Consumer insights that drive value creation opportunities in the Indonesian domestic apple supply chain

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Abstract

Agrifood chains that are based on the values defined by end consumers are able to secure a competitive edge over other chains, but securing that competitive edge requires a thorough understanding of the consumers and their value preferences. This study was conducted with a view to understanding domestic apple consumers in Malang, Indonesia, and using that information to guide the opportunities for domestic apple supply chain development in Indonesia. Data were collected through an intercept survey of 200 apple consumers. The survey was designed to identify the respondents' consumption and buying patterns, as well as their attribute preferences for domestic apple compared to imported apple. Respondents were segmented based on their demographic profile and their value preferences for the domestic apple. Three significantly different clusters of domestic apple consumers were identified: the 'indifferent consumers' disregarded the importance of most attributes of domestic apples; the 'pro-sensory consumers' valued sensory attributes more than search attributes; and the 'value seeking consumers' rated most of the value attributes as important in making a purchase. This study identifies the need for value chain members to adopt practices along the chain that enhance particular attributes of domestic apples in order to increase value for each consumer segment.

Keywords: apples, consumer preference, cluster analysis, market segment, Indonesia

1 Introduction

In Indonesia, the cultivation of apple (*Malus domestica*) is predominant in East Java Province, specifically in the districts of Malang, Batu and Nongkojajar Pasuruan as these areas have the natural characteristics required for growing apples, that is, a temperate climate with average temperatures of 16–27 °C, soil types with good drainage and high lands with elevations of 700–1400 m above sea level (Indonesian Citrus and Subtropical Fruits Research Institute, 2015). In these districts, farmers commonly cultivate the Manalagi, Rome Beauty and Anna varieties of apple, which have been formally classified by the Indonesian Ministry of Agriculture as the national apple varieties (Sugiyatno *et al.*, 2011). The domestic apple production in 2016 was around 329,000 tons for a total of two harvest seasons, resulting

from 3,735 ha of production area (Statistics of East Java, 2016). In terms of local employment, for example in the production area of Batu District alone, more than two thousand farmer households were involved in apple cultivation (Statistics of Batu, 2013), contributing to their income from the horticultural sector.

However, the development of the domestic apple industry is confronted with a number of challenges such as soil degradation and increased production costs. In addition, one of the most challenging issues is the significant competitive pressure created by imported apples. Despite the low apple consumption rate of 1.2 apples per capita per year, Indonesia imported approximately 129 million kilograms of apples in 2013 with a value of US$ 175 million. The average increase in import value is 6.39 % per year, with the imports mostly coming from China, the United States and New Zealand (Indonesian Ministry of Agriculture, 2016). This situation has impacted on domestic apples because the lower quality with

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fluctuating prices of domestic apples makes them less competitive than imported ones. The fundamental requirement for the sustainable competitive advantage of an industry is the strategic orientation that focuses on consumer preferences and on the responsiveness of the value chain towards the dynamic needs and wants of the final consumer. However, there is a lack of knowledge about the consumer perspective in the development of the domestic apple supply chain in Indonesia. Therefore, this study focuses on understanding consumers' value preferences towards apples in order to identify potential value chain improvement opportunities for the domestic apple industry in Indonesia. Specifically, this study aims to identify the consumption and buying patterns of apple consumers, as well as the attribute preferences for the domestic apple compared to those for the imported apple, and to segment the consumers of domestic apples according to their characteristics and value preferences. This article complements the extant literature by examining the consumer valuation of domestically produced apples in comparison with imported apples, in terms of consumption and buying patterns and attribute preferences, as well as the segmentation of domestic apple consumers.

2   Literature review

Consumer preferences are diverse, and the motives underlying food selection are typically characterised by the importance that consumers place on the intrinsic and extrinsic attributes of food (Gao *et al.*, 2011; Jimenez-Guerrero *et al.*, 2012; Alphonce *et al.*, 2015; Verain *et al.*, 2016). The experiential eating quality that derives from intrinsic, natural product characteristics such as organoleptic or other biophysical and biochemical characteristics has been shown to have a significant influence on consumer demand and preferences (Migliore *et al.*, 2015; Verain, *et al.*, 2016). According to Mowat & Collins (2000), value chain actors need to be conscious of overall consumer preferences as well as the specific preferences of each consumer segment, both of which need to be addressed in order to improve value chains.

