Analysis of Fruit Consumer Satisfaction in an Online Purchasing System Using an E-commerce Platform: A Naive Bayes Approach

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ABSTRACT

E-commerce platforms have now developed into fresh agricultural products, one of which is fruit. Purchasing online means customers cannot choose their own products like in offline stores. Therefore, the aim of this research is to identify the attributes that consumers often talk about and analyze consumer satisfaction with fruit on e-commerce platforms. Data analysis in this research was carried out using descriptive statistical methods and the Naïve Bayes approach. Data was taken from the Tokopedia platform with a total of 316 reviews using random sampling. The research results show that the attributes most frequently reviewed by consumers are service attributes (49%) and product attributes (44%), while the price attribute is reviewed the least (7%). Attributes related to product, price and service were assessed as having negative performance overall because nine of the twelve attributes analyzed indicated consumer dissatisfaction. Seller reviews are very important for business continuity so that sellers can improve their services and pay more attention to product quality so that the reviews appear positive. Research using the naive Bayes approach to determine customer satisfaction sentiment towards fruit products has not been widely carried out so the results of this research can complement previous studies.

Keywords: Consumer Satisfaction, E-commerce, Fruit, Digital Marketing, Naïve Bayes

1. INTRODUCTION

Fruit is a horticultural commodity that has an important role for all Indonesian society [1]. Apart from that, fruit is a food ingredient that is abundantly available in Indonesia [2]. According to data from the Central Statistics Agency (BPS), in 2022 the production of fruit plants in Indonesia will reach 27,712,183 tons [3]. Fruit production in Indonesia can continue to be increased because more and more people like to eat fruit. Based on BPS data (2024), snake fruit, bananas, rambutan, durian, watermelon, papaya, guava have experienced an increase in per capita consumption [4]. This shows that fruit in Indonesia has opportunities that can continue to be developed.

Fruit is a food source of vitamins. According to several studies, fruits containing micronutrients can improve immune function [5]. This is a reference for people to plant and cultivate various types of fruit-producing plants [6]. The World Health Organization (WHO) recommends consuming more than 400 grams of fruit and vegetables every day to improve health [7]. Therefore, Indonesian people's interest in shopping for fruit to meet their daily needs is quite high.

Competition for products and services in the era of globalization is increasingly numerous and diverse due to market openness [8]. The advances in technology and information that are currently developing provide various conveniences for people in shopping for various needs. In recent years, online shopping has become a popular trend in many countries, including Indonesia [9]. E-commerce has been widely used by entrepreneurs as a means of transacting with consumers. Sales via e-commerce and traditional sales are very different because of the differences in the

transaction process between sellers and buyers, as well as the existence of software that provides a virtual display of shopping baskets, payment methods and delivery routes [10]. E-commerce is able to encourage Indonesia's economic growth and state revenues in the form of taxes. E-commerce is currently also developing into a platform for selling fresh agricultural products, including fruit. Purchasing fruit using e-commerce has the weakness that consumers cannot directly choose the fruit products they purchase. Fruits are a source of essential vitamins, minerals, dietary fiber and antioxidants that play a fundamental role in improving human health and well-being [11]. Therefore, it is important for consumers to be able to buy fresh fruit.

Shopping activities via e-commerce are expected to increase. According to research [12], there has been a shift in consumer behavior, the strategies of business actors and the closure of the modern conventional retail market which has gradually undergone changes since 2016. One e-commerce that is much in demand by the Indonesian people is Tokopedia. According to research [13], Tokopedia is an e-commerce platform made in Indonesia which was founded in 2009 under the auspices of PT. Tokopedia and in the first quarter (Q1) of 2021 Tokopedia was the most widely accessed e-commerce on the internet.

