The consumer preferences for new styrax based perfume products using a conjoint analysis approach

C R Kholibrina* and A Aswandi
Environment and Forestry Research Development Institute of Aek Nauli, Simalungun, 21174, Indonesia
*Email: rizlanicut@gmail.com

Abstract. Thousands of tons of raw styrax resin are exported, while various derivative products with millions of dollars in value are imported for centuries. Tobarium Styrax Perfume is the first domestic product that explores the styrax essential oil formula for signature perfumes. The objective of study is to determine consumer preferences for a new styrax based perfume product. A conjoint analysis approach was utilized to determine consumer preferences for these innovation products. Fifty consumers were asked to provide an assessment of the combination of perfume products. Data processing was assisted by computer with SPSS 14.0 program. The influence of five product profiles on consumer preference including scent variant, package, volume, grade of essential oil, and prices were examined. The results show that higher utility values indicate greater preference. The highest utility value is indicated by factor grade (essential oil concentration), this illustrates the respondents' greatest preference for the quality of signature perfume. The scent variant (importance value 53.958) has the most influence on overall preference. This means that there is a large difference in preference between product profiles containing the most and the least desired scents. This is because the preference for a particular scent is personal and unique which might have affected the perception of respondents. The highest consumer's preference is a perfume with scent Rizla, package spray, volume 25 mL, grade signature perfume and price IDR 120,000. The grade and price play a significant role but not as significant as scent variant. Two statistics, Pearson’s R and Kendall’s tau, provides high correlation between the observed and estimated preferences. This information is expected to encourage this domestic innovation product development.

1. Introduction
Styrax resin has been traded throughout the civilization in Nusantara. Although it contributes significantly to community's livelihood, the added value of endemic and historic non-timber forest products has not yet been explored [1]. Thousands of tons of raw resin are exported, while various styrax resin derivative products in the form of medicines, perfumes, beauty and food ingredients with millions of dollars in value are imported annually [2]. One of the added value schemes is product innovation of Tobarium Styrax Perfume. This perfume is the first domestic product that utilizes styrax essential oil as a base-note for signature perfumes [3].

The main consideration of styrax perfume innovation is multi-dimensional benefits of styrax resin as a source of community’s livelihood. Increasing added value is implemented by processing the raw materials into of high economic perfume products [3-5]. Knowledge about aromatic compounds of styrax resin is very limited in domestic communities. The resin associated with the scent of burned
incense and it is underutilized for high-value products for centuries. The consequences, their aromatic
formulas are unexplored, and potential for higher prices does not met in the local market.

_Tobarium Styrax Perfume_ is a research invention which explores the incense fragrance formulation
that known as god’s resin and used by almost all religions and beliefs in the world. The market prospect
to be targeted is to meet a demand for imported perfume products which reaches USD 401 million per
year [6,7]. The consumer awareness for organic products is also an opportunity to develop these quality
products.

Since the last decade, consumers have become more selective for a personal care product that they
will use. Although many similar products are available, high-quality products and competitive prices
will fulfill customer’s satisfaction and increase the loyalty to the product. To fulfill the customer
satisfaction, Tobarium Styrax Perfume provides six main scent variants including _Rizla_ (floral fresh),
_Azwa_ (woody), _Riedha_ (fruity fresh), _Aphis_ (blue oceanic), _Jeumpa_ (cananga) and _Tiara_ (oud oriental).
These products are packaged in various sizes that can be adjusted to consumer’s needs and desires. The
market segments being targeted are middle up society peoples and young executives who like exotic
and energetic aromas; tourists visiting Lake Toba; aromatherapy oil collector; organic product buyers;
and hospitality industry [4,6,7].

The objective of study is to determine consumer preferences for a new styrax based perfume product
innovation. The information about some important attributes considered by consumers and how the
combination of perfume product attributes that meet consumer needs and desires are expected to
encourage the development of this domestic innovation product. Impacts of product development
include increasing the value added of styrax resin that driving the local community welfares. The
innovation product will increase the product efficiency and national competitiveness and it will build
the national pride on domestic products.

2. Materials and Methods

A conjoint analysis approach was utilized to determine consumer preferences for _Tobarium Styrax
Perfume_ products. This approach was also applied in several previous studies [8,9]. Conjoint analysis
is a research tool for developing effective product design. Using this analysis, the researcher can
answer questions such as: What product attributes are important or unimportant to consumer? What
levels of product attributes are the most or least desirable in the consumer’s mind? The main result of
this analysis is a design of a product or service, or a particular object desired by most respondents [9].