2.1   Consumer value preferences

Consumers usually purchase food by considering intrinsic and extrinsic quality factors, and these considerations are influenced by consumers' demographic and socioeconomic characteristics (Gao *et al.*, 2011, 2014; Alphonce *et al.*, 2015). The intrinsic attributes are the parts of the product that cannot be altered without manipulating the nature of the product itself. These include the product's

physical appearance, ingredient composition and organoleptic properties (Jimenez-Guerrero *et al.*, 2012; Alphonce *et al.*, 2015). This intrinsic category can be further classified into the attributes sought by consumer prior to purchase, known as search attributes (for example, freshness, colour, size and variety); and the attributes experienced during consumption, known as experience/sensory attributes (for example, hardness, taste, aroma, acidity and ripeness) (Poole *et al.*, 2007; Mora *et al.*, 2011, Moser *et al.*, 2011; Badar *et al.*, 2015). Whereas the extrinsic attributes are those product characteristics that do not form the physical part of the product (Jimenez-Guerrero *et al.*, 2012; Alphonce *et al.*, 2015). This extrinsic category can be further classified into safety attributes (for example, certifications, labels on organically grown or fair-trade) and marketing attributes (for example, price, packaging) (Moser *et al.*, 2011; Adhikari *et al.*, 2012; Badar *et al.*, 2015).

In terms of apples, Bonany *et al.* (2013, 2014) found that the sweet taste and firmness were the most preferred value attributes in European countries. In Argentina and France, the consumers of apples place greater value on intrinsic value attributes such as juiciness, sweetness, firm texture, crunchiness, taste and freshness (Galmarini *et al.*, 2013). In Switzerland, taste, aroma and freshness were reported as the three most important intrinsic quality attributes of apples (Péneau *et al.*, 2006). Studies have also revealed that external attributes are becoming more important for consumers. Gunden & Thomas (2012) found that USA consumers value taste, hygiene, nutritional value and affordable price when purchasing fruits and vegetables, while a Danish study of several product categories revealed that consumers greatly value the healthiness and sustainability aspects of food along with intrinsic attributes (Verain *et al.*, 2016). Earlier studies in the USA highlighted that the colour and price of apples are relatively important attributes for consumers when they make their purchase decisions (Manalo, 1990; Baker & Crosbie, 1994). Apple consumers in Denmark were found to value organically grown and domestically or locally produced apples (Denver & Jensen, 2014).

Furthermore, studies have highlighted that consumer value preferences and consumption patterns are influenced by demographic characteristics. Konopacka *et al.* (2010) showed that consumers' age and gender have significant influences on fruit consumption. Their study, conducted across European countries, indicated that the level of apple and peach consumption was higher among female consumers than male consumers. Moreover, the levels of apple and peach consumption among older respondents were greater than that of younger respondents. Another European study by Bonany *et al.* (2013, 2014) showed

that consumers have specific varietal preferences in specific geographic locations. According to that study, Nicoter apples were the most widely accepted variety in Germany, the Netherlands and Switzerland, while Golden Delicious apples were the most preferred variety in Spain and Poland. Those studies clearly highlight the complexity of understanding consumers' preferred value attributes, and also point to the need to carry out product- and country-specific studies in order to develop targeted interventions in an industry's value chain.

2.2 Consumers' preference-based segmentation

Segmenting specific groups of consumers who have similar preferences towards the value attributes of a product is essential in order to deliver products that meets those needs. According to Verain *et al.* (2016) consumer segmentation provides insights into differences in the importance and perception of food attributes across consumer groups. Thus, the identification of consumer segments is crucial in developing targeted marketing strategies for specific consumer segments (Gao *et al.*, 2011; Alamanos *et al.*, 2013). More broadly, classifying consumers into segments based on the perceived product value is beneficial for identifying targeted value chain development strategies (Macharia *et al.*, 2013) and for achieving sustainable development of the agri-food industry (Gunden & Thomas, 2012).

Consumer segmentation studies provide deep insight into consumer preferences. For example, Skreli & Imami (2012) revealed that apple consumers in Tirana, Albania, could be classified into four classes. Each class had different valuations of important attributes such as fruit origin, variety, size and price. Another study of apple consumer in Europe showed that based on similarity in attribute importance, consumers could be clustered into six segments and further classified into two mega clusters, each with specific characteristics (Bonany *et al.* 2014). Thus, the successful understanding of the preferences of each consumer segment is advantageous for different players in fruit value chains, such as breeders, producers and marketers.

