

Consumer Satisfaction and Sensory Evaluation of West Java Robusta Coffee: Consumer Interest, Motivation, and Cluster Analysis

MIA ROSMIATI^a, RIJANTI RAHAJU MAULANI^a, RAMADHANI EKA PUTRA^a, DIAH NOFITASARI^a, AND ANGGA DWIARTAMA^{a,*}

^aSchool of Life Sciences and Technology, Institut Teknologi Bandung, Jalan Ganesha 10, Bandung 40132, Indonesia

*Corresponding author
dwiartama@itb.ac.id

Received: 15.08.2025; Published online: 21.10.2026



Abstract

This study analysed sensory satisfaction, consumer interest attributes, and motivations in the consumption of West Java Robusta coffee. The research was conducted in West Java, Indonesia, from April 2021 to February 2022 using an organoleptic or hedonic panel test and questionnaire survey involving 200 respondents recruited through convenience sampling. Six Robusta coffee samples from Kuningan, Ciamis, Tasikmalaya, Cianjur, Bogor, and Sumedang were evaluated for taste, aroma, acidity, steeping colour, and aftertaste. Sensory data were analysed using Friedman tests, Wilcoxon signed-rank post-hoc tests, K-means cluster analysis, Kruskal-Wallis tests, and Spearman rank correlations. Respondents rated Bogor coffee highest for taste and aroma, Sumedang coffee highest for acidity and aftertaste, and Kuningan coffee highest for steeping colour. Cluster analysis identified three consumer segments: consumers satisfied with all sensory attributes ($n = 68$), consumers satisfied overall but dissatisfied with aftertaste ($n = 79$), and consumers generally dissatisfied with Robusta coffee ($n = 53$). Halal assurance was the most highly rated consumer interest attribute, followed by price, quality, promotion, and brand product. The primary motivations for consuming Robusta coffee were drowsiness removal, health interest, and following consumption trends. Sensory satisfaction was positively correlated with health interest and drowsiness removal motivations, but not with following consumption trends motivation. The findings suggest that West Java Robusta coffee can be strengthened through sensory improvement, halal assurance, and provenance-based market positioning.

Keywords: coffee consumption; consumer interest; consumer segmentation; halal assurance; Robusta coffee; sensory evaluation

1 Introduction

Coffee is one of the world's most widely consumed beverages, served in both hot and cold forms and embedded in diverse social, culinary, and commercial practices. In Indonesia, coffee is also a popular national beverage and an important plantation crop with substantial economic value. Its domestic consumption has increas-

ingly become associated with lifestyle changes, as reflected in the rapid growth of coffee shops and cafés (Putri et al., 2021). This domestic trend is part of a broader global expansion of coffee consumption. In Indonesia, per-capita coffee consumption has reached approximately 1.4 kg/year, with local consumption growing by around 8% annually (International Coffee Organization [ICO], 2021; Utama et al., 2021).

