Quality Assessment of Skincare Products with Simple Additive Weighting Approach to Detect Illegal Skincare Products

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ABSTRACT

The increasing public need for skincare products encourages manufacturers to innovate in creating products that suit consumer needs. However, with easy access to information in the digital era, new problems have arisen related to the diversity of skincare products on the market, including the rise of fake products containing dangerous ingredients. This research uses the Simple Additive Weighting method to evaluate the quality of skincare products based on predetermined criteria. With a large female population in Indonesia and significant growth in online sales of skincare products, this research contributes to helping consumers choose safe and effective skincare products. It is hoped that using the Simple Additive Weighting method can identify or reduce the risk of using fake skincare which can endanger skin health and cause serious dermatological problems. Therefore, a thorough understanding of skincare and the use of analytical methods such as Simple Additive Weighting are important in the consumer decision-making process.

KEYWORDS
Skincare
Decision-Making Process
Simple Additive Weighting

1. Introduction

Skincare is a series of activities that support skin health [1], [2], [3]. The meaning of skincare includes improving the appearance and alleviating skin conditions. Skincare can include nourishment for the skin to avoid the negative effects of excessive sun exposure [4], [5].

From Indonesia’s population of 267 million with a female population of 130 million, Skincare products are increasingly in demand. This is evident from the increase in online sales of Skincare products which reached 4.75%. Other predictions also show that the industry will surpass $716 billion by 2025 and $784.6 billion by 2027 [6], [7]. According to research data from Mckinsey revealed that there was a 20-30% jump in the online revenue of beauty industry players during the pandemic outbreak [8], [9], [10].

The increasing need for Skincare has made producers compete to create Skincare products that suit the needs of consumers [11]. In this digital era, access to skincare, be it product information, product sales, to product usage reviews, is increasingly easy to get through social media, market places, and other digital sources [12].

However, this convenience also raises new problems related to the diversity of skincare products available in the market. The problem is the rampant circulation of illegal Skincare or Skincare with harmful ingredients, of course this can endanger skin health and cause serious dermatological problems.

The use of these dangerous products can trigger a wide range of side effects. The most common thing that happens is skin irritation, because the workings of mercury itself erode the skin continuously so that the skin becomes white faster in a short time. This triggers consumers to prefer dangerous products with quick results. However, if used for a long period of time, it will cause other problems such as organ damage, eye damage, cancer and severe health risks.
After observation, there were about 400 users of illegal skincare products from 5 cosmetic stores in Cisaat market. The most sales of dangerous skincare is store C, which can sell 120 products in one month. Then Store B can sell 100 products in one month, Store E 85 products in one month, store A 50 products in one month, and Store D 45 products in one month.

However, this convenience also raises new problems related to the diversity of skincare products available on the market. The problem is the rampant circulation of fake Skincare or Skincare with harmful ingredients [13], [14]. Of course, this can harm skin health and cause serious dermatological problems. The use of this dangerous product can trigger various kinds of side effects. The most common thing that happens is irritation of the skin, because the workings of mercury itself erode the skin continuously so that the skin becomes whiter faster in a short time. This triggers consumers to prefer dangerous products with fast results. However, if used for a long time it will cause other problems such as organ damage, eye damage, cancer and severe health risks.

Based on the literature review of various related studies, the use of a Decision Support System using the SAW method is suitable for use in this case because it is very close to the highest preference value [15]. In addition, the comparison between the SAW method and the TOPSIS method, the SAW method is greater in value than the TOPSIS method [16].

This research provides benefits for users of beauty cosmetics to be more careful in the processing of selected products, by paying attention to existing indicators. In addition, for the Government to further tighten product supervision through BPOM, by means of clear regulations so that the public does not become victims of dangerous beauty products.
2. Literature Review

In research first SAW method is the right method to solve the problem of teenagers' needs for skincare products at affordable prices. Using several relevant criteria produces alternative skincare products with a low budget but has the maximum benefits for teenagers [17].

Research second uses SAW and TOPSIS methods to find suitable products. From several products, the Ponds brand is ranked first as the best alternative. This research also argues that the SAW method is more relevant and suitable for solving this case compared to the TOPSIS method [16].

Research third conducted similar research using the AHP method. The number of people who want to use skincare products, but are confused in determining which products are suitable for their skin problems. With this AHP method can determine skin care products based on priorities from the calculation results of the AHP method [13].

3. Method

In conducting this research, the author identified the problems caused by the use of illegal skincare. The author observes a cosmetic store that sells more than 50 types of cosmetic products. This research uses the SAW method with several variables relevant to the object of research, namely, products, users, reviews and product safety. This research will produce which products are suitable for marketing.

![Fig. 3. Framework](image)

3.1 Data Collection

In conducting this research, there are three data collection methods used by the author:

a. Observation

The author made observations to several cosmetic stores in the market, of the several shops that operate, there are still many that sell illegal cosmetics [18].

b. Interview.