The scope for research is _Tobarium Styrax perfume_ product with an analysis unit of 50 customers
of this new innovation product. Respondents were selected purposively and interviewed during
October 2019 to March 2020. The consumers were asked to provide an assessment of the combination
of perfume products including scent, packaging, volume, essential oil concentrations and prices of
perfume products.

Data processing includes generate orthogonal design and running the conjoint analysis were
 assisted by computer with SPSS 14.0 program. Two statistics analyses, _Pearson's R_ and _Kendall's tau_
were measured for correlation between the observed and estimated preferences.

3. Results and Discussion

3.1. Generating an orthogonal design

Generate orthogonal design generates a data file containing an orthogonal main-effects design that
permits the statistical testing of several factors without testing every combination of factor levels. This
design can be displayed with the Display Design procedure [9].

This study examined the influence of five factors on consumer preference-scent, package, volume,
grade essential oil, and prices. There are six factor levels for scent, each one differing in scent variant
(_Rizla, Azwa, Riedha, Aphis, Jeumpa or Tiara_); two package levels (roll on spray); two volume levels
(15 mL and 25 mL); two grade levels (perfume or signature perfume) and three levels price (IDR
120,000; IDR 150,000; IDR 200,000) for last factor. Table 1 displays the variables used with their labels
and values.
Table 1. Variables in *Tobaria* *styrax* perfume consumer’s preferences

| Factor | Values | Label |
|--------|--------|-------|
| Scent  | 1, 2, 3, 4, 5, 6 | *Rizla, Azwa, Riedha, Aphis, Jeumpa, Tiara* |
| Package| 1, 2 | Roll on spray |
| Volume | 1, 2 | 15 mL, 25 mL |
| Grade  | 1, 2 | perfume, signature perfume |
| Price  | 1, 2, 3 | IDR 120,000; IDR 150,000; IDR 200,000 |

The first step is to create the combinations of factor levels that are presented as product profiles to the subjects. The generate-orthogonal design procedure creates an orthogonal array, also referred to as an orthogonal design. The combinations of factor levels are displayed in Table 2.

Table 2. Display of orthogonal design

| Card ID | Scent variant | The packaging | Volume | EO grade | The price |
|---------|---------------|----------------|--------|----------|-----------|
| 1       | *Rizla*       | spray          | 25 mL  | perfume  | IDR 150,000 |
| 2       | *Azwa*        | rollon         | 15 mL  | signature perfume | IDR 120,000 |
| 3       | *Azwa*        | spray          | 25 mL  | perfume  | IDR 200,000 |
| 4       | *Rizla*       | spray          | 15 mL  | signature perfume | IDR 120,000 |
| 5       | *Azwa*        | rollon         | 15 mL  | perfume  | IDR 150,000 |
| 6       | *Riedha*      | rollon         | 15 mL  | perfume  | IDR 150,000 |
| 7       | *Jeumpa*      | spray          | 15 mL  | perfume  | IDR 120,000 |
| 8       | *Tiara*       | spray          | 15 mL  | perfume  | IDR 150,000 |
| 9       | *Azwa*        | rollon         | 15 mL  | perfume  | IDR 120,000 |
| 10      | *Jeumpa*      | rollon         | 25 mL  | signature perfume | IDR 200,000 |
| 11      | *Azwa*        | rollon         | 25 mL  | perfume  | IDR 200,000 |
| 12      | *Aphis*       | rollon         | 25 mL  | signature perfume | IDR 150,000 |
| 13      | *Rizla*       | rollon         | 15 mL  | signature perfume | IDR 200,000 |
| 14      | *Azwa*        | spray          | 15 mL  | signature perfume | IDR 150,000 |
| 15      | *Riedha*      | rollon         | 25 mL  | perfume  | IDR 120,000 |
| 16      | *Rizla*       | rollon         | 15 mL  | perfume  | IDR 200,000 |
| 17      | *Riedha*      | rollon         | 15 mL  | signature perfume | IDR 150,000 |
| 18      | *Rizla*       | rollon         | 15 mL  | perfume  | IDR 120,000 |
| 19      | *Aphis*       | rollon         | 15 mL  | perfume  | IDR 120,000 |
| 20      | *Aphis*       | spray          | 15 mL  | perfume  | IDR 200,000 |
| 21      | *Jeumpa*      | rollon         | 15 mL  | perfume  | IDR 150,000 |
| 22      | *Riedha*      | rollon         | 15 mL  | perfume  | IDR 200,000 |
| 23      | *Tiara*       | rollon         | 15 mL  | perfume  | IDR 200,000 |
| 24      | *Riedha*      | spray          | 15 mL  | signature perfume | IDR 200,000 |
| 25      | *Riedha*      | spray          | 25 mL  | perfume  | IDR 120,000 |
| 26      | *Tiara*       | rollon         | 25 mL  | signature perfume | IDR 120,000 |
| 27      | *Rizla*       | rollon         | 25 mL  | perfume  | IDR 150,000 |
| 28      | *Rizla*       | spray          | 15 mL  | signature perfume | IDR 120,000 |
| 29      | *Aphis*       | rollon         | 25 mL  | perfume  | IDR 120,000 |
| 30      | *Jeumpa*      | rollon         | 15 mL  | signature perfume | IDR 200,000 |
| 31      | *Riedha*      | rollon         | 15 mL  | signature perfume | IDR 120,000 |

