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Abstract. The tourism sector is one of income source for the region and for the country. The area of South Malang Beach is one of the tourist areas that has the potential and appeal to the natural beauty of the beach. Mapping and positioning are used to see the position of one beach attraction with other similar tourist objects based on tourist perceptions. Biplot analysis is one of the statistical methods which aims to provide an overview of the position of objects with variables simultaneously in two-dimensional graphs. The research data was obtained from the results of the questionnaire distribution of visitors' perceptions of eight coastal attractions on the Southern Cross Line (JLS) based on the service marketing mix variable (7P). The research respondents were 130 people from eight beach objects on JLS. Based on the results and graphs of Biplot analysis, it is known that Batu Beach and Ungapan Beach are the beaches that have the most advantages in service marketing mix variables (7P). Whereas the beach that is perceived to have no advantages at all in the service marketing mix variable is Sendang Biru Beach.

Keywords: Biplot Analysis, Mapping of Coastal, Marketing The first section in your paper

1. Introduction

The growth of tourism sector shows an increase. The tourism sector belongs to the service sector which is one of the means for both regional and central government to increase the regional and state income. Tourism will also enhance the role of several supporting sectors on the private ones such as travel agents, handicraft/ souvenir industries, tourist objects and attractions, lodging/ hotels, restaurants and others. Both national and international tourisms involve a variety of aspects such as economy, culture, sociology, psychology, legal, ecology, and others. Notwithstanding, the economic aspect is often seen to be the concern and considered important among others since tourism greatly influences the income of the state revenue as well as of the surrounding population.

South Malang coastal area is one of the regions in Indonesia, especially in the East Java Province, which has naturally beautiful beaches as its tourism potential and tourist attraction. There are quite a number of beaches in the coast of South Malang, specifically on the Southern Route Line. It is a route passing three sub-districts, namely Sumbermanjing Wetan, Gedangan, and Bantur. More improvement in terms of transportation access further advances the potential of tourists visiting South Malang. Moreover, understanding each of the beaches' characteristics will provide a reference for the development of coastal tourism managers in the South Malang region, especially in the Southern Route Line.

One of the methods in mapping and spotting the position of a coastal tourism object in South Malang is by 'positioning'. According to [1], positioning is setting the position of the product to occupy a place that is apparent, distinctive and desirable for consumers compared to the competing product embedded in the targeted consumers' minds. Tourists will consider the perception of certain coastal attractions in making their choice; therefore, the managers of tourist attractions need to apply the right marketing strategy. One of them is to present the beach as a tourist attraction fulfilling the tourists' wishes and needs. An effective marketing strategy is needed to increase the visitors of tourist attractions in South Malang region; this is why service marketing in the form of marketing mix is highly essential and is an alternative needed to be considered for the coastal attractions management in Southern Route Line (SRL) area. The marketing mix strategy, according to [1], consists of product, price, place, and promotion. Whereas, according to Zeithaml and Bitner in [2], it needs to be broadened by adding three components in the service marketing dimensions: people, physical evidence, and process.

The statistical analysis that can be used for mapping and positioning a coastal tourism object, especially in the SRL region, is the Biplot analysis. It is one of the methods in a number of multivariate analyses aiming to provide a simultaneous overview of an object's relative position with the variables in smaller dimensions, of which the output is in the form of two-dimensional graphs. Consequently, applying the Biplot analysis is suitable for positioning the coastal tourism objects in Southern Route Line region with simultaneous marketing mix variables. The information related to the proximity between objects, the diversity of variables, the correlation between variables, and the relationship of variables to objects can be obtained from the analysis.

Based on the previous explanation, this research focuses on the application of Biplot analysis in conducting mapping and positioning coastal tourism objects in the Southern Route Line of South Malang region. The coastal tourism objects used in this study are Sendang Biru Beach, Goa China Beach, Ungapan Beach, Bajulmati Beach, Batu Bengkung Beach, Nganteb Beach, Ngudel Beach, and Balekambang Beach. These are the beaches located on the coast of South Malang and traversed by the Southern Route Line. The data collection is conducted by distributing questionnaires to visitors of each beach used as the research objects. The information obtained from this research is expected to be a matter of consideration and input in the effort to implement the right marketing strategy, so that it can provide benefits to the parties concerned.