The author conducted an interview with one of the cosmetics store partners regarding the urgency of the problem of using cosmetics (the interview form is listed in the attachment) [19], [20], [21]. In addition, the author also conducted interviews with several people who have used Skincare products. Some of them are people who have used harmful products that cause side effects on facial skin.

c. Literature

The author studies this SAW method by observing several previous journals from 2020-2024. Of the ten journals, the method that is very relevant to this case is the SAW method. This method is superior and more accurate than TOPSIS, AHP, PROMETHE and other SPK methods.
3.2 SAW Processing
In this research, 4 relevant criteria have been determined in determining skincare products that are suitable for consumers. Namely, sales level, selling price, rating and harmful content in the product.

<table>
<thead>
<tr>
<th>Table 1. SAW Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 SELS Benefit</td>
</tr>
<tr>
<td>C2 PRICE Cost</td>
</tr>
<tr>
<td>C3 RATING Benefit</td>
</tr>
<tr>
<td>C4 HAZARDOUS SUBSTANCES cost</td>
</tr>
</tbody>
</table>

Criteria C1 and C3 are benefits, where the higher the weight value, the more profitable it will be. While C2 and C4 are costs, where the lower the weight value, the more favorable it will be. Once the criteria are defined, we need to determine the weight for each criterion. Usually, this weight is determined based on the relative importance of each criterion in decision making. Here is the formula to determine the relative weight in SAW method [22], [23], [24], [25]:

\[ \text{Bobot} (W)_j = \frac{\text{Bobot Kriteria}_j}{\sum_{j=1}^{m} \text{Bobot Kriteria}_j} \]

- Bobot \((W)_j\) adalah bobot kriteria ke-\(j\).
- Bobot Kriteria \(j\) adalah bobot yang diberikan pada kriteria ke-\(j\).
- \(m\) adalah jumlah kriteria.

<table>
<thead>
<tr>
<th>Table 2. Weight determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRITERIA</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

- After the weight of each criterion is determined, we can enter the data from each skincare product sample.

<table>
<thead>
<tr>
<th>Table 3. Product Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODUK</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Azzarine</td>
</tr>
<tr>
<td>Citra Super</td>
</tr>
<tr>
<td>Emina</td>
</tr>
<tr>
<td>Fair &amp; Lovely</td>
</tr>
<tr>
<td>Garnier</td>
</tr>
<tr>
<td>Home Snow</td>
</tr>
<tr>
<td>Krim HN</td>
</tr>
<tr>
<td>L. Sky Glow</td>
</tr>
<tr>
<td>Natural 99</td>
</tr>
<tr>
<td>Ponds</td>
</tr>
<tr>
<td>Temulawak</td>
</tr>
<tr>
<td>Viva Skin Food</td>
</tr>
<tr>
<td>Wardah</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Each criterion with a benefit value will take the maximum value, while the criteria with a cost value will take the minimum value.

a. The data from these product samples must be normalized first. Normalization is done by changing the value of each criterion into a range of 0 to 1, where 1 indicates the best value and 0 indicates the worst value. This normalization is done with the formula:

\[
\text{Normalisasi } (N)_{ij} = \frac{\text{Nilai Alternatif } (i,j)}{\sqrt{\sum_{k=1}^{n} (\text{Nilai Alternatif } (i,k))^2}}
\]

Normalisasi \((N)_{ij}\) adalah nilai normalisasi dari alternatif \(i\) pada kriteria ke-\(j\).

\(n\) adalah jumlah alternatif.

Nilai Alternatif \((i,j)\) adalah nilai alternatif \(i\) pada kriteria ke-\(j\).

**Table 4. Normalization Result**

<table>
<thead>
<tr>
<th>NORMALISASI</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azzarine</td>
<td>1.00</td>
<td>0.50</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Citra Super</td>
<td>0.70</td>
<td>1.00</td>
<td>0.80</td>
<td>0.50</td>
</tr>
<tr>
<td>Emina</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Fair &amp; Lovely</td>
<td>1.00</td>
<td>0.50</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Garnier</td>
<td>1.00</td>
<td>0.50</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Home Snow</td>
<td>0.70</td>
<td>1.00</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Krim HN</td>
<td>0.33</td>
<td>0.50</td>
<td>0.78</td>
<td>0.33</td>
</tr>
<tr>
<td>L. Sky Glow</td>
<td>0.33</td>
<td>1.00</td>
<td>0.88</td>
<td>1.00</td>
</tr>
<tr>
<td>Natural 99</td>
<td>0.33</td>
<td>1.00</td>
<td>0.88</td>
<td>1.00</td>
</tr>
<tr>
<td>Ponds</td>
<td>1.00</td>
<td>0.47</td>
<td>0.98</td>
<td>0.50</td>
</tr>
<tr>
<td>Temulawak</td>
<td>0.33</td>
<td>1.00</td>
<td>0.78</td>
<td>1.00</td>
</tr>
<tr>
<td>Viva Skin Food</td>
<td>0.70</td>
<td>1.00</td>
<td>0.98</td>
<td>0.50</td>
</tr>
<tr>
<td>Wardah</td>
<td>1.00</td>
<td>0.50</td>
<td>1.00</td>
<td>0.50</td>
</tr>
</tbody>
</table>