Research regarding consumer satisfaction in purchasing via e-commerce has previously been carried out. Research [14], analyzes consumer satisfaction with the attributes of fresh fruit and vegetables when purchasing online using the User Generated Content (UCG) approach, the Tokopedia case study provides results that the variables most considered by consumers are product, delivery and service variables. The results of research [15], regarding the influence of product quality and price on interest in buying fruit and vegetables at the Sayur Box Surabaya e-commerce during the COVID-19 pandemic using the Structural Equation Modeling analysis method based on Partial Least Square (SEM-PLS) provide product quality results has a positive but not significant influence on buying interest, while price has a positive and significant influence on buying interest. Meanwhile, this research will focus on looking at fruit consumer satisfaction in e-commerce, especially Tokopedia, using the naive buys approach. In addition, it is important to carry out this research to identify reviews that are often mentioned by consumers when buying fruit online with the attributes considered, namely product, price and service. This research also analyzes consumer satisfaction for each attribute using descriptive statistical methods and a naïve Bayes approach so that it is able to complement previous research.

2. LITERATURE REVIEW

2.1 E-Commerce of Fruit Products

Many e-commerce platforms are trying to develop online shopping channels for fresh agricultural products [16]. The use of e-commerce in marketing agricultural products has changed the agribusiness landscape in the digital era [17] and is important for the future agribusiness system [18]. The existence of e-commerce provides main advantages such as expanded market reach, reduced intermediary costs, increased consumer involvement, and increased information dissemination [17]. In addition, e-commerce services can help provide solutions to ineffective communication problems [19]. E-commerce for fresh agricultural products has facilitated people's lives, improved people's shopping health level, accelerated product turnover, reduced losses, promoted

agricultural development, and reduced human-to-human contact during the epidemic (Zhang et. al., 2023).

On the other hand, there are also negative comments and news about the platform. This negative situation is caused by several reasons, such as differences in the quality of fresh products, inadequate commodity categories and inefficient delivery due to lack of personnel and so on [16]. In Indonesia, e-commerce transactions for vegetable and fruit products are still low because from an economic, social, ecological and legal perspective they have not been able to make a significant contribution, however, Indonesia's stable politics and rapidly developing digital technology can support the development of vegetable e-commerce. and fruit in Indonesia [19].

2.2 Consumer Satisfaction Attributes

Satisfaction will be realized if an action occurs with a response between likes and dislikes, satisfaction and dissatisfaction [20]. Product quality is one of the important attributes of fresh agricultural products, and is the most core and fundamental criterion that consumers must choose [21], [22], [23]. Research findings show that the quality, price and packaging of fresh products influence consumer perceptions and attitudes [24], [25], [26]. Price is one of the attributes taken into account by customers. Found that advertising/ promotions, price, and discounts are important attributes in customer satisfaction in purchasing fruit [27].

Research conducted by [28] shows that consumers who are oriented towards experience attributes value fruit quality more (48.8%); consumers who are oriented towards attribute search value more the appearance of the fruit (33.7%); while the rest consider both. [29] shows that quality product attributes such as no defects, no stains, ripeness, freshness, no pesticides, no preservatives, nutritional value and cleanliness are consistently considered important for both fruit and vegetables. Based on the research results of [30], freshness is the main key to customer satisfaction for vegetables and fruit, so it is necessary to maintain the freshness of the product in the hands of customers by utilizing storage technology using cold storage and transport vehicles equipped with cold boxes.

Consumer satisfaction is largely determined by taste perception [31] and the level of fruit ripeness [32]. Timeliness and length of distribution time is one of the factors that influences purchasing and consumer satisfaction [16], [33], [34]. Consumer satisfaction can be increased with informative service, good packaging, careful selection of fresh products and providing promotions [35]. Apart from quality, service is also a major determinant of customer satisfaction [36]. Fresh product e-commerce has high requirements for timeliness, product quality, efficiency and optimization in service (Zhang et. al., 2023).

According to [37], customers' main priority in buying fruit and vegetables is their availability. When purchasing online, customers expect that in an application the product availability displayed is always available and finally the customer benefit program is something that cannot be taken lightly because this is what fosters loyalty in customers [38]. Reviews on online purchases have a significant influence on total sales of fruit and vegetables [18].

2.3 *Naïve Bayes Measuring Public Sentiment with the Naïve Bayes Approach*

The Naïve Bayes method is used to see the level of consumer shopping satisfaction [20]. [39], in research carried out an analysis to see customer sentiment in shopping at online stores using the Naïve Bayes Classifier algorithm method which is a classification method using probability and statistical methods. [40], analyzes opinions and categorizes positive and negative comments using the Naive Bayes classifier to test public and investor sentiment and attitudes.

