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Green Tea Product Development: Integrating QFD with PLS-SEM, BMC, and AHP for Optimal Business Growth

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Abstract: *Green tea offers numerous health benefits; however, its market sales remain relatively low. PT Mitra Kerinci, the producer of the Likicha brand green tea, reported that only 38% of its annual production was absorbed by the market. This situation underscores the need for a strategic development plan to enhance sales performance. Therefore, an integrated approach combining PLS-SEM, BMC, QFD, and AHP methods was employed to formulate a strategy to increase the sales volume of Likicha green tea. This study aimed to identify consumer preferences for green tea products to develop a product strategy that enhances market absorption. The findings of this study indicate that consumer purchase intentions for green tea are influenced by health benefits, product packaging attributes, and price. A business mapping of the green tea industry was conducted to obtain a comprehensive internal and external analysis. The QFD data analysis identified technical requirements and prioritized component needs for improving green tea production. These results were then used to formulate criteria and strategic alternatives aimed at increasing green tea sales volume. The results indicate that product quality holds the highest priority among the criteria, with a weight of 64.3%. Among the strategic alternatives, sourcing high-quality tea leaves and optimizing processing methods emerged as the top priority, with a weight of 26.2%.*
Keywords: *customer preference; green tea; QFD; quality; sales.*

Type of the Paper: Regular Article.

1. Introduction

Tea is one of the most widely consumed beverages globally, including in Indonesia. It is derived from the leaves of the tea plant (*Camellia sinensis*) and can be processed into various types, such as green tea, black tea, white tea, and others [1]. According to data from the Central Statistics Agency (BPS) in 2020, national tea production reached 94.1 tons, reflecting a 20.3% increase from the previous year's production of 78.2 tons. West Sumatra Province is among the largest tea-producing regions in Indonesia, with a plantation area of 3,714 hectares in 2020.

Green tea is widely recognized for its numerous health benefits, primarily due to its high polyphenol content [2,3]. According to Ahmed et al. [4], green tea processing involves the inactivation of the polyphenol oxidase enzyme to prevent polyphenol oxidation, thereby preserving the natural polyphenol that contributes to its health benefits. Other studies have also demonstrated that polyphenols in green tea, particularly flavonoid, play a significant role in the prevention and treatment of hypertension [5].

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In 2023, Indonesia's tea market generated revenues of USD 2.2 billion and is projected to grow at a compound annual growth rate (CAGR) of 4.81% from 2023 to 2028 [6]. Despite being a major tea producer, most of Indonesia's tea production is exported, while the domestic market remains dominated by medium to low quality tea. This situation indirectly indicates that, despite the high quality of Indonesian tea, it remains less popular in the domestic market than internationally. The national tea industry has yet to fully optimize this potential.

One of the key players in the Indonesian tea industry is PT Mitra Kerinci, which manages both tea plantations and processing facilities. The company produces a range of tea products, including green tea under trademarks such as Kerinci Tea, Teh Minang, and Liki Tea. Likicha is one of PT Mitra Kerinci's flagship green tea products, known for its distinctive flavor that sets it apart from typical green teas. It has a sweeter taste due to the removal of sap from the tea leaves during the production process. This product has been marketed since March 2023 in 40-gram plastic jar packaging, priced at IDR 40,000 per unit. Despite its high quality and distinctive flavor, Likicha's market performance remains limited. In 2023, PT Mitra Kerinci reported that only 38% of Likicha's total production—62 kg out of 162 kg—was sold. This low market absorption presents a potential risk to the company's business sustainability.

To address this issue, it is essential to analyze consumer preferences based on purchasing behavior, as measured by purchase intentions [7,8]. Understanding the factors that influence purchase intention can help companies develop products aligned with consumer preferences, thereby enhancing profitability. Partial Least Squares–Structural Equation Modeling (PLS-SEM) is an appropriate method for analyzing the factors that influence consumer purchase intentions [9]. This method is suitable given the specific and limited respondent group in this study, as well as the large number of variables examined—conditions that align with the characteristics of the PLS-SEM approach [10]. The PLS-SEM method has been employed in previous studies, such as the one conducted by Sumi and Kabir [11], to analyze factors influencing the purchase intentions of organic tea consumers in Bangladesh. Their findings indicate that product attributes, perceived benefits, environmental concerns, trust, and price significantly affect purchase intention. The study demonstrated that the examined variables accounted for up to 74% of the variance in consumer purchase intentions. Using this approach, the present research aims to identify the factors influencing green tea consumers' purchase intentions in Indonesia.