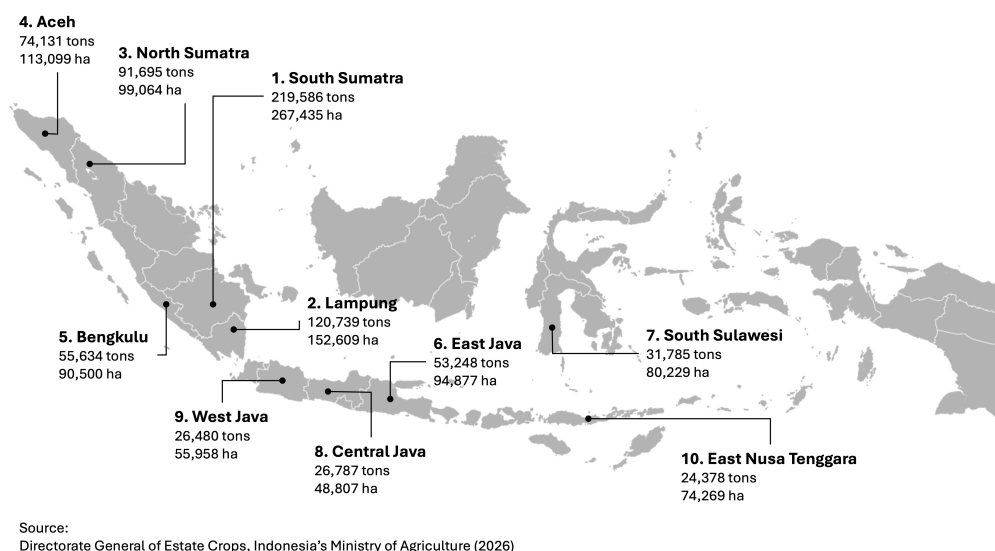


Figure 1: 10 main coffee-producing regions of Indonesia

Coffee beans are an agricultural, plantation, and food commodity that move through several economic forms: as a primary cash crop at the farm level, as a traded commodity in domestic and export markets, as an agro-industrial raw material in processing, and as a value-added product in cafés, retail, and food-service chains. This classification is important because the economic significance of coffee is not limited to farm production. Coffee supports employment and income for farmers, plantation workers, processors, traders, retailers, and café workers along the farm-to-consumer chain. In Indonesia, the coffee business is an important source of income for approximately 1.5 million coffee farmers (Revadiana & Trimio, 2021).

West Java is one of Indonesia's important coffee-producing provinces, with annual production of approximately 19,600 tons, or 2.71% of national coffee production (Anggraeni et al., 2020). It is also home to Geographical Indication (GI)-based coffee products. GI Arabica coffee is centred around the Bandung region, whereas GI Robusta coffee products are more sparsely distributed in lower-altitude areas, including Bogor, Cianmis, Cianjur, Kuningan, Pangandaran, Sumedang, and Tasikmalaya (Piatti & Dwiartama, 2021). For international readers unfamiliar with Indonesia's geography, a map of

the main coffee-producing regions of Indonesia is shown in Figure 1.

Despite Indonesia's position as an important coffee producer, previous studies have noted persistent challenges related to productivity and quality consistency. Coffee quality is shaped by cultivation practices, post-harvest handling, processing, roasting, brewing, and service. When coffee quality falls below consumer expectations, preference and consumption behaviour may be affected (Sunarharum et al., 2021). This issue is particularly important for Robusta coffee, which has often been positioned as a mass-market or instant-coffee ingredient rather than as a differentiated specialty product.

Coffee consumption is influenced by personal preferences, product attributes, economic considerations, consumption context, socio-demographic background, lifestyle, and health concerns (Rosiana, 2020; Samoggia et al., 2019). These factors shape consumer satisfaction, which in turn may support loyalty and repeat purchase when a product meets consumer needs and expectations (Najib & Fahma, 2020). Measuring consumer preference has therefore become important for product development and marketing, particularly for identifying attributes that drive consumer choice and buying behaviour (Arista et al., 2021; Asioli et al., 2016). Consumer

satisfaction can be examined by assessing the perceived usefulness and relative value of product attributes (Jervis et al., 2012). In coffee, these attributes commonly include coffee type, price, aroma, taste, and serving technique (Enggartyasto et al., 2020; Hanafiah & Wardhana, 2019).

West Java Robusta coffee can be positioned within the emerging Fine Robusta category (Hetzl, 2011), but it remains less widely recognised in both domestic and global markets than Arabica specialty coffee (Taufik et al., 2018). This study therefore analyses consumer satisfaction with West Java Robusta coffee through sensory evaluation, with attention to taste, aroma, acidity, steeping colour, and aftertaste. The study also examines consumer interest attributes and consumption motivations, including halal assurance, which is especially relevant in Indonesia's predominantly Muslim consumer context and in the broader literature on halal consumer citizenship (Voloder, 2015).

The study addresses four objectives: (1) to evaluate the sensory satisfaction of West Java consumers with Robusta coffee samples from six major Robusta-producing regions; (2) to segment consumers based on sensory satisfaction profiles; (3) to identify consumer interest attributes that shape purchasing decisions; and (4) to examine motivations for consuming Robusta coffee. By linking regional sensory variation, consumer segmentation, and halal assurance, this study contributes to a more situated understanding of how West Java Robusta coffee may be developed and positioned in the market.

2 Material and methods

2.1 Research design and study area

This study used a cross-sectional consumer sensory evaluation and questionnaire survey. The research was conducted in West Java, Indonesia, from April 2021 to February 2022. Primary data were collected through an organoleptic or hedonic panel test, direct observation, interviews, and a structured questionnaire survey. Secondary data were used to support the contextual description of Robusta coffee production and consumer

preference (Aiman et al., 2017; Mahmud et al., 2020).