3 Materials and methods

3.1 Data collection methods

Data were collected through a survey conducted in the city of Malang, Indonesia. Malang was selected as the study site because it is the final retail destination of the majority of domestic apples produced in the districts of Batu, Malang and Pasuruan. Prior to the survey, human ethics research approval was obtained from the School of Agriculture and Food Sciences, The University of Queensland, Australia. The survey was administered with the assistance of trained

enumerators. The survey period was June to July 2016. Data were collected from 200 respondents aged over 18 years, covering both domestic and imported apple consumption. There are four types of retailer outlets where consumers purchase apples in Malang: (a) traditional wet markets where stallholders or peddlers (often a personal business) gather in an open or covered area to sell produce and other food items (Wei *et al.*, 2003); (b) semi-permanent/permanent outlets owned and operated by personal businesses who sell fruits along the side of the road, known as roadside stalls; (c) supermarkets such as national chains, and (d) modern fruit shops with automatic check-outs. In Malang Municipality, there are approximately twenty traditional wet markets (Statistics of Malang, 2014) and several large supermarkets in addition to some modern fruit shops. There are many roadside stalls but the exact number of these is unknown. As Indonesian consumers often shop at traditional wet markets (Wei *et al.*, 2003), the sample composition of 200 respondents was allocated as follows: 40 % from wet markets, 30 % from roadside stalls and 30 % from supermarkets and modern fruit shops. During their purchase of apples, respondents were intercepted randomly and invited to participate in the survey.

In selecting the 200 respondents for the survey, retail outlets in the north, west, south, east and central parts of the municipality were selected by adopting a simple random approach, and then the consumer sample was further stratified based on those types of retail outlets. The sample size was previously estimated by using the sample size formula of the confidence interval approach (Zikmund & Babin, 2016), as follows:

$$n = \frac{\sigma^2 \, Z^2}{E^2} \qquad (1)$$

where n is the sample size, σ is the standard deviation of the population, Z is the measure of confidence level desired, and E is the precision desired.

In order to conduct the survey, a questionnaire was developed comprising three sections. The first section was designed to collect data on general apple consumption and buying preferences. The second section focused on examining apple attribute preferences for both domestic and imported apples. The third section of the questionnaire sought information on the respondents' demographic characteristics. As the apple purchase decisions were expected to be influenced by both intrinsic and extrinsic attributes (Gao *et al.*, 2011, 2014; Alphonce *et al.*, 2015), the relevant attributes were identified and adapted from previous apple quality acceptance and preference mapping studies by Bonany *et al.* (2013, 2014). Colour, fineness (smoothness of the fruit skin), size, aroma and firmness were classified as search attributes during purchase, while juiciness (amount of liquid released during chewing), mealiness (mealy feeling while

chewing the apple), crispness (force for first bite and its noise intensity), chewiness (duration and number of masticatory cycles before swallowing the apple), toughness of the skin (force needed to penetrate the skin) and sweet flavour were classified as the sensory attributes of the apples. Price and packaging were considered as extrinsic attributes. Eleven intrinsic attributes (5 search and 6 sensory) and two extrinsic attributes were included in the questionnaire, and a five-point Likert scale where 1 = "not at all important" and 5 = "very important" was used to measure consumers' preference ratings. At most retail outlets in Indonesia, consumers are usually provided with taste samples, helping them to make decisions and choose the fruit based on the sensory attributes.

3.2 Data analysis

The data collected from the consumer survey were analysed using the IBM SPSS statistical software package. General facts about the consumption and buying preferences of the apple consumers were analysed using descriptive statistics. The respondents' preferences for domestic and imported apple attributes were compared using the Wilcoxon signed-rank test. This method was employed as the two sets of preferences were measured from the same respondent using a 1–5 Likert scale. The comparison analysis was useful in order to identify which attributes of the domestic apple were considered less attractive than the imported apple, and thereby, to identify potential ways of improvement. Then, since the focus of this study was to understand the segmentation of domestic apple consumers and suggest how those insights could be used to develop the domestic apple industry, consumers were segmented based on domestic apple preference attributes. Hierarchical cluster analysis using Ward's method with Squared Euclidean distance was employed to generate consumer segments. The hierarchical clustering method was chosen because it is relatively more advantageous than methods in which the procedure is done without pre-specifying the number of clusters. In addition, this technique is regarded as very efficient since it applies an analysis of variance to estimate the distances between clusters (Kennedy *et al.*, 2008). Hence, the method allows the easy identification of the market segments gained from grouping respondents with similar coefficients into clusters (Campbell *et al.*, 2004). Cronbach's Alpha value was used to measure the reliability of the items used in the analysis. The values of the 13 domestic apple attributes and imported apple attributes were 0.841 and 0.854 respectively, indicating that the scale used in the study was internally reliable (Hair, 2010). The appropriate number of interpretable clusters was identified based on the agglomeration schedule and dendrogram (Kennedy *et al.*, 2008).