Remarks:
*Generate Orthogonal Design.
SET SEED 2000000.
ORTHOPLAN
/FACTORS=scent 'scent variant' (1 'Rizla' 2 'Azwa' 3 'Riedha' 4 'Aphis' 5 'Jeumpa' 6 'Tiara') package 'the packaging' (1 'rollon' 2 'spray') volume 'volume' (1 '15mL' 2 '25mL') grade 'EO grade' (1 'perfume' 2 'signature perfume') price 'the price' (1 'IDR120,000' 2 'IDR150,000' 3 'IDR200,000')
/REPLACE
/minimum 18
/Holdout 4
/Mixhold no.
Once an orthogonal design was created, it is necessary to create the product profiles to be rated by the subjects or respondents. A listing of the profiles in a single table can be obtained or display each profile in a separate table or plan card. The information for each product profile is displayed Figure 1.

| Profile Number 1 | Card ID | scent variant | the packaging | volume | EO grade | the price |
|------------------|--------|---------------|---------------|--------|----------|----------|
| 1                | Rizla  | spray         |               | 25mL   | perfume  | IDR150,000|

| Profile Number 2 | Card ID | scent variant | the packaging | volume | EO grade | the price |
|------------------|--------|---------------|---------------|--------|----------|----------|
| 2                | Azwa   | rollon        |               | 15mL   | signature perfume | IDR120,000|

| Profile Number 3 | Card ID | scent variant | the packaging | volume | EO grade | the price |
|------------------|--------|---------------|---------------|--------|----------|----------|
| 3                | Azwa   | spray         |               | 25mL   | perfume  | IDR200,000|

**Figure 1.** Example of some plan cards for each product profile

3.2. Running the analysis

After an orthogonal design was generated, consumer preferences for each product profile were obtained from 50 respondents as listed in Figure 2.

The preference data collected from a survey of 50 customers who bought and will buy a Tobarium styrax perfume product. The data consist of responses from 50 subjects, each identified by a unique value of the variable ID. Subjects were asked to rank the 31 product profiles from the most to the least preferred. The variables PREF1 through PREF31 contain the IDs of associated product profiles.

Analysis of the data is a task that requires the use of command syntax [10] as below:

```
CONJOINT PLAN='perfumeiwors'
/DATA='DataSet1'
/SEQUENCE=PREF1 TO PREF31
/SUBJECT=ID
/FACTORS=SCENT (DISCRETE)
PACKAGE (LINEAR MORE)
VOLUME (LINEAR MORE)
GRADE (LINEAR MORE)
PRICE (LINEAR LESS)
/PRINT=SUMMARYONLY.
```
3.3. **Utility scores**

Part-worth utilities (also known as attribute importance scores and level values or simply as conjoint analysis utilities) are numerical scores that measure how much each feature influences the customer's decision to make that choice [9]. Table 3 shows the utility (part-worth) scores and their standard errors for each factor level.