2.2 Coffee samples and coding

Six Robusta coffee samples were obtained from major Robusta coffee-producing areas in West Java: Kuningan, Ciamis, Tasikmalaya, Cianjur, Bogor, and Sumedang. For the sensory test, the samples were coded numerically to reduce identification bias: coffee 1 = Kuningan, coffee 2 = Ciamis, coffee 3 = Tasikmalaya, coffee 4 = Cianjur, coffee 5 = Bogor, and coffee 6 = Sumedang. The West Java sampling locations are shown in Figure 2.

2.3 Participants, sampling, and respondent characteristics

Respondents were recruited using convenience or accidental sampling. The target respondents were consumers who purchased and consumed coffee at the research locations and who were willing to participate in both the sensory evaluation and questionnaire survey. A total of 200 respondents participated in the study.

The sample was dominated by young adult coffee consumers. Based on age, 19% of respondents were 20 years old, 51% were 21–30 years old, 7% were 31–40 years old, 17% were 41–50 years old, and 6% were 51–60 years old. Male respondents represented 74% of the sample, while female respondents represented 26%. Respondents reported consuming sachet-packed, Arabica, Robusta, or mixed coffee products. They obtained information about coffee from social media, television, family, friends, and sellers. Respondents usually purchased coffee in supermarkets, coffee shops, traditional markets, retailers, and larger stores. On average, respondents consumed coffee one to two times per day, most often in the morning and/or afternoon, and spent approximately 10,000 to 50,000 Indonesian Rupiah per cup during the study period.

2.4 Sensory evaluation procedure

An organoleptic or hedonic panel test was used to assess respondents' sensory satisfaction with

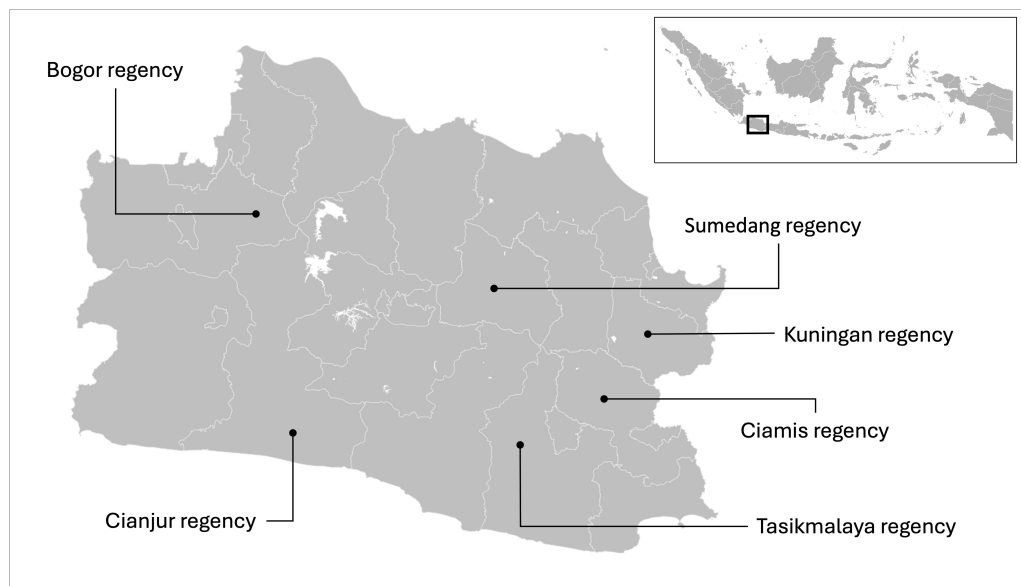


Figure 2: West Java Robusta coffee sampling locations: Kuningan, Ciamis, Tasikmalaya, Cianjur, Bogor, and Sumedang

each coffee sample. Respondents evaluated five sensory attributes: taste, aroma, acidity, steeping colour or brew colour, and aftertaste. Taste, acidity, and aftertaste were evaluated using the sense of taste, while aroma was evaluated using the sense of smell after the sample aroma was inhaled (Ariva et al., 2020). Respondents rated each attribute using a five-point hedonic scale: 1 = dislike very much, 2 = dislike, 3 = neutral, 4 = like, and 5 = like very much.