Cross tabulations and ANOVA were subsequently performed to compare means among the clusters and to reveal the characteristics of each cluster (Badar *et al.*, 2015; Lim-Camacho *et al.*, 2017). Furthermore, post-hoc tests using the Duncan procedure (DMRT) were employed to identify significant differences across clusters. The chi-square (χ^2) test was applied to examine the significant differences among nominal or categorical responses (Alamanos *et al.*, 2013; Berenson *et al.*, 2013) in terms of the consumption patterns, buying preferences and socio-economic characteristics of respondents.

4 Results

4.1 Demographic characteristics of respondents

Table 1 presents a summary of the socio-demographic profiles of the respondents. The sample had a 65.5 % representation of females. The sample also had a greater representation of individuals aged 21–50 years. More than half of the sample had an education level of senior high school or above. In terms of occupation, the majority of the respondents were private employees (44.5 %) followed by self-employed (24.5 %), and they earned 3,000,000 to 9,000,000 Indonesian Rupiah (IDR) (equal to US\$ 222–\$ 667) as family income per month.

Table 1: *Demographic characteristics of respondents (n = 200).*

Characteristic	Category	Percentage (%)
Gender	Male	34.5
	Female	65.5
Age (Years)	< 20	4.0
	21–30	30.0
	31–40	28.0
	41–50	26.5
	51–60	9.0
	> 60	2.5
Education	No education	0.5
	Elementary school [*]	9.0
	Junior high school [†]	9.5
	Senior high school [‡]	41.5
	Undergraduate degree	36.5
	Postgraduate degree	3.0
Family size (people)	1–2	6.5
	3–4	63.5
	5 or more	30.0
Household income (IDR [§]/month)	< 3,000,000	40.5
	3,000,000–9,000,000	45.0
	9,000,001–15,000,000	12.0
	15,000,001–21,000,000	2.5

[*] Runs for six years starting from year 1 to year 6, [†] Runs for three years from year 7 to year 9, [‡] Runs for three years from year 10 to year 12; [§] IDR: Indonesian rupiah (1,000,000 IDR ≈ 62 EUR).

4.2 Consumption and buying preferences

Table 2 presents the consumption and buying patterns of the respondents in regard to both domestic and imported apples. The respondents commonly consumed apples in fresh form while some respondents consumed processed apples such as apple juice, smoothies, chips, porridge or jams. Both the domestic and imported apples were consumed in large proportion as fresh fruits. With respect to consumers' buying preferences, patterns varied across the sample. A majority of the respondents (44.5 %) indicated that they prefer fresh domestic apples of medium size; according to the standardisation of apple grading in Indonesia, the medium size amounts to 8–10 fruits per kilogram. However, in terms of imported varieties, the respondents preferred larger apples.

The consumers also indicated that they normally purchased 1 kilogram of fresh domestic apples in one shopping trip. This related to family size, where the quantity of apples purchased was sufficient for all family members. Interestingly, the majority of the respondents purchased domestic apples from traditional wet markets while the imported apples were purchased from supermarkets.

As mentioned above, the Indonesian Ministry of Agriculture has formally identified the Manalagi, Rome Beauty, and Anna as the national apple varieties. According to the survey conducted in the present study, the Manalagi apple was the most popular among the three varieties. As many as 64.5 % respondents selected this variety as their preference. Rome Beauty was the second most preferred variety with 18.5 % of respondents selecting this variety, and the Anna was the least preferred (17 %).

4.3 Domestic and imported apple attribute preferences

The two sets of value preferences were compared using the Wilcoxon signed-rank test. The results revealed that the respondents reported a significantly greater level of preference for the search attributes of imported apples than for the domestic apples. Four search attributes, namely, colour ($Z = 2.76$; $p = 0.06$), fineness ($Z = 2.71$; $p = 0.07$), size ($Z = 2.77$; $p = 0.06$) and aroma ($Z = 3.60$; $p = 0.00$), and one sensory attribute, namely, the toughness of the skin ($Z = 2.66$; $p = 0.08$), had significantly greater mean ranks for imported apples than for domestic apples. However, one search attribute, namely, firmness, and five sensory attrib-