**Table 3. Utility scores**

| Scent    | Utility Estimate | Std. Error |
|----------|------------------|------------|
| Rizla    | 2.763            | .457       |
| Azwa     | .113             | .457       |
| Riedha   | .809             | .457       |
| Aphis    | -1.144           | .601       |
| Jeumpa   | -.291            | .601       |
| Tiara    | -2.251           | .601       |
| Package  |                  |            |
| rollon   | .863             | .477       |
| spray    | 1.727            | .954       |
| Volume   |                  |            |
| 15 mL    | .793             | .477       |
| 25 mL    | 1.587            | .954       |
| Grade    |                  |            |
| perfume  | 6.437            | .477       |
| signature perfume | 12.873 | .954 |
| Price    |                  |            |
| IDR 120,000 | -1.186       | .276       |
| IDR 150,000 | -2.371       | .551       |
| IDR 200,000 | -3.557       | .827       |
| (Constant)| 5.171           | 1.255      |

Higher utility values indicate greater preference. The highest utility value is indicated by factor grade, this illustrates the respondents' greatest preference for the quality of signature perfume. Furthermore, the lowest utility value is obtained by the *Tiara* scent, this indicates the lowest preference for this variant. As expected, there is an inverse relationship between prices and utility, with higher prices corresponding to lower utility (larger negative values mean lower utility).

The presence of a grade or scent or volume corresponds to a higher utility, as anticipated. Since the utilities are all expressed in a common unit, they can be added together to give the total utility of any combination. For example, based on the statistics analysis, the total utility of a perfume with scent *Rizla*, package spray, volume 25 mL, grade signature perfume and price IDR 120,000 is:

\[
\text{utility}(\text{scent Rizla}) + \text{utility}(\text{package spray}) + \text{utility}(\text{volume 25 mL}) + \text{utility}(\text{grade signature perfume}) + \text{utility}(\text{price IDR120,000}) + \text{constant} = 22.935
\]

If the perfume had package scent Azwa, package rollon, volume 15 mL, grade perfume and price IDR200,000, based on the statistics analysis, the total utility would be:

\[
\text{utility}(\text{scent Azwa}) + \text{utility}(\text{package rollon}) + \text{utility}(\text{volume 15 mL}) + \text{utility}(\text{grade perfume}) + \text{utility}(\text{price IDR200,000}) + \text{constant} = 9.82
\]

3.4. **Coefficients**

Table 4 shows the linear regression coefficients for those factors specified as LINEAR. The utility for a particular factor level is determined by multiplying the level by the coefficient. For example, the predicted utility for a price of IDR 150,000 was listed as -2.371 in the utilities Table 3. This is simply the value of the price level, 2, multiplied by the price coefficient, -1.186.
Table 4. Coefficients

| Factor | Coefficient estimate |
|--------|----------------------|
| Package | 0.863                |
| Volume  | 0.793                |
| Grade   | 6.437                |
| Price   | -1.186               |

3.5. Relative importance

Running the analysis, it can determine both the relative importance of each attribute as well as which levels of each attribute are most preferred. The range of the utility values (highest to lowest) for each factor provides a measure of how important the factor was to overall preference [9]. Factors with greater utility ranges play a more significant role than those with smaller ranges. Table 5 shows the importance value for each factor as below:

Table 5. Importance values

| Factor | Value  |
|--------|--------|
| Scent  | 53.958 |
| Package| 3.490  |
| Volume | 3.876  |
| Grade  | 27.938 |
| Price  | 10.738 |

The results show that scent (importance value 53.958) has the most influence on overall preference. This means that there is a large difference in preference between product profiles containing the most desired scent and the least desired scents. This is because the consumer’s preference for a particular scent is personal and unique [11].

The results also show that a package and volume (importance value 3.490 and 3.876, respectively) play the least important role in determining overall preference. The grade and price play a significant role but not as significant as scent. Perhaps there are because the range of grade and prices are narrow. In addition, consumers also consider that the price offered is still relatively affordable for a signature quality if compared to imported similar quality perfumes.

This result showed that it would be critical to consider how a product performs in a testing panel before launching it. Regardless of how effective a product is, if consumer does not like its scent, it may have a completely different perception of product, making the product fail miserably. Considering the fragrances used in this study are smoother, more refreshing, more striking or sweeter, which might have affected the perception of the respondents. Therefore, the scents are the subject of a complex discussion because its interpretation varies with context, and external factors can influence since the recognition of a particular scent as its personal interpretation, linked also to the sensory memory [11,12].