After identifying the factors influencing consumer purchase intentions, the next step involves mapping the Likicha product's business model using the Business Model Canvas (BMC) method. The BMC provides a comprehensive overview of the business through its nine core elements, with particular emphasis on the value proposition and key activities, which are especially relevant for identifying technical requirements and components in the product that require

improvement [12]. According to Osterwalder and Pigneur [13], the value proposition is a critical element that addresses customers' problems and fulfills their needs. Mapping the business model can also enhance the value of the green tea industry [14]. Business value encompasses all benefits received by customers relative to the sacrifices made, including price, time, and effort.

To improve and develop Likicha products, the Quality Function Deployment (QFD) method was applied. QFD captures the voice of the customer and translates it into technical requirements that can be implemented in the product design and development process [15]. According to Altuntas et al. [16], QFD is a methodology for developing new products or improving existing ones by constructing a House of Quality matrix. Fonseca and Carvalho [17] suggest using QFD as a systematic framework to enhance product quality by prioritizing the voice of the customer. The application of the QFD method is expected to enhance the business value of the green tea industry. For the Likicha green tea brand, this can support differentiation from competitors, strengthen customer loyalty, and build a strong product image through quality improvements [18].

Finally, after identifying the technical requirements that need improvement, strategies to increase the sales volume of Likicha products can be formulated. The Analytic Hierarchy Process (AHP) is employed to prioritize these strategies based on the results of PLS-SEM, BMC, and QFD, offering a comprehensive view of the company's needs [19]. AHP is considered effective for supporting decision making in complex situations and for prioritizing the most appropriate strategies [20].

This study aims to identify the factors that influence consumer purchase intentions for green tea products and to formulate development strategies for Likicha green tea at PT Mitra Kerinci to support business growth. This research employs an integrated approach combining PLS-SEM, BMC, QFD, and AHP methods. The integration of these four methodologies enables the formulation of a comprehensive, data-driven strategy to enhance the sales volume of green tea. This approach is encapsulated in the research title “Enhancing Green Tea Product Development: Integrating QFD with PLS-SEM, BMC, and AHP for Optimal Business Growth”.

2. Materials and Methods

2.1. Research Methods

This study adopts an integrated approach utilizing four analytical techniques: Partial Least Squares Structural Equation Modeling (PLS-SEM), Business Model Canvas (BMC), Quality Function Deployment (QFD), and Analytic Hierarchy Process (AHP). This approach was selected to identify and map the factors influencing consumer purchase intentions and to formulate product development strategies for green tea at PT Mitra Kerinci.