2. Literature review

The data of the marketing mix concept used is the 4P marketing mix concept which is expanded again with 3P to 7P, namely product, price, place, promotion, people, physical evidence, and process. According to Zeithaml, the marketing mix is elements of marketing that are interrelated, mixed, organized and used appropriately in order to achieve marketing objectives effectively [2]. The commonly known marketing mix is 4P, namely product, price, promotion, place. In service marketing, there are other elements that can be controlled and coordinated for the purposes of communication with consumers and satisfying service consumers. These elements are people, physical evidence, and process [11]. The following is the 7P marketing mix variable used in the study:

1. Product (X1)

    Service products are a form of service organization offering aimed at achieving organizational goals through satisfying customer wants and needs [12]. In this study, service products offered by

tourist managers in the form of coastal attractions such as the uniqueness of the beach, and the beauty of the beach.

2. Price (X2)

    Price is the amount of money needed to get a product [1]. Prices in tours are the amount of money / expenses that must be incurred to buy entry tickets and parking tickets by prospective visitors to get the available facilities at the tourist attraction.

3. Place (X3)

    Place in marketing services is a service location [2]. The place in the tourist attraction meaning of easy access to tourist sites using private vehicles and public transportation.

4. Promotion (X4)

    According to Buchari Alma, promotion is a form of marketing communication which is a marketing activity to disseminate information [2]. Facilities provide information and convince potential visitors with promotional media to visit attractions. Information in the form of advertisements through print and electronic media.

5. People (X5)

    According to Yazid, people are all actors in the process of presenting services that play a role as service providers and can influence the perceptions of buyers [11]. All people involved in providing services to visitors at attractions.

6. Physical Evidence (X6)

    Physical evidence is the physical environment in which services are delivered and the place where components in service organizations interact with service consumers [11]. Physical evidence in a tourist attraction in the form of availability of facilities in the tourist attraction includes parking lots, places of worship, public toilets, and lodging.

7. Process (X7)

    The process is all actual procedures, mechanisms, and flow of service activities delivered [11]. The process of providing services in tourism objects can be seen from the process of delivering information to tourist visitors and post-service guarantees.

3. 3. Research methods

The data were in the form of primary data. They were obtained from the questionnaire results of visitors' perceptions toward nine coastal attractions in the Southern Route Line of Malang Regency. There are eight beaches that are the object of research, namely Batu Bengkung Beach, Sendang Biru Beach, Nganteb Beach, Bajulmati Beach, Goa Cina Beach, Balekambang Beach, Ungapan Beach, and Ngudel Beach. The obtained primary data were utilized for mapping the coastal attractions in the Southern Route Line based on the service marketing mix. The data of the marketing mix concept used is the 4P marketing mix concept which is expanded again with 3P to 7P, namely product, price, place, promotion, people, physical evidence, and process. The scale used in this research was the Likert scale.

The sampling technique used in this study was non-probability sampling, quota sampling and convenience sampling. There is no information about the total visitor population (infitine population), so quota sampling is the right method used in this study for sampling based on conditions on each beach. Quota sampling is a nonprobability sampling technique in the form of a two-stage judgmental sampling [3]. The first stage is to develop control categories for quotas. The second stage is the sample element is selected based on ease or judgment. While convenience sampling is based on considerations conveniently, readily, and available (available) [10]. According to Fraenkel and Wallen regarding a minimum sample size, the minimum sample size for descriptive research is 100 sample units [9]. The number of samples was 130 respondents from eight coastal tourism objects.

The research variables are variables obtained from positioning in the service sector, namely using the marketing mix concept. According to Zeithaml, the marketing mix is elements of marketing that are interrelated, mixed, organized and used appropriately in order to achieve marketing objectives effectively [2].