[41], identified vegetable attributes that consumers consider and the performance of each attribute on consumer satisfaction through consumer reviews or user-generated content using the Naive Bayes method. A total of 567 reviews with ratings 1–3 were included in negative sentiment and ratings 4–5 were included in positive sentiment. The research results show that all attributes have positive sentiment or consumers are considered satisfied with product attributes, price attributes and service attributes.

[42], applies a multinomial naïve Bayes model to determine public perceptions that can influence coffee demand using data from Twitter scrapping. The model used was successful in determining positive public sentiment. It can be concluded that positive sentiment from the public influences the increase in coffee orders in Indonesia. [43] also explored consumer reviews using the Python naïve Bayes classifier, but on the cherry on e-commerce platforms. The sentiment value calculation uses RostEA software to separate positive and negative review sentences one by one, and obtain quantitative results from the sentiment value of each review [43]. In this research, Naïve Bayes was used to see fruit customer satisfaction in e-commerce.

3. METHODS

Data analysis in this research was carried out through descriptive statistical methods and the Naïve Bayes approach. Descriptive statistical analysis aims to identify the characteristics of fruit purchases through the Tokopedia platform, which are considerations for consumers who buy. The Naïve Bayes method, on the other hand, is used for the classification of positive and negative reviews and for analyzing the satisfaction of customers who buy fruit online. Some of the steps involved in this method include the following [41], [44], [45] :

3.1. Data collection

Data collection and input into the system begins with web data scraping. Web scraping is taking a semi-structured document from the internet, generally in web pages in a markup language such as HTML or XHTML, and analyzing the document to extract specific data from the page for other purposes. The web scraping process is done using Webscraper.io, a Chrome extension that can be used for scraping web data. The output of this system is in the form of rating data and customer reviews of fresh fruit buyers on Tokopedia.

3.2. Pre-Processing

Pre-processing is a critical step in data selection because not all data is in optimal condition for processing, so it is necessary to change all capital letters to lowercase, delete characters other than letters, delete user usernames or mentions, delete hashtags, delete URLs or links, remove emojis, stop words from every customer review.

3.3 Data categorization

Data categorization is carried out on data that has gone through a labeling process. Review data labeled regarding product attributes, price, and service will later be categorized into positive sentiment for review ratings 4 and 5 and negative sentiment, which will be classified for review ratings 1, 2, and 3.

3.4 The Naïve Bayes model

The Naïve Bayes model was formulated using Microsoft Excel. The analysis stage begins with determining P(C). The Naïve Bayes equation is explained as follows:

$$P(x/C) = P(x_1 x_2 x_3, \dots, x_n | C) \qquad (1)$$
$$P(C) = \frac{N_j}{N} \qquad (2)$$

After understanding the calculation results presented above, the following action is to identify the opportunities for each class.

$$P(C|x) = \frac{P(x|C).P(C)}{P(x)} \qquad (3)$$

Keterangan:
$P(x|C)$: Probability of x in a certain class
x : Data for each attribute
C : A class consisting of positive and negative reviews of a product
$P(C)$: Probability in a particular class
N_j : The amount of data from a particular class
N : Total amount of data
$P(C|x)$: The probability of a certain class based on an attribute

3.5 Evaluation

The model that has been formed is then tested using test data. Testing is carried out to determine the level of accuracy, precision, and recall. Accuracy, precision, and recall calculations are explained as follows:

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} \times 100\% \qquad (4)$$
$$Precision = \frac{TP}{TP+TN} \times 100\% \qquad (5)$$
$$Recall = \frac{TP}{TP+FP} \times 100\% \qquad (6)$$

Detail:
TP : True Positive (reviews are right in the positive/satisfaction class)
TN : True Negative (reviews are right in the negative/dissatisfaction class)
FP : False Positive (fake reviews in the positive/satisfaction class)
FN : False Negative (fake reviews in the negative/dissatisfaction class)

The evaluation results show how capable the model is in determining sentiment, which includes consumer satisfaction and dissatisfaction with the fresh fruit they buy on the Tokopedia platform. The value of each attribute of fresh fruit will be known based on consumer satisfaction and dissatisfaction classes.

