviewed, verified, and take full responsibility for the final content.

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