3.1. The basic concept of biplot analysis

Biplot analysis is basically an attempt to provide a graphical representation of the X data matrix in a plot by overlapping vectors in low dimensional space, which is usually two dimensions representing row vectors of matrix X (object's illustration) with vectors representing columns matrix X (variable description)[3]. The matrix used as input in the Biplot analysis is symbolized by X.

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & \cdots & x_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{np} \end{bmatrix}$$

In that:

n: The number of observation objects

p: The number of observed variables

In Biplot, the term 'bi' is a simultaneous overlapping between vectors representing rows (object's illustration) and columns (variable's illustration) of the matrix. The point of using the Biplot analysis is to demonstrate between objects and variables simultaneously in a high-dimensional space into a low-dimensional one, so that the graphical interpretation will be done easily.

3.2. Singular value decomposition (SVD)

The Biplot analysis calculation uses singular value decomposition or Singular Value Decomposition (SVD). The use of SVD in Biplot analysis is to produce a line of mutually free (orthogonal) X matrices of size n × p in equation (2.1) containing n objects and p variables corrected to the average and have r rank. The decomposition of singular values can be written as [4]:

$$X = ULV'$$

In that:

U : a matrix with a column in the form of an eigenvector of XX' of which the size is $n \times r$

L : diag $(\sqrt{\lambda_1}, \sqrt{\lambda_2}, \dots, \sqrt{\lambda_p})$ a diagonal matrix in the form of an eigen value root of $X'X$ of which the size is $r \times r$

V : matrix with a column in the form of an eigenvector of $X'X$ of which the size is $p \times r$

The U and V matrices are the orthonormal columns ($U'U = V'V = I_r$) and L is the diagonal matrix of size ($r \times r$) with the diagonal elements being the roots of the eigen $X'X$ in that $\sqrt{\lambda_1} \geq \sqrt{\lambda_2} \geq \dots \geq \sqrt{\lambda_r}$.

To describe Biplot, an α value is needed in defining the matrix G and H[5]. For example, $G = UL^{\alpha}$ and $H' = L^{1-\alpha}V'$ with $0 \leq \alpha \leq 1$, thus it equals:

$$X = UL^{\alpha}L^{(1-\alpha)}V' = GH'$$

The value of α = 0, then G = UL0 and H'=LV' is called GH Biplot or Column Metric Preserving, which maintains column matrices (showing variables in the X matrix), is used to determine the variables' diversity and the correlation between variables.

The value of α = 1 is $G = UL$ and $H' = L^{\circ}V'$ which is called JK Biplot or Row Metric Preserving maintaining row matrix (showing objects in the X matrix) and is used to determine the proximity between objects.

The value of α = 0.5 is $G = UL^{1/2}$ and $H' = L^{1/2}V'$ which is called symetric Biplot because it has the same weight/ scale for each row and column. Symetric Biplot is used to interpret the relationship between variables with the object of research.

3.3. The size of biplot compatibility

Biplot is considered capable of providing sufficient information when providing minimum information of 70% [6]. The measure of compatibility in Biplot can be evaluated by testing two eigen values λ_1 dan λ_2 with two-dimensional X matrix approach in the form of [7]:

$$\rho^2 = \frac{(\lambda_1 + \lambda_2)}{\sum_{k=1}^{r} \lambda_k}$$

In that:

λ_1: The 1st largest eigenvalue
λ_2: The 2nd largest eigenvalue
λ_k: eigen value number-k, with k = 1, 2, ..., r

If the value of ρ^2 is closer to the value of one, then Biplot provides a better representation of the actual data information.