Table 2: *Consumption and buying preferences of respondents (n = 200).*

Preference	Category	Percentage (%)	
		Domestic Apples	Imported Apples
Form of consumption	Fresh fruit	55.5	78.5
	Processed	44.5	21.5
Frequency of consumption	Every day/almost every day	2.0	1.5
	2–3 times a week	13.5	4.0
	Once a week	13.0	9.5
	2–3 times a month	31.5	15.5
	Once a month	20	35.0
	Less than once a month	20	34.5
Fruit size	Very large (3–4 fruits/kg)	9.5	25.0
	Large (5–7 fruits/kg)	40.5	49.0
	Medium (8–10 fruits/kg)	44.5	25.0
	Small (11–15 fruits/kg)	5.5	1.0
Purchase quantity/visit	< 1 kg	1.0	20.0
	1 kg	58.3	57.5
	2 kg	27.6	18.0
	≥ 3 kg	13.0	4.5
Preferred retailer	Traditional wet market	59.0	24.5
	Supermarket	15.5	47.0
	Modern fruit shop	5.0	15.0
	Road side stall	20.5	13.5

utes, namely, juiciness, mealiness, crispness, chewiness and sweetness, had no significant difference across both types of apples. Both extrinsic attributes, namely, price ($Z = 2.33$; $p = 0.20$) and packaging ($Z = 3.11$; $p = 0.02$) had significantly greater mean ranks for imported apples than for domestic apples.

4.4 Domestic apple value attribute-based market segments

By applying hierarchical cluster analysis using Ward's method, the respondents were segmented based on their preferences for 13 attributes of domestic apples. The dendrogram was then used to determine the appropriate number of interpretable clusters. Accordingly, a three-cluster solution was deemed relevant to describe the different consumer segments for domestic apples in Malang, Indonesia. These three segments were labelled as '*indifferent*' (cluster one; 35.5 %), '*pro-sensory*' (cluster two; 45.5 %) and '*value seeking*' (cluster three; 19 %). The results revealed significant differences across clusters in terms of intrinsic (search and sensory), and extrinsic attributes.

4.4.1 Cluster one – Indifferent group

The members of the 'indifferent cluster' were the least interested in the value attributes of domestic apples. They pur-

chased and consumed domestic apples without giving much attention to quality attributes, placing a relatively high importance only on sweetness with this attribute gaining the highest rating from this cluster. This group rated most attributes as neutral and rated packaging, skin toughness, mealiness and size as not important. Cluster one was similar to cluster three only in terms of respondents" preferences on juiciness and price, and there were no similarities between cluster one and cluster two (Table 3).

In terms of buying and consumption patterns, this cluster can be categorised as light consumers because the frequency of consumption is relatively low. However, the quantity of apples they purchased per trip was similar to that of the other two groups. A majority of the respondents in this cluster usually bought one kilogram of apples in one shopping trip (59 %) and they preferred medium sized (50.7 %) apples. The majority (77.5 %) preferred to buy domestic apples from traditional wet markets (Table 4). The respondents of this cluster were relatively younger and a majority of them were educated up to senior high school level. These respondents belonged to the medium household income bracket of IDR 3,000,000–9,000,000 per month (45.1 %); compared to cluster two, they had a significantly greater household income level (Table 5).

Table 3: *Comparison of clusters based on attribute importance for domestic apples (n = 200).*

	Cluster 1 (n = 71) Indifferent	Cluster 2 (n = 91) Pro-sensory	Cluster 3 (n = 38) Value seeking	F-value	p-value
Intrinsic – Search attributes					
Colour	3.59[a]	4.22[b]	4.32[b]	10.097	0.000
Fineness	3.59[a]	4.29[b]	4.63[c]	20.537	0.000
Size	2.94[a]	3.95[b]	3.58[c]	22.764	0.000
Aroma	3.15[a]	4.14[b]	2.55[c]	69.351	0.000
Firmness	3.08[a]	4.41[b]	4.61[b]	77.334	0.000
Intrinsic – Sensory attributes					
Juiciness	3.46[a]	4.38[b]	3.24[a]	47.185	0.000
Mealiness	2.82[a]	3.98[b]	3.16[c]	34.586	0.000
Crispness	3.61[a]	4.32[b]	4.79[c]	30.367	0.000
Chewiness	3.87[a]	4.63[b]	4.79[c]	32.422	0.000
Skin toughness	2.85[a]	4.42[b]	4.05[c]	81.356	0.000
Sweetness	4.01[a]	4.71[b]	4.97[c]	55.172	0.000
Extrinsic attributes					
Price	3.69[a]	4.59[b]	3.84[a]	22.399	0.000
Packaging	2.20[a]	3.65[b]	4.03[c]	57.248	0.000

These results were based on a 1–5 Likert scale. The alphabet in superscript indicates the results of the Duncan post-hoc test. The same superscripted letters in each column in the same row indicate that, for the cluster in the particular attribute, there is no statistically significant difference at $\alpha = 0.05$ level. Different superscripted letters indicate that there is significant difference between clusters at $\alpha = 0.05$.