4. RESULTS AND DISCUSSION

4.1. Factors That Influence Consumer Satisfaction Through Fruit Attributes

Currently, purchasing agricultural products can not only be done offline by shopping at markets, supermarkets or stalls but can also be done online. In this research, fruit consumer reviews on e-commerce have been explored. In the reviews, we look at what attributes are often mentioned by consumers. The attributes used are Product, Price and Service. Each attribute has indicators that are often discussed by consumers.

Product attributes have 5 indicators, namely quality, size and weight, freshness, taste and color. Each of these indicators has keywords that are often mentioned by consumers in their reviews. Freshness is the keyword most frequently mentioned by consumers. This shows that consumers want fresh fruit to consume. Freshness is desired by consumers because fruit is considered healthier and tastes better [46]. Freshness in fruit is an important indicator in determining consumer satisfaction.
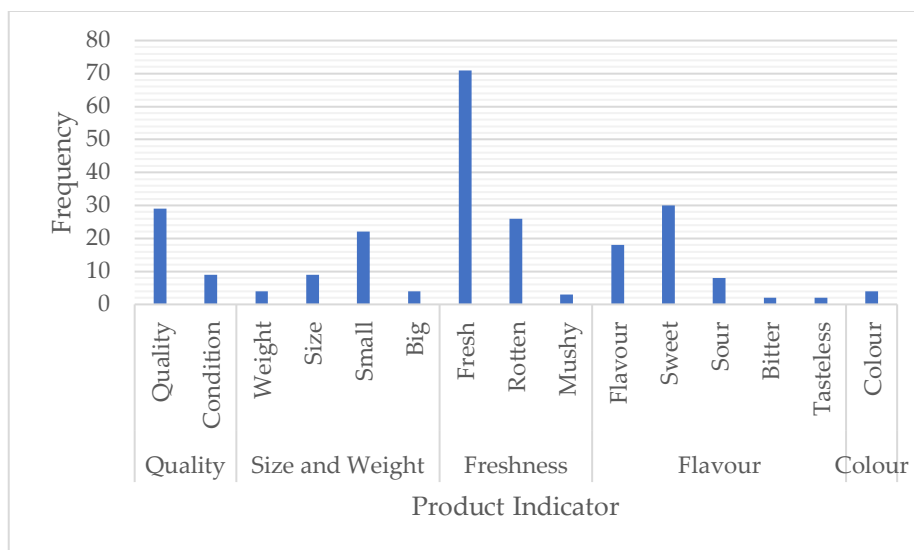

Figure 1. Keywords in Product Attributes that Consumers Often Mention

The second indicator that is often mentioned is sweetness. Consumer preferences also depend on fruit quality characteristics such as sweetness [47], [48]. Sweetness reviews are aimed at apple, strawberry, banana, and papaya. Based on consumer reviews, there are also fruits that have a bitter taste, indicated for papaya, sour for strawberries, and bland for papaya and strawberries. After sweetness, quality is the most frequently reviewed indicator. Product quality is very important, especially for fruit. Consumers buy fruit for health purposes so the good condition of the fruit is very important [49].