2.5 Questionnaire variables

In addition to the sensory evaluation, a structured questionnaire collected information on socio-demographic characteristics, consumer interest attributes, and motivations for consuming Robusta coffee. Consumer interest was measured using nine attributes rated on a five-point Likert scale: halal assurance, price, quality, promotion, brand product, serving, packaging, coffee production, and origin of coffee. Consumption motivation was measured using three items: drowsiness removal, health interest, and following consumption trends.

2.6 Statistical analysis

The data were analysed descriptively and inferentially using SPSS 25.0 (Statistical Package for Social Sciences). Five statistical procedures were applied. First, the Friedman test was used to determine whether the six coffee samples differed significantly in respondent ratings for each sensory attribute. Second, Wilcoxon signed-rank post-hoc tests were used to identify which pairs of coffee samples differed significantly. Third, K-means cluster analysis was used to segment respondents based on their hedonic ratings across the five sensory attributes. The number of clusters was set at $K = 3$ based on interpretability and validation using silhouette coefficients. Fourth, Kruskal-Wallis tests were used to determine whether consumer clusters differed significantly in ratings of consumer interest attributes, followed by Dunn's post-hoc tests for pairwise comparison when appropriate. Fifth, Spearman rank correlation was used to examine relationships between mean sensory satisfaction scores and motivation scores. Statistical significance was assessed at $p < 0.05$.

2.7 Ethical considerations

Participation in the study was voluntary. Respondents were informed about the purpose of the study before participating, and only aggregated, anonymous responses were used in the analysis. No personally identifying information is reported in this article.

3 Results and discussion

3.1 Sensory satisfaction across West Java Robusta coffee samples

The sensory evaluation was designed to assess consumer preference for West Java Robusta coffee based on taste, aroma, acidity, steeping colour, and aftertaste. These sensory attributes are central to coffee acceptance because they define the immediate drinking experience and contribute to product differentiation. Robusta coffee is generally associated with a stronger body, lower acidity, and higher caffeine content than Arabica coffee (Nurhayati, 2017). Previous research on Robusta coffee in East Java also found that distinctive taste and aroma, both shaped by roasting and processing, are important attributes for consumers (Winarno et al., 2018).

Descriptive observations indicated clear variation among the samples. Respondents described the Cianjur sample as relatively bland, bitter, and full-bodied, while samples from other regions were perceived as having lighter to thicker body, cleaner sensory notes, and, in some cases, a fruity taste when the coffee cooled. The Kuningan and Tasikmalaya samples were associated with a grassy aroma, the Ciamis sample with an earthy aroma, and the Cianjur sample with a less intense aroma. By contrast, the Bogor and Sumedang samples were not perceived as having a disturbing aroma. The Sumedang sample was associated with a fruity acidity, while the Tasikmalaya sample was perceived as less acidic. Aftertaste also varied, with Kuningan associated with a light-brown aftertaste, Ciamis with an earthy aftertaste, Sumedang with a fruity aftertaste, and Tasikmalaya, Cianjur, and Bogor with a bitter aftertaste.

The Friedman test confirmed that consumer ratings differed significantly across the six Robusta coffee samples for all five sensory attributes ($p < 0.05$) (Table 1). These results show that Robusta coffee from different regions of West Java has distinct sensory profiles. Based on mean ratings, Bogor coffee received the highest score for taste and aroma, Sumedang coffee received the highest score for acidity and aftertaste, and Kuningan coffee received the highest score for steeping colour. This suggests that no single region dominated all sensory attributes; rather, each region had a specific sensory strength.

The Wilcoxon signed-rank post-hoc test further clarified these differences (Table 2). Tasikmalaya coffee tended to be less preferred than coffee from other regions, particularly for taste, acidity, and aftertaste. Kuningan, Bogor, and Cianjur performed well for taste, while Sumedang was most clearly differentiated in acidity and aftertaste. These differences are important for product positioning. For example, a producer may emphasise Bogor coffee for consumers who prioritise taste and aroma, while Sumedang coffee may appeal to consumers seeking brighter acidity and a more favourable aftertaste.

