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

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Abstract

Managing agri-food chains based on the value defined by end consumers provides competitive advantage but requires a thorough understanding of consumers and their value preferences. This study was conducted to identify consumer preferences for apples and to segment consumers so that findings could be used to guide domestic apple value chain development in Indonesia. Data were collected through an intercept survey of 200 apple consumers in Malang, Indonesia. Three significantly different clusters of domestic apple consumers were identified. The 'indifferent consumers' disregarded the importance of most attributes of domestic apples, while 'pro–sensory consumers' valued sensory attributes more than search attributes. 'Value–conscious consumers' rated most of the value attributes as important in making a purchase. This study identifies the need for adopting practices along the chain that enhance particular attributes of domestic apples so as to increase value for each consumer segment.

Key words: Apples, consumer preference, market segment, supply chain, Indonesia

Introduction

Consumer preferences are diverse, and the motives underlying food selection are typically characterised by the importance consumers place on both 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 and Collins (2000), value chain members need to be conscious of overall consumer preferences as well as specific preferences of each consumer segment, both of which need to be addressed in improving value chains.

Indonesia has imported approximately 84 million kilograms of apples in 2015 with a value of US$139 million (Indonesian Ministry of Agriculture, 2016), despite its low rate of apple consumption of 0.90 kilograms per capita per year. Imports of high quality apples from China, the USA and New Zealand have a significant impact on markets for domestically produced apples. Thus, the development of the domestic apple industry of Indonesia requires a holistic value chain approach which looks at potential improvement opportunities along the chain from input supply to consumption. Therefore, this study focuses on understanding consumers' value preferences towards apples so as to identify potential value chain improvement opportunities for the domestic apple industry in Indonesia.

Consumer value preferences: Consumers usually purchase food by considering intrinsic quality and extrinsic quality factors influenced by demographic and socio-economic characteristics of those consumers (Gao *et al*., 2011, 2014; Alphonce *et al*., 2015).

Intrinsic attributes are parts of the product that cannot be altered without manipulating the nature of the product itself. These include products' physical appearance, ingredient composition and organoleptic properties (Jimenez-Guerrero *et al*., 2012; Alphonce *et al*., 2015). On the other hand, extrinsic attributes are those product characteristics that do not form the physical part of the product such as price, certification and packaging (Jimenez-Guerrero *et al*., 2012; Alphonce *et al*., 2015). Intrinsic attributes can be further classified into search attributes (for example freshness, colour, size and variety) and experience/sensory attributes (for example hardness, taste, aroma, acidity and ripeness). Those intrinsic attributes that consumers seek prior to purchase are classified as search attributes while intrinsic attributes that they experience during consumption are classified as experience/sensory attributes (Poole *et al*., 2007; Mora *et al*., 2011, Moser *et al*., 2011; Badar *et al*., 2015). Similarly, the extrinsic attributes can be further classified into safety attributes (for example certifications, organic, fair-trade labels) and marketing attributes (for example price, packaging) (Moser *et al*., 2011; Adhikari *et al*., 2012; Badar *et al*., 2015). However, some researchers adopt different classifications in categorising fruit quality attributes. In a study on fresh fruits, Gao *et al*. (2014) considered all visual attributes such as colour, shape, and size as external attributes while all sensory characteristics were classified as internal attributes and credence attributes. A study by Qing, *et al*. (2012) on fresh fruit categorised appearance, texture and flavour of the fruit as sensory attributes while location, brand, time and handling of the fruit were categorised as non-sensory attributes.

Gao *et al*. (2011) demonstrated that the most important attributes of fresh citrus among USA consumers were inherent natural cues such as freshness, flavour and appearance. In terms of

apples, Bonany *et al*. (2013, 2014) found that the sweet taste and greater firmness were the most preferred value attributes in European countries. In Argentina and France, 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).

Some studies have also revealed that external attributes are becoming more important for consumers. Gunden and Thomas (2012) found that USA consumers value taste, hygiene, nutritional value and affordable price when purchasing fruits and vegetables, while a Danish study based on several product categories revealed that consumers greatly value healthiness and sustainability aspects of food along with intrinsic attributes (Verain *et al*., 2016). Similarly, earlier studies on apples highlighted that colour and price are relatively important attributes for consumers when they make their purchase decisions (Manalo, 1990; Baker and Crosbie, 1994). Apple consumers in Denmark were also found to value organically grown and domestically or locally produced apples (Denver and Jensen, 2014).