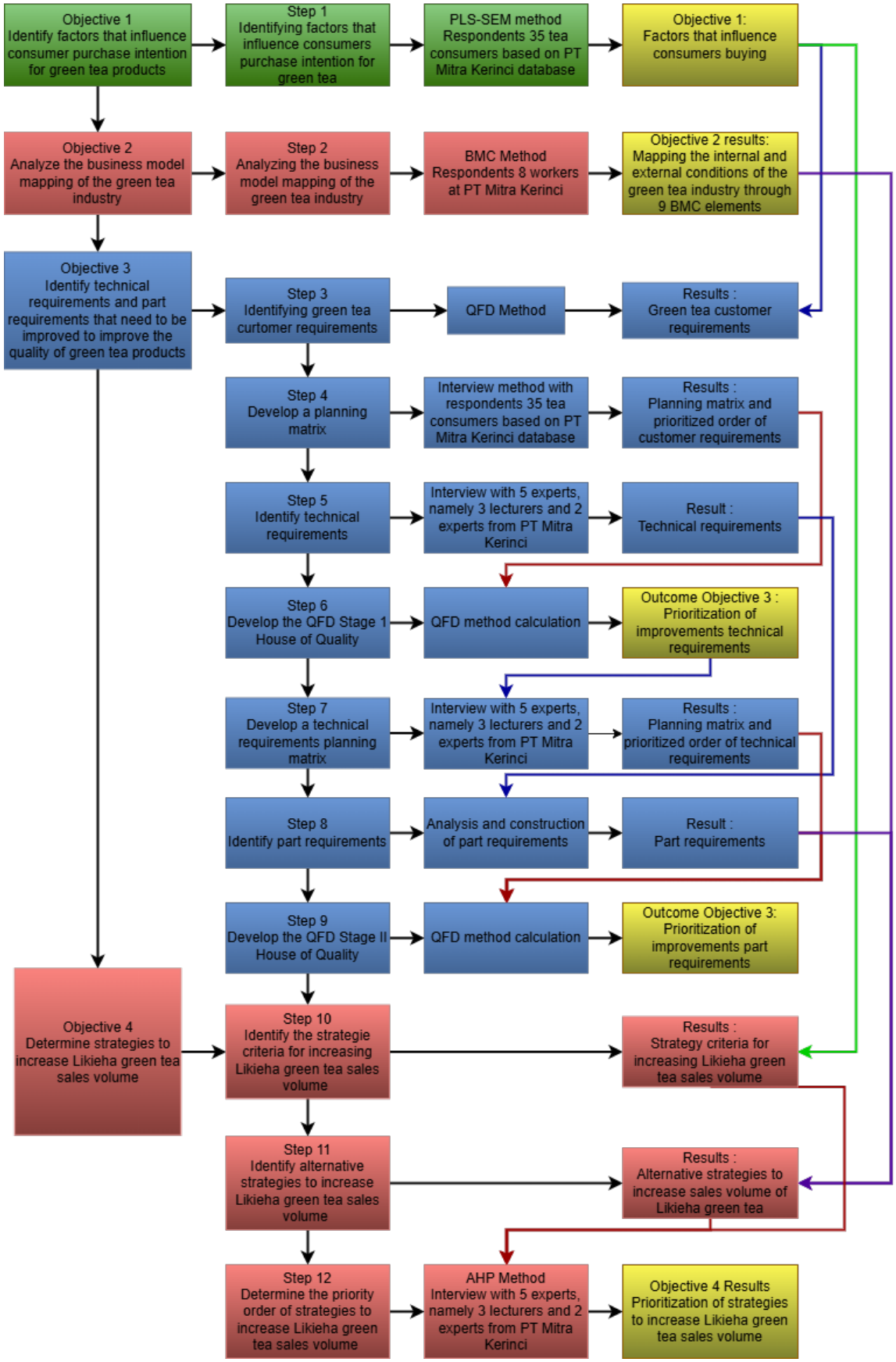

Fig. 1. Research Stages

The PLS-SEM method was employed in the initial stage to identify the factors influencing consumer purchase intentions for green tea products. Subsequently, the Business Model Canvas (BMC) was used to map the company's internal and external conditions through its nine business

model elements. The results of both methods were used as input for the QFD method, which identified technical requirements and established priorities for product quality improvement. Finally, the AHP method was employed to prioritize strategies for increasing green tea sales volume by integrating insights from the factor analysis, business model, and QFD. The integration of these four methods enabled the formulation of a holistic and data-driven strategy to enhance green tea sales performance.

2.2. Research Framework

This research framework is structured based on the integrative flow of the PLS-SEM, BMC, QFD, and AHP methods, where the output of each technique serves as input for the next. The research process began with PLS-SEM to identify the factors influencing green tea consumers' purchase intentions, which were then used as the foundation for the QFD method to determine customer requirements. Business Model Canvas (BMC) was employed to map the company's business strategy, encompassing its internal and external conditions. This information subsequently served as the foundation for developing technical requirements in the QFD.

In the final stage, the AHP method was employed to prioritize development strategies based on the analysis of identified criteria and alternatives. AHP facilitated quantitative data processing and the determination of the optimal strategy using Expert Choice 11 software. This research workflow aims to develop effective strategies to increase the sales volume of green tea at PT Mitra Kerinci through a systematic, evidence-based approach. Accordingly, the study is expected to make a significant contribution to green tea product development and the company's marketing strategy. The research framework is illustrated in Fig. 1.

3. Results and Discussion

3.1. Identification of Factors Affecting Green tea Consumer Purchase Intention

Identification of factors influencing the purchase intention of green tea consumers was conducted using the PLS-SEM method, involving 35 respondents, namely green tea consumers at PT Mitra Kerinci. The research objectives were achieved by first describing the variables based on the questionnaire results. Subsequently, the measurement model (outer model) was analyzed by assessing validity, reliability, and discriminant validity. The results indicate that all attributes met the validity and reliability criteria after one iteration. Next, the structural model (inner model) was analyzed by calculating the R-Square value and testing the significance of the path coefficient [9]. The results indicate that the model falls within the moderate category based on the R-Square value. According to the significant test, the factors influencing green tea consumer purchase intention include health benefits, product form attributes, and price, with perceived quality and perceived value serving as mediating variables [11]. These findings are derived from the second

iteration of the research model, as the first iteration contained indicators that did not meet the validity and reliability criteria [21]. The final PLS-SEM Framework is presented in Fig. 2.