3.4. Interpretation

The information that can be obtained from the Biplot analysis includes [8]:
1. Proximity between objects
2. Variable diversity
3. Inter-Variable Correlation
4. Linkage of Variables with objects

3.5. Service marketing mix

The Biplot on mapping of the coastal tourism objects in the Southern Route Line uses the '7P' service mix marketing variables as follow:
1. Product
2. Price
3. Place
4. Promotion
5. People (Human Resources)
6. Physical Evidence
7. Process

4. Results and disscussion

4.1. Biplot analysis

Biplot analysis is based on the decomposition of the obtained data's singular value from the questionnaire data's average score. The input in Biplot analysis is an average matrix; a matrix that contains the average of each object or data matrix of n objects and p variables. The input data used consists of 8 objects and 7 variables. The data is shown by the matrix X as follows:

$$\mathbf{X} = \begin{bmatrix} 2.953 & 2.309 & 3.058 & 2.361 & 2.721 & 2.581 & 2.733 \\ 1.671 & 1.526 & 2.324 & 1.969 & 1.966 & 2.097 & 1.616 \\ 2.478 & 2.106 & 2.094 & 1.619 & 2.246 & 2.654 & 2.248 \\ 2.510 & 2.237 & 3.191 & 2.430 & 2.479 & 2.513 & 2.565 \\ 3.082 & 1.757 & 2.455 & 2.602 & 2.142 & 2.380 & 2.290 \\ 3.151 & 2.785 & 3.464 & 2.756 & 2.162 & 3.041 & 2.470 \\ 2.955 & 2.134 & 3.171 & 2.225 & 2.685 & 2.646 & 2.593 \\ 2.317 & 2.065 & 2.272 & 1.910 & 2.267 & 2.207 & 2.308 \end{bmatrix}$$

The G and H matrices plotted in the Biplot graph are the coordinates of variables and objects from the two-dimensional Biplot analysis. The G2 and H2' matrices that were formed are:

$$
G_2 = \begin{bmatrix}
-0.426 & 0.220 \\
0.952 & -0.552 \\
0.432 & 0.576 \\
-0.247 & -0.224 \\
0.024 & -0.064 \\
-0.796 & -0.340 \\
-0.373 & 0.151 \\
0.435 & 0.233
\end{bmatrix}
\qquad
H_2' = \begin{bmatrix}
-0.760 & 0.332 \\
-0.543 & 0.130 \\
-0.813 & -0.479 \\
-0.507 & 0.539 \\
-0.268 & 0.336 \\
-0.422 & 0.111 \\
-0.507 & 0.399
\end{bmatrix}
$$

In this research, there are 3 Biplot charts with 3 α values, namely 0, 0.5, and 1. Biplot with a value of α = 0 is also called GH Biplot or Column Metric Biplot, which is used to determine the variables' diversity and correlations between variables. Biplot with the value α = 1 is also called the JK Biplot or Row Metric Biplot, which is used to determine the proximity between objects. While Biplot with a value of α = 0.5 is also called Symetric Biplot, which is used to interpret the relationship between variables with the object of research. The following is a Biplot analysis graph with a value of α = 0.5 using the GGEBiplotGUI package in Figure 1.
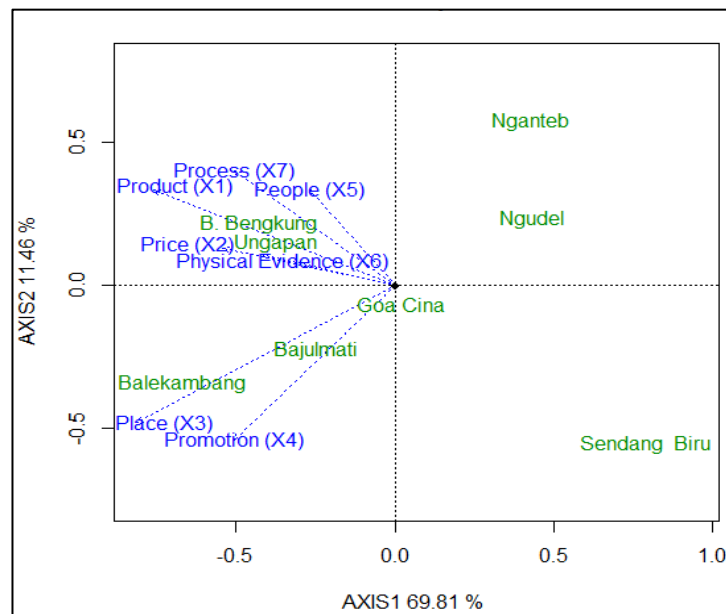