Furthermore, studies have highlighted that consumer value preferences and consumption are influenced by demographic characteristics. Konopacka *et al*. (2010) showed that consumers' age and gender have significant influences on fruit consumption. This study, conducted across European countries, indicated that female consumers had higher apple and peach consumption levels than male consumers. Moreover, relatively older respondents' apple and peach consumption levels were greater than that of younger respondents. Similarly, another European study by Bonany *et al*. (2013, 2014) showed that consumers have specific varietal preferences that vary based on geographic location. According this 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. A study by Galmarini *et al*. (2013) pointed out that consumers of different cultural backgrounds from different countries in Europe also had different value perceptions of the quality of apples. Although these studies clearly highlight the complexity of understanding consumers' preferred value attributes, they also raise the need to carry out product and country specific studies to develop targeted interventions in developing an industry's value chains.

Consumers' preference-based segmentation: Consumers' value food attributes differently, therefore segmenting specific groups of consumers who have similar preferences towards value attributes of a product is essential in being able to deliver product 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 in identifying targeted value chain development strategies (Macharia *et al*., 2013) and to achieve sustainable development of the agri-food industry (Gunden and Thomas, 2012).

Consumer segmentation studies provide deeper insight into consumer preferences. For example, Skreli and 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 consumers 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 preferences of each consumer segment is advantageous for different players in fruit value chains, such as breeders, producers and marketers (Bonany *et al*., 2014).

Based on those recent studies, fundamental requirement of sustainable competitive advantage of an industry is the strategic orientation that focus 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 evidence of the adoption of a consumer perspective in the development of domestic apple supply chain in Indonesia. The research questions that arise are: (1) what are the consumption and buying patterns, as well as the attribute preferences for domestic apple compared to those for imported apple? (2) what are the different segments of domestic apple consumers in Malang, Indonesia and their characteristics and value preferences? Therefore, the objective of this study is to identify the consumption and buying patterns, as well as the attribute preferences for domestic apple compared to those for imported apple, and to segment consumers of domestic apple according to their characteristics and value preferences. Thereby, the knowledge from this consumer study can be used in the development of domestic apple supply chain. This article complements the literature by examining consumer valuation towards domestically produced apple in comparison with imported apple, in terms of consumption and buying patterns, attributes preferences, as well as the segmentation of domestic apple consumers.

Materials and methods

This study was conducted in the city of Malang, Indonesia as it is the final retail destination of the majority of domestic apples produced in the districts of Batu, Malang and Pasuruan. 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) sell produce and other food items are gathered in an open or covered area (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 City, 2014) and several large supermarkets in addition to some modern fruit shops. There are many roadside stalls but the exact number 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. 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.

Questionnaire design: In order to conduct the survey, a questionnaire was developed with 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 demographic characteristics of respondents. As consumers' apple purchase decisions were influenced by both intrinsic and extrinsic attributes (Gao *et al*., 2011, 2014; Alphonce *et al*., 2015), the relevant attributes were identified based on 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 sensory attributes of 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" were used to measure consumers' preferences ratings. At most retail outlets in Indonesia, consumers were usually provided with taste samples, helping them to make decision in choosing the fruits based on the sensory attributes.

Before proceeding with the survey, human ethics research approval was obtained from the School of Agriculture and Food Sciences, The University of Queensland, Australia. The survey was completed with the assistance of trained enumerators. During the period June – July 2016 primary data were collected from 200 respondents aged over 18 years, covering both domestic and imported apple consumption. Respondents were intercepted randomly while they purchased apples and invited to participate in the survey. Through a face-to-face survey, 200 apple consumers were intercepted at wet markets (*n*=80), roadside stalls (*n*=60) and supermarkets and modern fruit shops (*n*=60).

Data analysis: Data collected from the consumer survey were analysed using the statistical software package IBM SPSS. General facts about the consumption and buying preferences of apple consumers were analysed using descriptive statistics. Respondents' preference for domestic and imported apple attributes were compared using Wilcoxon signed ranks 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 to identify which attributes quality of domestic apple considered lower than the imported one and thereby, potential way of improvement can be identified. Then, since the focus of this study was to understand the segmentation of domestic apple consumers and 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 market segments gained from grouping respondents with similar coefficients into clusters to be easily identified (Campbell *et al*., 2004). Cronbach's Alpha value was used to measure the reliability of the items used in the analysis. Values of 13 domestic 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 to reveal the characteristics of each cluster (Badar *et al*., 2015; Lim-Camacho *et al*., 2017). Furthermore, post-hoc tests using the Duncan procedure 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 consumption, buying preference and socio-economic characteristics of respondents.

Results and discussion

Demographic characteristics of respondents: Table 1 highlights the socio-demographic profile of respondents. In Indonesia, females are the primary grocery shoppers for households and consistent with this general shopping habit, this 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 Indonesian Rupiah (IDR) 3,000,000 to IDR 9,000,000 per month, or equal to US$ 222 to US$ 667 as family income.