3.2 Consumer segmentation based on sensory satisfaction

To understand whether all consumers evaluated Robusta coffee in the same way, K-means cluster analysis was conducted using the five sensory attributes. The analysis produced three distinct consumer segments (Table 3). Cluster 1 consisted of 79 respondents who generally liked the sensory properties of Robusta coffee but gave a low score to aftertaste. Cluster 2 consisted of 53 respondents who were generally dissatisfied with Robusta coffee across sensory attributes. Cluster 3 consisted of 68 respondents who liked all sensory properties, including aftertaste.

The cluster structure suggests that consumer satisfaction with Robusta coffee is not uniform. The largest group, Cluster 1, is particularly important because it represents consumers who are not opposed to Robusta coffee but are sensitive to aftertaste. For this segment, improvements

Table 1: Friedman test results for consumer preferences towards West Java Robusta coffee.

No.	Attribute	Kuningan (1)	Ciamis (2)	Tasikmalaya (3)	Cianjur (4)	Bogor (5)	Sumedang (6)	Sig.	Explanation
1	Taste	3.43	3.33	3.19	3.30	3.44	3.40	0.000	Significant
2	Aroma	3.35	3.16	3.39	3.30	3.46	3.40	0.000	Significant
3	Acidity level	3.30	3.15	2.90	3.06	3.23	3.39	0.000	Significant
4	Steeping colour	3.37	3.17	3.13	3.31	3.12	3.32	0.000	Significant
5	Aftertaste	3.18	3.01	2.79	2.87	3.15	3.24	0.000	Significant

Note: Coffee sample codes are 1 = Kuningan, 2 = Ciamis, 3 = Tasikmalaya, 4 = Cianjur, 5 = Bogor, and 6 = Sumedang.

Table 2: Wilcoxon signed-rank post-hoc test results for West Java Robusta coffee preference levels.

Coffee pair	Taste	Aroma	Acidity level	Steeping colour	After-taste
1-2	0.143	0.015*	0.460	0.001*	0.002*
1-3	0.001*	0.513	<0.001*	0.001*	<0.001*
1-4	0.046*	0.683	0.001*	0.380	<0.001*
1-5	0.086	0.172	0.303	0.001*	0.903
1-6	0.643	0.357	0.373	0.518	0.399
2-3	0.028*	0.001*	<0.001*	0.326	0.001*
2-4	0.631	0.029*	0.143	0.037*	0.053
2-5	0.262	<0.001*	0.199	0.374	0.095
2-6	0.459	<0.001*	0.002*	0.067	0.005*
3-4	0.144	0.130	0.011*	0.002*	0.287
3-5	0.001*	0.195	<0.001*	0.936	<0.001*
3-6	0.005*	0.716	<0.001*	0.003*	<0.001*
4-5	0.027*	0.008*	0.001*	0.005*	<0.001*
4-6	0.112	0.360	<0.001*	0.677	<0.001*
5-6	0.425	0.440	0.026*	0.005*	0.135

Note: * indicates significance at $p < 0.05$. Coffee sample codes are 1 = Kuningan, 2 = Ciamis, 3 = Tasikmalaya, 4 = Cianjur, 5 = Bogor, and 6 = Sumedang.

in processing, fermentation, roasting, or brewing protocols that reduce unpleasant aftertaste may have a direct effect on acceptance. Cluster 3 represents the strongest potential market for premium or Fine Robusta positioning, while Cluster 2 may consist of consumers whose baseline sensory preference is less compatible with Robusta coffee, possibly because of stronger familiarity with Arabica or sweeter coffee products.

3.3 Consumer interest attributes and differences across clusters

Beyond sensory satisfaction, respondents also assessed attributes that may influence their interest in consuming Robusta coffee (Table 4). Halal assurance received the highest overall mean

score (4.65), followed by price (4.15), quality (4.11), promotion (4.05), and brand product (4.03). Serving, packaging, coffee production, and origin of coffee were rated slightly lower but remained within a generally favourable range.

The high score for halal assurance indicates that consumers in West Java attach importance to product trust, safety, and religious-cultural acceptability. This finding is consistent with studies showing that halal labels can influence purchase decisions by increasing consumer confidence and reducing uncertainty (Hardiansyah & Manurung, 2020; Maulida, 2013). In the context of coffee, halal assurance may not only function as a compliance attribute but also as a trust signal in an increasingly competitive market.