Rot and small fruit size are also mentioned in consumer reviews. Rotten fruit gives a bad impression to consumers. If the fruit delivered is rotten, the fruit will not be consumed and consumers will give negative reviews to the online shop. However, even though some consumers feel disappointed when they get rotten fruit, because they get a cheap price, they feel it is reasonable. In some shops, fruit that is about to rot is sold at a cheap price. The cheap price of the fruit then attracts consumers' attention to buy.
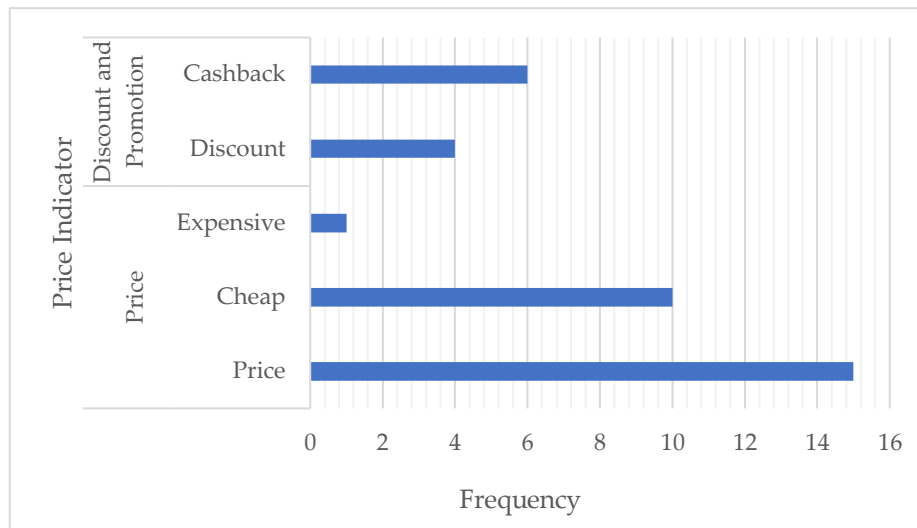
Figure 2. Keywords in Price Attributes that Consumers Often Mention

In the price attribute, the indicator that is often mentioned in consumer reviews is price. Price is an important thing for consumers. The low price was also mentioned by several consumers. Meanwhile, high prices are rarely mentioned by consumers. Consumers know that the price of fruit is quite expensive. There are even consumers who are willing to pay premium prices as long as they have access to fresh fruit [25], so that when there are cheap fruit prices, some consumers comment on this. Cashback and discount indicators are also mentioned in the review. Purchasing fruit online through e-commerce provides consumers with the opportunity to get discounts and cashback.

Service attributes have the most indicators compared to other attributes. In this research, service attributes include delivery, seller response and attitude, packaging, warranty, and catalogue. The delivery indicator most mentioned in reviews is delivery. This shows that delivery is important for customers because they want the fruit they order to arrive quickly, besides that fruit is a product that does not last long so consumers want the product to arrive quickly.

Fast delivery is also a keyword in consumer reviews. The faster the product arrives, the more satisfied the consumer is, and vice versa. The accuracy of delivery according to schedule is also a review by consumers. Logistics is an important way to transfer goods from suppliers to consumers. The quality of logistics services directly influences consumers' desire to buy online [21]. Another service indicator is the seller's response and attitude. Seller and response are keywords often reviewed by consumers. When purchasing online, consumers want sellers who respond quickly and well. A seller's unfavorable response and attitude can also result in negative consumer reviews. In online markets, it is important to pay attention to service because the seller's reputation is built through platform reviews or feedback systems [50], [51].

Packaging using a neat box is a concern for consumers. Fruit packaging is very important because fruit is a product that is easily damaged so packaging needs to be paid attention to. Packaging using boxes is considered safe for fruit products. Handling and packaging of fruit is the key to maintaining the freshness of the fruit until it reaches the consumer's table [52].

One important service attribute is a guarantee. In the review, the keyword mentioned in the guarantee indicator is refund. Customers get a refund in the form of money if any fruit is not delivered or runs out. This is also closely related to availability. Many consumers also comment on availability. Several consumers reviewed the suitability between the products sent and those in the catalog. However, sometimes the shop is not given information if the fruit has run out so there is a discrepancy between availability and what is in the application.

Table 1. Keywords in Service Attributes that Consumers Often Mention

Atributte	Indicator	Keyword	Frequency	Frequency of each indicator
Service	Delivery	Delivery	43	120
		Fast	25	
		Safe	19	
		Courir	15	
		Long Time	13	
		Slow	3	
		Schedule	2	
	Seller response	Seller	29	52
		Response	13	
		Friendly	6	
		Service	1	
		Communicative	1	
		Informative	2	
	Packaging	Packaging	4	50
		Neat	15	
		Box	31	
	Guarantee	Refund	11	11
	Catalog	Suitable	32	33
		Application	1	

Source: Processed Primary Data (2024)