Consumption and buying preferences: Respondents commonly consumed apples in fresh form while some respondents consumed processed apples such as apple juice, smoothies, chips, porridge or jams. In comparison, both domestic and imported apples were consumed as fresh fruits (Table 2). Normally, the harvest period of domestic apple in Indonesia is twice a year, that is, during July to August and during January to March. Even though the supply fluctuated depending on the harvest seasons, consumers might still find domestic apples in retail outlets during the off season, while the imported apple was also available all year round. However, the frequency of consumption of domestic apple was greater than imported apple. Previous 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 (FAO), in which Indonesian consumption of fruits and vegetables was 40 kg per capita per year, and specifically the apple consumption level was at 0.90 kilograms per capita per year.

With respect to consumers' buying preferences, patterns vary across the sample. A majority of the respondents (44.5%)

Table 1. Demographic characteristics ($n = 200$)

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[1]	9.0
	Junior high school[2]	9.5
	Senior high school[3]	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

[1]Runs for six years starting from year 1 to year 6, [2]Runs for three years from year 7 to year 9, [3]Runs for three years from year 10 to year 12.

indicated that they prefer fresh domestic apples of medium size, which according to the standardisation of apple grading in Indonesia, is around 8-10 fruits per kilogram. However, in terms of imported varieties they preferred larger apples. Consumers also indicated that they normally purchased 1 kilogram of fresh domestic apples in one shopping trip. This relates to family size, where the quantity of apples purchased is sufficient for all family members. Interestingly, the majority of the respondents purchased domestic apples from traditional wet markets while imported apples were purchased from supermarkets. This is in line with the findings of the study by Wei *et al*. (2003) that highlighted most Indonesian consumers often shop fresh produce at traditional wet markets as they have the ability to bargain and purchase products at a cheaper price. Respondents who preferred to purchase apples from supermarkets and modern fruit shops indicated that they prefer to buy good quality apples at a fixed price and at their convenience. Table 2 presents the consumption and buying patterns of both domestic and imported apples.

Domestic and imported apple attribute preferences: The two sets of value preferences were compared using Wilcoxon signed ranks test. Results revealed that respondents attach a significantly greater level of preference on search attributes of imported apples than on domestic apples. Four search attributes, i.e. 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, 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, firmness, and five sensory attributes, *i.e.* juiciness, mealiness, crispness,

Table 2. Consumption and buying preferences ($n = 200$)

Preferences	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

chewiness and sweetness, had no significant difference across both types of apples. Both extrinsic attributes, 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. These results clearly highlight that imported apples are regarded as more visually appealing than domestic apples. This information implies potential improvement for domestically produced apple, that in order to compete with imported apple, visual appearance quality of domestic apple must be improved better than the imported quality.

Domestic apple value attribute-based market segments: By applying hierarchical cluster analysis using Ward's method, 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. On the basis of the 13 attributes of domestic apples preferred by consumers, the three identified segments were labelled "indifferent consumers" (35.5%), "pro-sensory consumers" (45.5%) and "value–conscious consumers" (19%). Results revealed significant differences across clusters in terms of intrinsic (search and sensory), and extrinsic attributes.

Indifferent consumers (cluster one): The cluster labelled as 'Indifferent consumers' were least interested in value attributes of domestic apples. They purchase and consume domestic apples without giving much attention to quality attributes, placing a relatively high importance only on sweetness as this attribute got the highest rating from this cluster. This group considered neutral

for most attributes, and even rated not important for packaging, skin toughness, mealiness and size. These results were similar to a study by Badar, *et al.* (2015) that identified mango lover consumers were merely concerned in consuming mangoes and considered fewer quality attributes as important. Cluster one was similar to cluster three only in terms of their preferences on juiciness and price, but there were no similarities between this cluster and cluster two (Table 3).

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

	Cluster 1 n=71 Indifferent consumers	Cluster 2 n=91 Pro–sensory	Cluster 3 n=38 Value–conscious	*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

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 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 are relatively younger and a majority of them are 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%) and compared to cluster two, they had a significantly greater household income level (Table 5).

Pro-sensory consumers (cluster two): This group constituted the largest cluster, with 45.5% of respondents. The cluster was labelled as "pro–sensory" since it rated the majority of the sensory attributes of domestic apples higher than search attributes. Respondents in this cluster identified sweetness, chewiness, skin toughness, juiciness, crispness and mealiness as the most significant sensory attributes of domestic apples. Similarly, they also differed significantly on their perceptions of fineness and aroma (Table 3). However, respondents in this cluster are 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 colour and firmness of apples.