Kruskal-Wallis tests showed that not all interest attributes differed significantly across clusters (Table 5). Halal assurance was highly rated in all clusters and did not differ significantly between clusters ($p = 0.069$), suggesting that it is broadly valued regardless of sensory satisfaction level. Price and quality differed significantly between clusters ($p < 0.05$), with Cluster 2, the dissatisfied segment, giving lower scores than the two more satisfied clusters. This indicates that consumers who are dissatisfied with Robusta coffee may also be less responsive to common purchase drivers such as price competitiveness and perceived quality. Origin of coffee also differed significantly between clusters ($p = 0.003$), with Clusters 2 and 3 rating it higher than Cluster 1. This suggests that provenance may matter both to consumers who are already satisfied and to consumers who remain selective or sceptical about Robusta coffee.

Promotion and brand product did not differ significantly across clusters. This may indicate that current promotional and branding practices

Table 3: Cluster profile: Mean hedonic scores by sensory attribute and cluster.

Attribute	Cluster 1 (<i>n</i> = 79)	Cluster 2 (<i>n</i> = 53)	Cluster 3 (<i>n</i> = 68)	<i>H</i> (KW)	Sig.
Taste	3.82	2.61	4.10	87.3	<0.001
Aroma	3.74	2.55	4.05	91.2	<0.001
Acidity	3.69	2.43	4.02	95.1	<0.001
Steeping colour	3.76	2.58	4.08	88.7	<0.001
Aftertaste	2.31	2.29	4.11	104.6	<0.001

Table 4: Level of consumer interest in Robusta coffee.

No.	Attribute	Score
1	Halal assurance	4.65
2	Price	4.15
3	Quality	4.11
4	Promotion	4.05
5	Brand product	4.03
6	Serving	3.96
7	Packaging	3.95
8	Coffee production	3.90
9	Origin of coffee	3.73

for West Java Robusta coffee are not yet sufficiently differentiated to shape cluster-specific preferences. It may also reflect the limited recognition of Robusta coffee compared with Arabica specialty coffee. Promotion, personal selling, sales programmes, and interactive marketing can help communicate product value to consumers (Hanifawati et al., 2017; Prihastomo & Usman, 2020), but these strategies need to be linked to sensory quality and clear product identity.

3.4 Motivations to consume Robusta coffee

Respondents consumed Robusta coffee for several reasons (Table 6). Drowsiness removal received the highest mean score (4.06), followed by health interest (3.91) and following consumption trends (3.60). These results indicate that functional motivations remain central to Robusta coffee consumption. Robusta coffee contains relatively high caffeine levels, and caffeine is commonly associated with alertness, arousal, improved mood, and perceived energy (Chaugule et al., 2019; Einöther & Giesbrecht, 2013).

Spearman rank correlations showed a moderate positive correlation between mean sensory satisfaction and health interest motivation ($r_s = 0.34$, $p < 0.001$), and a weak positive correlation between mean sensory satisfaction and drowsiness removal motivation ($r_s = 0.18$, $p = 0.012$). No significant correlation was found between mean sensory satisfaction and following consumer trends motivation ($r_s = 0.07$, $p = 0.321$). These results suggest that consumers motivated by perceived health and alertness benefits may also pay closer attention to sensory quality. By contrast, following consumer trends appears to be less connected to sensory evaluation, indicating that it may be shaped more by lifestyle, café culture, and social visibility than by product-specific sensory satisfaction.

This finding has practical implications for Robusta coffee marketing. If consumers value Robusta coffee because of its functional effects, producers and retailers should not rely only on caffeine-related claims. They should also invest in sensory quality, because consumers motivated by function still evaluate coffee through taste, aroma, acidity, colour, and aftertaste.

3.5 Implications for West Java Robusta and Fine Robusta positioning

The results point to a more nuanced market position for West Java Robusta coffee. Robusta has historically been associated with instant coffee and mass-market products, while Arabica has been more commonly associated with specialty coffee. However, the emergence of Fine Robusta has created an opportunity to reposition Robusta coffee based on quality, provenance, and differentiated sensory profiles (Hetzl, 2011). The results

Table 5: Kruskal-Wallis test: Consumer interest attributes by cluster.