The attributes most frequently reviewed by consumers are service attributes (49%) and product attributes (44%), while the least reviews regarding price attributes (7%). Service is the main attribute that sellers must pay attention to, especially delivery indicators, seller response and attitude, and packaging. Timely and fast delivery; fast, solution and good seller response; as well as safe fruit packaging will be a positive review. Apart from that, product attributes are also important because they are the object being sold. Fruit quality and freshness are the most frequently reviewed, so sellers really need to pay attention to them. Therefore, in order for consumer reviews to be positive, sellers must provide good service and quality.
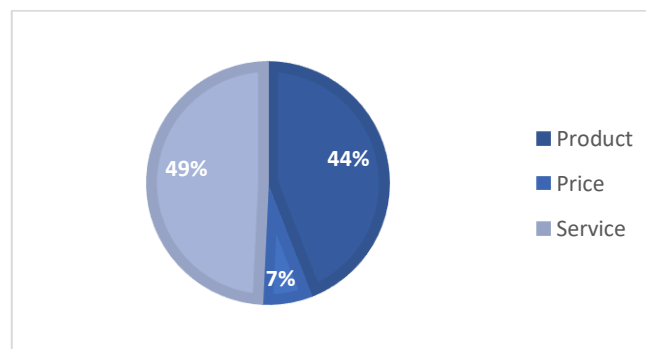

Figure 3. Percentage of Attributes Frequently Mentioned by Consumers

4.2. Accuracy Measurement Results

Based on the results of tests carried out on 316 user comment data. Then, the training data will be tested to become test data. This test was carried out to determine the accuracy, precision, and

recall level that describes the performance of each model formed. Table 2 shows the results of the analysis carried out on each model [41]. Testing is based on accuracy, Class Recall, and Class Precision values in sentiment analysis, with an accuracy performance value of 72.82% and a precision value of 92.59%. In comparison, Class Recall produces a value of 96.71%.

Table 2. Accuracy Measurement Results

Accuracy	**0,728211009**	72,82%
Precission	0,925984252	92,59%
Recall	0,967105263	96,71%
Rata-Rata	0,873766841	87,37%

Source: Processed primary data (2024)

4.3. Consumer Satisfaction

As a result of the data collected, it was found that there were 172 positive reviews and 144 negative reviews. Based on Table 1, the attributes related to product, price, and service are considered to have negative performance overall because nine of the twelve attributes analyzed indicate consumer dissatisfaction.

Table 3. Results of Consumer Satisfaction Analysis with Naïve Bayes

Attribute	Indicator	Average probability		Conclusion
		Positive	**Negative**	
Product	Quality	0,00304	**0,03509**	Dissatisfaction (negative performance)
	Size Weight	0,00750	**0,01130**	Dissatisfaction (negative performance)
	Freshness	**0,00277**	0,00073	Satisfaction (positive performance)
	Flavor	**0,00784**	0,00711	Satisfaction (positive performance)
	Color	0,00000	**0,00339**	Dissatisfaction (negative performance)
Price	Price	0,00000	0,00000	Satisfaction (positive performance)
	Promotional Discounts	0,00001	**0,00012**	Dissatisfaction (negative performance)
Service	Delivery	0,00038	**0,00101**	Dissatisfaction (negative performance)
	Attitude Response	0,00016	**0,00061**	Dissatisfaction (negative performance)
	Packaging	0,00004	**0,00016**	Dissatisfaction (negative performance)
	Warranty	0,00002	**0,00016**	Dissatisfaction (negative performance)
	Catalog	**0,00028**	0,00000	Satisfaction (positive performance)

Source: Processed Primary Data (2024)

The product attribute on Tokopedia involves several aspects, such as quality indicators, weight, freshness, taste, and color, which are factors considered by consumers when buying fresh fruit. Based on these five indicators, three aspects do not satisfy consumers, while the other two aspects receive positive assessments. The quality, size, weight, and color of fresh fruit received from Tokopedia are considered unsatisfactory by consumers. This creates a negative experience that is reflected in their reviews. Several consumer comments highlighted that the weight of the fruit received was too small, and the color of the fruit tended to be green because it needed to be ripe, creating dissatisfaction. Consumers have expectations that the fresh fruit they buy on Tokopedia will ripen and smells sweet. and smells sweet. The preferences of consumers who buy online at Tokopedia are not much different from the preferences of consumers when shopping offline at traditional markets. Consumers prefer fruit with a bright color, medium size, and sweet smell [53], [54]. Consumers also like fruit skin that is clean and free of spots [55]. These consumer reviews show that product quality must meet expectations to satisfy consumers. Nevertheless, fresh fruit products'

freshness and taste aspects receive positive consumer feedback, creating a satisfying experience. Consumers are satisfied with fresh fruit products that taste in line with their expectations. In line with this, Sari et al. [56] revealed in their research that the most crucial attribute consumers consider when buying fruit is taste, and consumers have a positive attitude towards all attributes.