Table 4: *Cluster comparison based on consumption preferences (in percentage, n = 200).*

	Cluster 1 (n = 71) Indifferent	Cluster 2 (n = 91) Pro-sensory	Cluster 3 (n = 38) Value seeking	χ^2-value	p-value
Frequency of purchase					
2–3 times a week	5.6	23.1	15.8		
Once a week	12.7	17.6	2.6		
2–3 times a month	23.4	34.1	36.8		
Other	56.3	25.2	44.8		
Mean rank	124.15	81.96	100.71	22.348	0.000
Quantity purchased/visit					
< 1 kg	1.4	1.1	0		
1 kg	59.2	56.7	60.5		
2 kg	22.5	31.1	28.9		
≥ 3 kg	16.5	11.1	10.5		
Mean rank	1000.56	100.34	98.14	0.63	0.969
Preferred fruit size					
Very large (3–4 fruits per kg)	8.5	12.1	5.3		
Large (5–7 fruits per kg)	33.8	45.1	42.1		
Medium (8–10 fruits per kg)	50.7	38.5	47.4		
Small (11–15 fruits per kg)	7	4.4	5.3		
Mean rank	100.38	92.58	104.74	3.816	0.148
Preferred market outlet					
Traditional wet market	77.5	78.0	44.7		
Supermarket	14.1	8.8	34.2		
Modern fruit shop	1.4	1.1	7.9		
Road side stall	7	12.1	13.2		
Mean rank	94.04	95.07	125.58	14.010	0.001

Chi-square (χ^2): p-value < 0.05 indicates there is a significant difference among clusters.

Table 5: *Cluster comparison based on socio-economic characteristics (in percentage, n = 200).*

	Cluster 1 (n = 71) Indifferent	Cluster 2 (n = 91) Pro-sensory	Cluster 3 (n = 38) Value seeking	χ^2-value	p-value
Age (years)					
≤ 30	36.6	36.3	23.7		
31–40	25.4	24.2	42.1		
41–50	28.2	26.4	23.7		
> 50	9.9	13.2	10.5		
Mean rank	98.21	100.97	103.66	0.247	0.884
Level of education					
Elementary school or less	7.0	14.2	2.6		
Junior high school	5.6	12.1	10.5		
Senior high school	60.6	35.2	21.1		
Under graduate degree	23.9	35.2	63.2		
Post graduate degree	2.8	3.3	2.6		
Mean rank	94.22	95.10	125.16	9.705	0.008
Household income (IDR per month)					
< 3,000,000	39.4	49.5	21.1		
3,000,000–9,000,000	45.1	42.9	50.0		
9,000,001–15,000,000	12.7	6.6	23.7		
15,000,001–21,000,000	2.8	1.1	5.3		
Mean rank	100.02	88.76	125.76	13.120	0.001

Chi-square (χ^2): p-value < 0.05 indicates there is a significant difference among clusters.

4.4.2 Cluster two – Pro-sensory group

The pro-sensory group constituted the largest cluster, with 45.5 % of respondents. The cluster was labelled 'pro–sensory' since the members rated the majority of the sensory attributes of domestic apples higher than the search attributes. The respondents in this cluster identified sweetness, chewiness, skin toughness, juiciness, crispness and mealiness as the most significant sensory attributes of domestic apples. They also differed significantly on their perceptions of fineness and aroma (Table 3). However, the respondents in this cluster were more conscious of the price of apples. Interestingly, the other two clusters were similar in that neither agreed nor disagreed about the importance of price in purchasing domestic apples. Cluster two was similar to cluster three only in terms of the importance they placed on the colour and firmness of apples.

The majority of respondents in this cluster consumed domestic apples more often than the respondents in the other two clusters. Nearly 41 % consumed domestic apples either two to three times a week or once a week. They normally bought one kilogram (56.7 %) or two kilograms (31.1 %) of apples per shopping trip. The majority preferred large apples (45.1 %) and traditional markets (59.2 %), a finding consistent with cluster one (Table 4). This cluster was similar to cluster one with equal percentages of respondents aged less than 30 years but the representation of respondents aged over 50 was greater than that of clusters one and three. However, the comparison of mean ranks revealed that age was not significantly different across clusters ($\chi^2 = 0.247$; $p = 0.884$). This cluster was also more educated than cluster one with more than 70 % of respondents having finished senior high school or completed an undergraduate degree (Table 5). However, this cluster had significantly lower household income levels than the other two clusters ($\chi^2 = 13.12$; $p = 0.001$).