The majority of respondents in this cluster consumed domestic apples more often than respondents in the other two clusters. Nearly 41% consumed domestic apples either 2-3 times a week or once a week. They normally bought one (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 less than 30-year olds but the representation of over 50-year olds 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 a significantly lower household income levels than the other two clusters ($\chi^2 = 13.12$; $P=0.001$). This was counter intuitive but can be explained that this cluster had the youngest profile (age below 30 years old), hence, they had normally just started their career and earned a regional minimum wage and that could be the reason why they were more conscious of the price of apples.

Value-conscious consumers (cluster three): Respondents in this cluster were the most value conscious group when buying domestic apples. 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, significantly different to the other two clusters. In terms of search attributes, fineness was the only one that ranked significantly greater than the other two clusters. Both colour and firmness attribute rankings were similar to 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 respondents in cluster two. Similar to other groups, they normally purchased one kilogram of apples in one shopping trip, and usually purchased medium to large apples. Unlike the other two clusters, a greater proportion of the respondents of 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 other clusters. In terms of socio-economic characteristics, the majority of respondents of this cluster belonged to the age category 31-40 years (42.1%) and were more educated, with a majority having an undergraduate degree (63.2%) (Table 5). Results revealed that the education level of this cluster was significantly greater than that of the other two clusters ($\chi^2 = 9.705$; $P=0.008$). This could explain why this cluster had a significantly greater household income level compared to the other two clusters.

Overall, the comparison of clusters provided some critical insights into attribute preferences of consumers of domestic apples. Although cluster three constituted the smallest cluster of all, this group was the most value conscious in terms of most of the search and sensory attributes which were also included as organoleptic attributes on domestic apples. This finding is identical with the

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

	Indifferent consumers *n*=71	Pro-sensory consumers *n*=91	Value-conscious consumers *n*=38	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/kg)	8.5	12.1	5.3		
Large (5-7 fruits/kg)	33.8	45.1	42.1		
Medium (8-10 fruits/kg)	50.7	38.5	47.4		
Small (11-15 fruits/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)

	Indifferent consumers *n*=71	Pro-sensory consumers *n*=91	Value-conscious consumers *n*=38	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/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	13.12	0.001

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

finding by Alamanos *et al*. (2013) that one of the tomato consumer segments in Greece labelled as "sensorialist" preferred organoleptic characteristics when selecting fresh tomato produce. Even though each cluster valued apple attributes differently and their preferences were different, there were several attributes valued highly by all clusters. The three highly rated domestic apple attributes were sweetness, chewiness and crispness. Similarly, in the study it was found out that domestic apple variety of Manalagi was the most preferred variety because of its sweetness, chewiness and crispiness. Manalo (1990) found that crispness as the most important apple attribute for New Hampshire consumers, while Denver and Jensen (2014) iden

tified that apple sweet taste is the most important attribute for consumers. Furthermore, as the consumers were grouped into several distinct market segments based not only on their preferences for product quality attribute, but also on demographic, the characteristic of each cluster can be identified. Hence, the information generated from these findings had clearly shown that consumer value preferences and consumption were relatively influenced by demographic characteristics as suggested by several studies (Konopacka *et al.*, 2010; Bonany *et al.*, 2013; Galmarini *et al.*, 2013).

The information generated in this study contributed to the limited knowledge on consumer value preference in Indonesia for fresh fruit in general and domestically produced apple in particular. The findings were useful for value chain players to create effective intervention for the sustainable development of domestic apple supply chain in Indonesia.

Pro–sensory and value–conscious consumer clusters who consume a greater proportion of domestic apples placed a significantly greater importance on the quality attributes of domestic apples. This raises the need to better position the domestic apple varieties in the minds of the consumers especially with respect to search attributes. Findings clearly showed that consumers buy with their eyes first and hence the industry need to take action to educate chain actors to improve their practices to make sure that domestic apples available at retail level are visually appealing. Apple farmers need to differentiate their products through adoption of new production technology and alternative varieties that are in demand and guide promotion of valued attributes. 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 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 more in providing better access to training and support to maintain apples at proper temperature levels. Generally, the supply chain actors need to play an active role by developing collaboration among themselves and improving their practices, because the supply chain in Indonesia is still not well organised and mostly fragmented in nature. Furthermore, promoting domestically grown apple through various program would also be a strategic approach to influence consumer's mindset.

Although, this study has focused on one particular city in which domestic apples are mostly available, it provides the need to focus on in-depth studies on understanding how domestic apple quality can be maintained across value chains as a mechanism of competing against imported apples. Future research may include different approach such as qualitative methods to provide further insight into consumers' behaviour in regards to domestically produced apple and the willingness to pay for this product.

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