3.6. Correlations

The Table 6 displays two statistics, Pearson’s R and Kendall’s tau, which provide measures of the correlation between the observed and estimated preferences. The table also displays Kendall’s tau for just the holdout profiles. The conjoint procedure computed the correlations between the observed and predicted rank orders for these profiles as a check on the validity of the utilities. In this case, there are high significant correlations between the observed and estimated preferences.
Table 6. Correlation coefficients

|                | Value | Sig.  |
|----------------|-------|-------|
| Pearson's R    | .968  | .000  |
| Kendall's tau  | .829  | .000  |
| Kendall's tau for Holdouts | .667  | .087  |

a. Correlations between observed and estimated preferences

3.7. Reversals

When specifying LINEAR models for package, volume, grade and price were chose, a linear direction (LESS or MORE) for the relationship between the value of variable and the preference for that value were expected. The conjoint procedure keeps track of the number of subjects whose preference showed the opposite of the expected relationship [9]. These cases are referred to as reversals.

Table 7. Number of reversals by factor and subject

| Factor   | volume | price | grade | package | scent |
|----------|--------|-------|-------|---------|-------|
| Subject  | 1      | Subject 1 | 0    | 0       | 0     |
|          | 2      | Subject 2 | 0    | 0       | 0     |
|          | 3      | Subject 3 | 1    | 0       | 0     |
|          | 4      | Subject 4 | 0    | 0       | 0     |
|          | 5      | Subject 5 | 0    | 0       | 0     |
|          | 6      | Subject 6 | 0    | 0       | 0     |
|          | 7      | Subject 7 | 0    | 0       | 0     |
|          | 8      | Subject 8 | 0    | 0       | 0     |
|          | 9      | Subject 9 | 0    | 0       | 0     |
|          | 10     | Subject 10 | 0   | 0       | 0     |
|          | 11     | Subject 11 | 0   | 0       | 0     |
|          | 12     | Subject 12 | 0   | 0       | 0     |
|          | 13     | Subject 13 | 0   | 0       | 0     |
|          | 14     | Subject 14 | 0   | 0       | 0     |
|          | 15     | Subject 15 | 0   | 0       | 0     |
|          | 16     | Subject 16 | 0   | 0       | 0     |
|          | 17     | Subject 17 | 1   | 0       | 0     |
|          | 18     | Subject 18 | 0   | 0       | 0     |
|          | 19     | Subject 19 | 0   | 0       | 0     |
|          | 20     | Subject 20 | 0   | 0       | 0     |
|          | 21     | Subject 21 | 0   | 0       | 0     |
|          | 22     | Subject 22 | 0   | 0       | 0     |
|          | 23     | Subject 23 | 1   | 0       | 0     |
|          | 24     | Subject 24 | 1   | 0       | 0     |
|          | 25     | Subject 25 | 0   | 0       | 0     |
|          | 26     | Subject 26 | 0   | 0       | 0     |
|          | 27     | Subject 27 | 0   | 0       | 0     |
|          | 28     | Subject 28 | 0   | 0       | 0     |
|          | 29     | Subject 29 | 0   | 0       | 0     |
|          | 30     | Subject 30 | 0   | 0       | 0     |
|          | 31     | Subject 31 | 0   | 0       | 0     |
|          | 32     | Subject 32 | 0   | 0       | 0     |

Table 7 displays the number of reversals for each factor and for each subject. There are three subjects showed a reversal for volume. That is, they preferred product profiles with lower volume. Furthermore, only one subject showed a reversal for price. This subject preferred product profiles with higher price. These reversals are probably due to complexity of consumer’s preference for an aromatic product and
the interpretation varies greatly since the recognition of a particular scent as its personal interpretation [11,12].

4. Conclusion
A conjoint analysis approach is reliable to determine consumer preferences for *Tobarium Styrax Perfume* products. The influence of five product profiles on consumer preference including scent variant, package, volume, grade essential oil, and prices were examined. The highest utility value is indicated by factor grade, this illustrates the respondents' greatest preference for the quality of signature perfume. As expected, there is an inverse relationship between price and utility, with higher prices corresponding to lower utility. The scent variant (importance value 53.958) has the most influence on overall preference. This means that there is a large difference in preference between product profiles containing the most and the least desired scents. This is because the preference for a particular scent is personal and unique which might have affected the perception of the respondents. The grade and price play a significant role but not as significant as scent variant. The highest consumer’s preference is a perfume with scent *Rizla*, package spray, volume 25 mL, grade signature perfume and price IDR 120,000. Two statistics, Pearson’s R and Kendall’s tau, provides high correlation between the observed and estimated preferences.

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