- After the criteria values are normalized, the next step is to multiply each normalized value by the relative weight of the criteria that have been determined previously, and then add them up to get the total value for each alternative using the formula:

1) Skor Akhir \((SA)_i\) = \(\sum_{j=1}^{m} \text{Bobot } (W)_j \times \text{Normalisasi } (N)_{ij}\)
2) Skor Akhir \((SA)_i\) adalah skor akhir (SAW) dari alternatif \(i\).
3) Bobot \((W)_j\) adalah bobot kriteria ke-\(j\).
4) Normalisasi \((N)_{ij}\) adalah nilai normalisasi dari alternatif \(i\) pada kriteria ke-\(j\).
5) \(m\) adalah jumlah kriteria.

**Table 5. Result**

<table>
<thead>
<tr>
<th>HASIL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Azzarine</td>
<td>0.98</td>
</tr>
<tr>
<td>Citra Super</td>
<td>0.67</td>
</tr>
<tr>
<td>Emina</td>
<td>1.00</td>
</tr>
<tr>
<td>Fair &amp; Lovely</td>
<td>0.80</td>
</tr>
<tr>
<td>Garnier</td>
<td>0.98</td>
</tr>
<tr>
<td>Home Snow</td>
<td>0.74</td>
</tr>
<tr>
<td>Krim HN</td>
<td>0.47</td>
</tr>
<tr>
<td>L. Sky Glow</td>
<td>0.76</td>
</tr>
<tr>
<td>Natural 99</td>
<td>0.76</td>
</tr>
</tbody>
</table>
After the final score comes out, this score must be ranked so that the order of the best and worst alternatives can be easily seen. To determine the ranking, the formula is used:

\[
\text{Rank} = \text{Rank (Final Score (SA))}
\]

Where \( \text{Rank (Final Score (SA))} \) is a ranking function that gives the rank order of the SAW final score.

4. Results and Discussion

4.1 SAW Analysis Result

<table>
<thead>
<tr>
<th>RANK</th>
<th>PRODUK</th>
<th>NILAI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emina</td>
<td>1,00</td>
</tr>
<tr>
<td>2</td>
<td>Ganier</td>
<td>0,98</td>
</tr>
<tr>
<td>3</td>
<td>Azzarine</td>
<td>0,98</td>
</tr>
<tr>
<td>4</td>
<td>Fair &amp; Lovely</td>
<td>0,80</td>
</tr>
<tr>
<td>5</td>
<td>Wardah</td>
<td>0,80</td>
</tr>
<tr>
<td>6</td>
<td>Ponds</td>
<td>0,79</td>
</tr>
<tr>
<td>7</td>
<td>Natural 99</td>
<td>0,76</td>
</tr>
<tr>
<td>8</td>
<td>L Sky Glow</td>
<td>0,76</td>
</tr>
<tr>
<td>9</td>
<td>Home Snow</td>
<td>0,74</td>
</tr>
<tr>
<td>10</td>
<td>Viva Skin Food</td>
<td>0,73</td>
</tr>
<tr>
<td>11</td>
<td>Temulawak</td>
<td>0,73</td>
</tr>
<tr>
<td>12</td>
<td>Citra Super</td>
<td>0,67</td>
</tr>
<tr>
<td>13</td>
<td>Krim HN</td>
<td>0,47</td>
</tr>
</tbody>
</table>

From the results of processing using the SAW method, skincare products that are the best alternatives are products with the Emina brand occupying the first position with a value of 1.00 and followed by Garnier products in the second position with a value of 0.98. And the lowest product position and indicated as dangerous is the product with the HN Cream brand with a value of 0.47. In this study there are 6 brands of skincare products that are indicated to have hazardous content with different percentages.

4.1.1 Attribution to Criteria

<table>
<thead>
<tr>
<th>KRITERIA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>30</td>
</tr>
<tr>
<td>C2</td>
<td>5</td>
</tr>
<tr>
<td>C3</td>
<td>30</td>
</tr>
<tr>
<td>C4</td>
<td>35</td>
</tr>
<tr>
<td>Jumlah</td>
<td>100</td>
</tr>
</tbody>
</table>

Determination of the weight of important criteria is done to give the level of importance of each criterion. In this study, the highest weight is on criterion C4 (content of hazardous ingredients) this
is because the purpose of this study is to detect dangerous skincare products. The lowest weight is criterion C2 (price), this criterion is important but the level of influence of C2 is not more influential than the other three criteria.