4.4.3 Cluster three – Value seeking group

The respondents in the value seeking cluster were the most attentive to value when buying domestic apples, implying that they seek value when purchasing this fruit. This cluster had the highest mean values for the majority of the search and sensory attributes. Of the sensory attributes, they ranked sweetness, crispness, chewiness and skin toughness as very important attributes, which was significantly different to the other two clusters. In terms of search attributes, fineness was the only one that ranked significantly greater in this cluster compared to the other two clusters. The rankings for the colour and firmness attributes were similar to the rankings of these attributes in cluster two, while this cluster placed the lowest importance on aroma (Table 3).

The majority of cluster three respondents consumed domestic apples two or three times a month (36.8 %), making them less frequent consumers than the respondents in cluster two. Similar to the other groups, they normally purchased one kilogram of apples in one shopping trip, and usually purchased medium to large sized apples. Unlike the other two clusters, a greater proportion of the respondents in this cluster purchased domestic apples from supermarkets (34.2 %) (Table 4), and that could be why they place a greater significance on apple value attributes than the respondents in the other clusters. In terms of socio-economic characteristics, the majority of respondents in this cluster belonged to the 31–40 age category (42.1 %) and were more educated, with a majority having an undergraduate degree (63.2 %) (Table 5).

5 Discussion

This study is an exploratory study given the small sample size of the respondents. Therefore, a much broader study involving a larger sample size in the future is needed in order to clearly comprehend the consumer profile and their preferences and behaviours in consuming apples. However, this study has provided some useful findings. As indicated by the result, more than half of the sample consisted of females. This is in line with general shopping habits in Indonesia, where females are the primary grocery shoppers for their households and tends to make the majority of decision for household purchases (Slamet & Nakayasu, 2017). In addition, most of the sample had an education attainment level of senior high school (years 10 to 12). This is also consistent with the statistical data (Statistics of Malang, 2016) demonstrating that those with an education level of senior high school and university were the largest group in the study location. This reflects that most of the respondents in the study had attained the level of education that is regulated as compulsory in Indonesia.

Normally, the harvest period for domestic apples in Indonesia occurs twice a year, that is, during July to August and during January to March. Even though the supply fluctuates depending on the harvest seasons, small numbers of apples can be harvested during the off-season. Thus, consumers might still find domestic apples in retail outlets during the off-season. The imported apple is available all year round. However, the frequency of consumption of domestic apples was greater than the frequency of consumption of imported apples. A related study by Rahayu *et al.* (2012) indicated that fruit and vegetable consumption in Indonesia was still below the standard consumption of 65 kilograms per capita per year recommended by the Food and Agriculture Organization; their study found that Indonesian consumption of fruits and vegetables was 40 kg per capita per year,

and specifically the apple consumption was 0.90 kilograms per capita per year.

That the majority of the respondents purchased domestic apples from traditional wet markets is in line with the findings by Wei *et al.* (2003) that most Indonesian consumers shop for fresh produce at traditional wet markets as it enables them to bargain and purchase products at a cheaper price. The respondents in the present study who preferred to purchase apples from supermarkets and modern fruit shops indicated that they preferred to buy good quality apples at a fixed price and at their convenience. The result of the two sets of value preferences comparison using the Wilcoxon signed-rank test clearly highlighted that imported apples were regarded as more visually appealing than domestic apples. This information implies a potential avenue for improvement of the domestically produced apple, namely, that the visual appearance of the domestic apple must be improved in order to compete with the imported apple.

In terms of the domestic apple attribute-based market segments, three clusters were successfully identified; the indifferent, pro-sensory and value seeking clusters. Indifferent consumers purchased domestic apples without paying much attention to quality attributes; the consumers in this cluster, merely considered sweetness as a relatively highly important attribute, with this attribute gaining the highest rating from the cluster. This result was similar to the results in a study by Badar *et al.* (2015) that found mango lover consumers were merely concerned with consuming mangoes and considered few quality attributes as important. In addition, the sweetness attribute was considered important by consumers across the three clusters in the present study, implying that most consumers preferred sweet apples. This finding is comparable to the findings by Bonany *et al.* (2013) in their study of European consumers where most of the consumers (clusters 1, 2, 5 and 6 in that study) preferred sweet apples. Hence, there is a similarity between Indonesian consumers and European consumers in terms of their preferences for sweetness in apples.