Figure 1. Symmetric Biplot graph α value = 0.5

4.2. The size of biplot compatibililty
The compatibility check of Biplot analysis was obtained by using the formula in equation 1. Based on the formula in equation 1, the compatibility measure of Biplot analysis was obtained with 3 α values, namely 0, 0.5, and 1 of 0.8127. In order to find the relationship between objects and variables, the Biplot graph interpreted was a Biplot graph with a value of α = 0.5. The compatibility measure of Biplot analysis with a value of α = 0.5 is 0.8127, this explains that the Symetric Biplot graph interpretation can fittingly elucidate the relationship of eight coastal tourism objects on the Southern Route Line with the seven marketing mix variables (7P) in the research.

4.3. Discussion

The analysis show the picture of marketing mix concept (Zeithaml [2]) with different situation, by mapping the 7 p element, they are product, price, promotion, place [2], and additional people, physical evidence, and process [11]. The mapping of eight coastal tourism objects in the SRL used the Biplot analysis with 3 alpha values, namely 0, 0.5, and 1 to produce 3 Biplot charts with different forms but having the same conclusion. Based on the Biplot analysis with a value of $\alpha = 0.5$, the researcher found that four groups of SRL beach tourism objects with similar characteristics were formed. The first group was Batu Bengkung Beach and Ungapan Beach which had the same direction as the variable vector Price, Product, Physical Evidence, Process, and People.

So, it can be concluded that Batu Bengkung Beach and Ungapan Beach had advantages in the coastal tourism objects' attractiveness, affordability of costs, adequate facilities, availability of information on the coastal objects, and the staff's attitude as the human resource, which was very good and must be maintained as stated by the visitors. Moreover, Batu Bengkung Beach and Ungapan Beach needed an increase in Place and Promotion variables. The two beaches needed to increase their access to the location so that it can easily be accessed by various modes of transportation. They also needed to increase the promotion intensity both in the form of printed and electronic advertising media.

The second group was Balekambang Beach, Bajulmati Beach, and Goa Cina Beach which had the same direction as Place and Promotion variables. It can be concluded that Balekambang Beach, Bajulmati Beach and Goa Cina Beach stood out in both their promotion intensity in the form of printed as well as electronic media and their location's access, as they can easily be accessed by either two or more wheels transportation.

The third group was Nganteb Beach and Ngudel Beach, and the fourth group, Sendang Biru Beach. These beaches tended to be less prominent and lacked superiority on the seven marketing mix variables (7P). It is because visitors as the respondents perceived that the three beaches had the same advantages as those of other beaches on SRL. So, it is necessary to increase their management of coastal attractions, especially on the seven marketing mix variables (7P).

5. Conclusions and Suggestions

5.1. Conclusions

The beach tourism object at SRL having the most advantage in the marketing mix variable (7P) is Batu Bengkung Beach. This beach is perceived to be superior and has an above average value in the five elements of the marketing mix variable, namely Price, Product, Physical Evidence, People, and Process. While the beach tourism object perceived as having deficiencies and has no similarities to others on SRL is Sendang Biru Beach. If viewed from the actual situation, this beach functions more as a fish auction location than as a beach attraction.

5.2. Suggestions

Based on this research, suggestions can be given, such as: (1) For the management of coastal attractions in the Malang Southern Cross Line, they should improve the marketing strategy by increasing the service mix marketing variable elements in accordance with the needs and characteristics of each beach attraction. (2) The Malang Regency Tourism Office should support this increase by providing assistance both materially and providing counseling to managers for the progress of coastal tourism objects and tourism aspects in Malang Regency.

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