4.1.2 Information System Implementation

- Dashboard Page

Fig. 4. Website Pages

This dashboard page contains all information about dangerous skincare ranging from characteristics, side effects, to products that are prohibited by BPOM.

- SAW Processing Page

Determination of Criteria and Weights

Fig. 5. Criteria Weight Page

Fig. 6.

On this page, several criteria are determined that are relevant to the selection of skincare products. If the criteria are not relevant, it will affect the final result of the calculation.
• Normalization

![Data Normalization](image)

The product data that has been collected must be normalized so that the units of value are the same, making it easier for subsequent calculations.

• Calculation Results and Ranking

![Calculation Result](image)

Here will be shown the results and ranking of each product. Thus, cosmetic store owners can see which products are safe to use and which products should not be traded.

4.1.3 System Testing to Consumers

After testing the system by 5 cosmetic stores that sell dangerous skincare products, there is a decrease in the sales rate of dangerous skincare products in one month.
From the graph above, it can be seen that store C has experienced significant changes. Initially store C could sell 120 dangerous skincare products down to 80 products per month. The shop owner expressed his awareness of the dangers of skincare. In addition to store C, other stores also experienced a decline in sales such as store A initially selling 50 products per month to 40 products per month, store B was originally able to sell 100 products per month to 87 products per month, store D was originally able to sell 45 products per month to 40 products per month, and store E was originally able to sell 85 products to 64 products per month. A decrease of 311. Reduced by about 77.5%. Some cosmetic store owners revealed that the decline in sales of illegal skincare products was due to the seller's awareness of the dangers of these products. However, some other cosmetic shop owners chose to ignore the dangers of these illegal products.

4.2 Discussion

The calculation results from table. 6. above Emina products occupy the highest value because this product is sold at an affordable price, the content formulation suits the needs of teenage skin that is just starting to do skincare, the advertising and branding built by this product is quite attractive and the marketing of the product is very broad. And the lowest calculation result is HN cream the products are, Citra Super with 6.2% mercury content, HN cream with more than 5% mercury content, I. Sky Glow with 0.6% mercury content, Natural 99 with 6.27% mercury content, Temulawak with 7.7% mercury content and Home Snow with 2% hydroquinone content (this content is still within the threshold of use, but cannot be used for a long time). In table. 7. there are 4 criteria In using this SAW method, choose several criteria that are relevant to the object of research. Also, do not overuse the criteria to avoid overfitting. Determine the weight of each criterion carefully, because this SAW method is quite sensitive to changes in scale. In this study, a SAW system was created to facilitate users of illegal skincare products to be wiser in choosing and using products. This system contains complete information about illegal skincare ranging from characteristics, side effects, and a list of skincare that is blacklisted by BPOM. from the results of system trials conducted by several cosmetic shop owners, after the system was used there was a decrease in sales of illegal products by 77.5% from monthly sales of 400 products to 311 products. One of them gave the reason “First, I reduced the supply of these products but not completely, secondly, some consumers who wanted to buy my products told me the effect, some chose other products, some continued to buy them on the grounds that they had been using them for a long time” he said. But there are also shop owners who are less concerned about the dangers of illegal skincare.

5. Conclusion

The SAW (Simple Additive Weighting) method is used in skincare product selection decision making by giving weights to relevant criteria such as ingredient quality, effectiveness, price, and others. After that, a ranking is made for each skincare product based on the total value obtained from multiplying the weight...
with the criteria value. The product with the highest total value will be selected as the choice that best suits the preferences and needs of skincare users.

Among the 13 skincare products that are the object of this research, using the SAW method, Emina brand products are the best alternative with a value of 1.00 and in second place is occupied by Garnier products with a value of 0.98. The product that occupies the lowest position is the HN Cream product with a value of 0.47 and this product is indicated to have harmful ingredients. In addition to HN Cream there are several products that are suspected of having harmful ingredients such as Natural 99, L Sky Glow, Citra Super and temulawak cream. If these products are used, it will cause skin irritation or even damage.

The use of web-based SPK has a significant impact in educating consumers about the safe use of skincare products. Through this online platform, consumers can easily access up-to-date information on safe and unsafe ingredients in skincare products, and get recommendations tailored to their skin type and needs. As such, the web-based SPK helps increase consumer awareness on the importance of choosing safe skincare products, as well as providing more detailed guidance in the process of selecting the right skincare products for their individual needs.

References

Dudi, H. Gustian et al. “Quality Assessment of Skincare Products with Simple Additive Weighting Approach to Detect Illegal Skincare Products.”