Attribute	Cluster 1	Cluster 2	Cluster 3	<i>H</i>	Sig.
Halal assurance	4.72	4.51	4.68	5.34	0.069
Price	4.24	3.89	4.21	8.72	0.013*
Quality	4.20	3.82	4.17	9.44	0.009*
Promotion	4.09	3.91	4.10	3.21	0.201
Brand product	4.08	3.85	4.07	4.10	0.129
Origin of coffee	3.60	3.98	4.01	11.89	0.003*

Note: * indicates significance at $p < 0.05$.

Table 6: Motivation to consume Robusta coffee.

No.	Attribute	Score
1	Drowsiness removal	4.06
2	Health interest	3.91
3	Following the trends	3.60

of this study show that West Java Robusta coffee cannot be treated as a homogeneous product. Regional samples differed in sensory strengths, and consumers differed in how they evaluated those attributes.

The three clusters offer direct implications for product development. Cluster 1 requires attention to aftertaste, suggesting the need for post-harvest, roasting, and brewing improvements that can reduce undesirable bitterness or lingering sensations. Cluster 3 offers the strongest base for premium Fine Robusta positioning because these consumers already respond positively to all sensory attributes. Cluster 2 may require a different strategy, because their dissatisfaction appears more fundamental. For this segment, marketing alone may not be sufficient unless accompanied by sensory reformulation, education, or pairing with consumption contexts that make Robusta more acceptable.

The importance of halal assurance further indicates that West Java Robusta coffee should be positioned not only through sensory quality but also through trust, certification, and cultural relevance. Halal certification may be especially useful when producers target Muslim-majority domestic markets or international halal markets. At the same time, origin of coffee and regional identity can be used to communicate provenance, particularly for consumers who value geograph-

ical differentiation. Together, sensory improvement, halal assurance, and provenance-based branding may strengthen the competitiveness of West Java Robusta coffee in both domestic and international markets.

3.6 Limitations and future research

This study has several limitations. First, the convenience sampling method means that the results cannot be generalized to the broader West Java coffee-consuming population. Second, although the sample of 200 respondents is useful for exploratory sensory and segmentation analysis, it is not sufficient for population-level inference. Third, the study did not use multi-attribute valuation methods and therefore did not estimate willingness to pay or marginal utility for specific attributes. Future studies using discrete choice experiments or related valuation methods could provide a more rigorous economic analysis of attribute value (Bliemer & Rose, 2010; McFadden & Train, 2000; Train, 2003). Fourth, the coffee samples were obtained from specific farms or processing units within each region; variation within a region may therefore be larger than the differences observed between regions. Fifth, the study period coincided with COVID-19 restrictions, which may have affected recruitment and sensory test conditions. Future research should combine broader sampling, controlled preparation protocols, chemical analysis, and economic valuation to strengthen the evidence base for West Java Robusta product development.

4 Conclusions

This study shows that West Java Robusta coffee has differentiated sensory profiles and that consumer satisfaction varies across both regions and consumer segments. Among the six samples tested, Bogor Robusta coffee received the highest ratings for taste and aroma, Sumedang Robusta coffee received the highest ratings for acidity and aftertaste, and Kuningan Robusta coffee received the highest rating for steeping colour. These findings indicate that regional identity can be used as a basis for Robusta coffee differentiation rather than treating West Java Robusta as a single undifferentiated product.

The cluster analysis identified three consumer segments: consumers who liked Robusta coffee but disliked its aftertaste, consumers who were generally dissatisfied with Robusta coffee, and consumers who liked all sensory attributes. This segmentation is useful for product development because it shows where improvement should be directed. Aftertaste is a critical attribute for the largest cluster, while the most satisfied cluster provides a promising target market for Fine Robusta positioning.

The study also highlights the importance of halal assurance in the coffee sector. Halal assurance was the highest-rated consumer interest attribute across clusters, suggesting that it functions as a broad trust signal beyond sensory satisfaction. For coffee producers and marketers, this means that improving sensory quality should be accompanied by credible certification, transparent production, and clear communication of origin. Such an approach may help West Java Robusta coffee strengthen its position in domestic markets and develop a more visible identity for international consumers.

Acknowledgements

The authors thank Institut Teknologi Bandung and all participants in this study for their support. This study was funded by the Program Penelitian, Pengabdian Masyarakat dan Inovasi (PPMI), School of Life Sciences and Technology, Institut Teknologi Bandung.

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