The pro-sensory group (cluster two) had a significantly lower household income level than the respondents in the other two clusters ($\chi^2 = 13.12$; $p = 0.001$), even though this cluster had a higher level of education than the respondents in cluster one. Cluster two also had the youngest profile (below 30 years of age), hence, this group was likely to be earning a minimum wage in the early stage of their careers, and therefore they were more conscious of the price of apples. The results also revealed that the education level of the value seeking group (cluster three) was significantly greater than that of the other two clusters ($\chi^2 = 9.705$; $p = 0.008$), and the age profile was also older than the other two clusters. This

could explain why this cluster had a significantly greater household income level compared to the other two clusters.

Overall, the comparison of clusters provides some critical insights into the attribute preferences of consumers of domestic apples. Although cluster three constituted the smallest cluster of all, this group was the most value attentive in terms of most of the search and sensory attributes which were also included as organoleptic attributes of domestic apples. This echoes the finding by Alamanos *et al.* (2013) where the 'sensorialist' group among tomato consumer segments in Greece preferred organoleptic characteristics when selecting fresh tomato. Even though each cluster in the present study valued apple attributes differently and their preferences were different, there were several attributes valued highly by all clusters. Across the clusters, the three highly rated domestic apple attributes were sweetness, chewiness and crispness.

It was found that the Manalagi domestic apple variety was the most preferred variety because of its sweetness, chewiness and crispiness. Manalo (1990) found crispness as the most important apple attribute for New Hampshire consumers, while Denver & Jensen (2014) identified that the sweet taste was the most important attribute for apple consumers in Denmark. Furthermore, as the consumers in the present study were grouped into distinct market segments based not only on their preferences for product quality attribute, but also on demographic, the characteristics of each cluster can be identified. Hence, the information generated from these findings indicates that consumer value preferences and consumption patterns are influenced by demographic characteristics, namely age, education and income, as suggested by several other studies (Konopacka *et al.*, 2010; Galmarini *et al.*, 2013).

These results add to the literature by providing consumer insights in the context of fruit consumption in a developing country. Even though the study focused on the consumption of domestically produced apples, a comparison with imported apples was also made with regard to buying and consumption patterns and fruit attributes preferences. The findings on the consumer segmentation based on the consumer profiles, and the findings on the preferences for the domestic apple attributes in each segment, provide useful information that can be applied by relevant actors in the supply chain to enhance the perceived value of domestically produced apples. Apple breeders, producers and retailers can take the opportunity to create value by tailoring the fruit quality attributes to meet the needs of each consumer segment.

6   Conclusion

This study contributes to the limited available information on consumer value preferences in Indonesia for fresh fruit in general and the domestically produced apple in particular. The findings are useful for value chain players seeking to create effective intervention strategies for the sustainable development of the domestic apple supply chain in Indonesia.

The pro-sensory and value seeking respondents purchased a large proportion of domestic apples and placed a significantly greater importance on the quality attributes of domestic apples. This highlights the need to better position the domestic apple varieties in the minds of consumers especially with respect to search attributes. The findings clearly show that consumers buy with their eyes first; hence, the industry needs to act to educate chain actors to improve their practices so that the domestic apples available at retail level are visually appealing. Guided by the understanding of valued attributes, apple farmers need to differentiate their products through the adoption of new production technology and the production of alternative varieties that are in demand. Relevant supporting agencies such as the local government, Ministry of Agriculture and agricultural research and development agencies could play an essential role in educating chain actors on how to maintain quality across the chain. Since traditional markets and road-side stalls were found to be the most preferred retailer outlets for the purchase of domestic apples, these types of retailers should be supported through better access to training and technology to maintain apples at proper temperature levels. The supply chain in Indonesia is fragmented and poorly organised, so the supply chain actors need to play an active role by developing collaboration among themselves and improving their practices. Furthermore, promoting the domestically grown apple through various marketing programs would also be a strategic approach to influencing the consumer mindset.

This study focused on one particular city in which domestic apples are readily available. The findings highlight the need to conduct further in-depth studies to understand how domestic apple quality can be maintained across value chains in order to better compete with imported apples. Other limitation of this study is that cluster three was small, and therefore making inferences from this is difficult at its best. Future research should include a larger sample size and different approaches, such as qualitative methods to provide further insight into consumers' behaviour. Since this study only considered price as an extrinsic attribute, future studies should also focus specifically on domestically produced apple and the willingness to pay for this product.

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