The Price Attribute is a vital factor in providing satisfaction to consumers. The data in this research indicates that consumers are satisfied with the price indicators for fresh fruit offered by Tokopedia. However, it should be noted that other indicators also influence consumer perceptions of prices, such as discount indicators. The research results show that the discount indicator variable is more likely to receive a negative review than a positive one. However, consumers tend to feel more satisfied when discount and cashback offers are frequent. They may be willing to accept fresh fruit products and services that do not meet their expectations if offered a discount or cashback, as reflected in the following review example, "...good, bought it at a discount, only the delivery was a day late". This is supported by the research results of Abda'u et al. [57], who found that consumers prefer cheap fruit even though it does not have the best other attributes.

The service attribute in the context of purchasing fresh fruit involves five indicators taken into account by consumers, namely delivery, attitude response, packaging, guarantee, and catalog. Analysis of the five indicators reveals that only one indicator shows positive performance according to consumer perception. This indicator is the suitability of the fresh fruit sent according to the information in the Tokopedia platform catalog. Other indicators, such as delivery indicators, are analyzed as unsatisfactory variables by consumers. This conclusion suggests that the appearance value is higher in negative reviews than in positive reviews.

Based on reviews, most consumers are dissatisfied with delivery services that are not on time, are at the wrong address, and are unsafe. It was further explained that the indicator of the seller's uncommunicative and non-communicative response caused negative sentiment to emerge, such as the review example, "... it is complicated, because the buyer's refund, aka refund, must include complete bank account and branch data, but it turns out that after pressing it, it can be done. That is a refund to O V O. The advantages of this shop: CS diligently apologizes, that is all. Thank You." Packaging and guarantees are service indicators with a negative performance impact and consumer dissatisfaction when shopping for fresh fruit on Tokopedia. Consumer satisfaction can be increased by providing safe packaging and ensuring that the fresh fruit received meets expectations. This suggestion is in line with the research results of Rohmah et al. [58], which show that packaging functions as protection for vegetables because vegetables are agricultural commodities that are easily damaged. Packaging can give the impression that the product is of good quality. The product's condition when it reaches the consumer must be in the best condition, meaning that the vegetables are kept fresh, clean, and undamaged. On the other hand, the urgency of providing a money-back guarantee with an easy procedure if there is a discrepancy in the fresh fruit products ordered is also needed to change negative consumer sentiment into positive sentiment in the online fresh fruit purchasing service variable on Tokopedia.

CONCLUSION

The attributes most frequently reviewed by consumers are service attributes and product attributes. Based on the results of the satisfaction analysis, it shows that consumers give positive sentiments to the freshness and taste of the fruit, but negative sentiments to the quality, weight and size, and color of the fruit. On the price attribute, positive sentiment was obtained, but on the promotion and discount attributes, negative sentiment was obtained. Meanwhile, in terms of service, only the catalog received positive sentiment, in terms of delivery, seller's response and attitude, and packaging, negative sentiment was obtained.

Sellers need to improve and maintain fruit quality. Consumers like fresh fruit with a sweet taste and need to pay attention to the level of ripeness of the fruit so that when the product reaches

the consumer's hands it is still fresh, not rotten or mushy. Then in terms of service, accuracy and speed of delivery need to be paid attention to because consumers like it if the fruit arrives quickly considering the nature of the fruit which rots easily. Fast and informative seller response is also important, especially regarding stock and estimates of when the fruit will arrive. Apart from that, packaging must also be made safe so that the fruit that reaches consumers is not damaged, considering the perishable nature of fruit. If service quality is improved, positive reviews can be obtained and sales will increase.

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