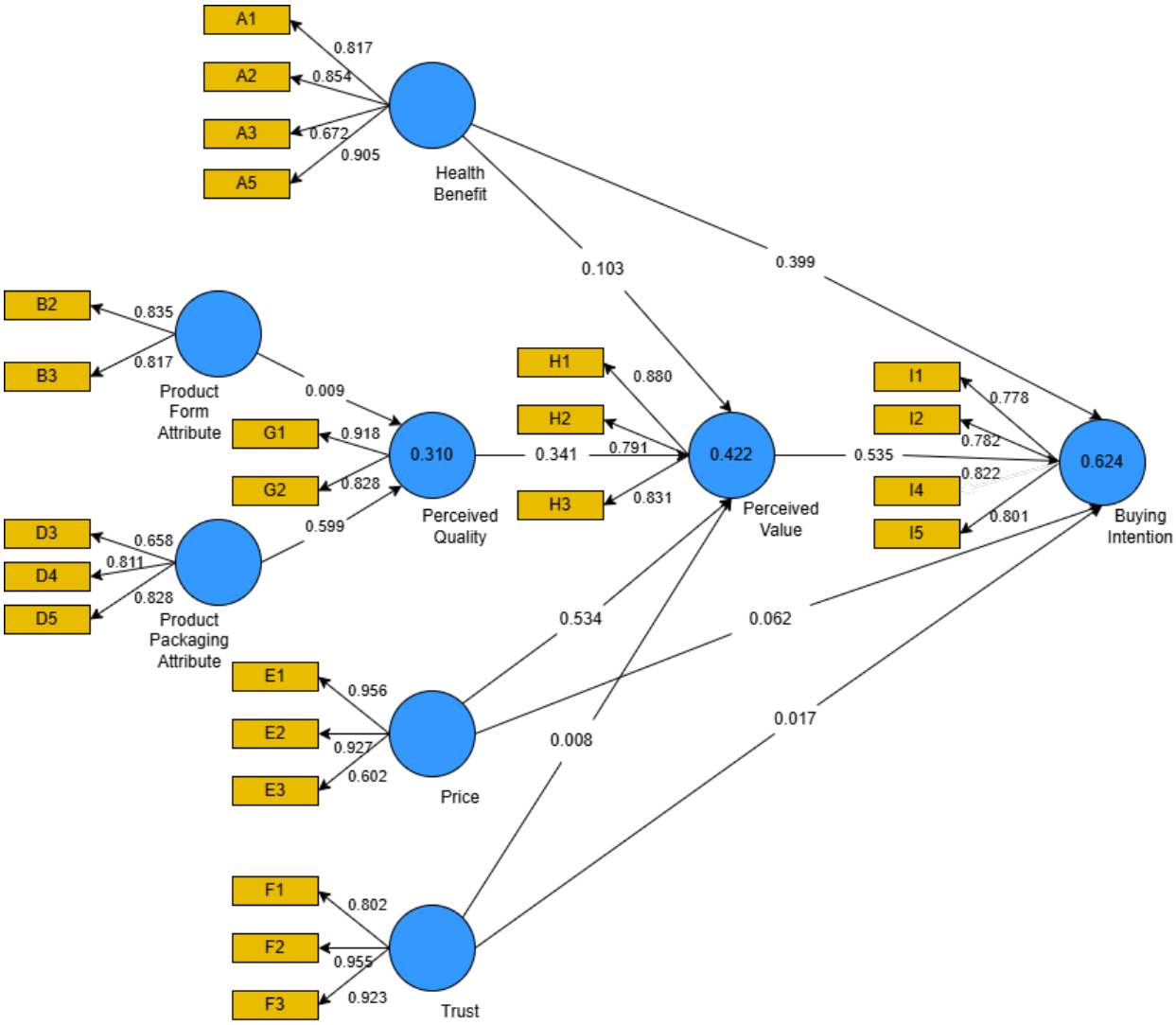

Fig. 2. Final PLS-SEM Framework

3.1.1 Discriminant Validity Test

A model is considered to have good discriminant validity if the correlation value between indicators and their constructs exceeds the correlation value between the indicators and other constructs [22]. In this study, discriminant validity was examined at the indicator level. In addition, discriminant validity can be assessed by comparing the square root of the AVE with the correlation between variables [22]. If the AVE root value is greater than the correlation values, the model is considered to meet the discriminant validity requirements. The results of the discriminant validity test in this study are presented in Table 1.

Based on the research results, several indicators from the initial model were eliminated to meet the measurement model evaluation criteria. This adjustment also resulted in changes to the loading factor values. As shown in Table 1, all variables have satisfied the criteria for the discriminant validity test.

Table 1. Discriminant Validity Test Result

Variable	Product Form Attributes	Product Packaging Attributes	Price	Trust	Health Benefits	Buying Intention	Perceived Quality	Perceived Value
Product Form Attributes	**0.826**							
Product Packaging Attributes	0.523	**0.769**						
Price	0.660	0.551	**0.807**					
Trust	0.486	0.457	0.422	**0.896**				
Health Benefits	0.457	0.536	0.454	0.591	**0.817**			
Buying Intention	0.461	0.547	0.545	0.429	0.578	**0.796**		
Perceived Quality	0.223	0.552	0.277	0.548	0.487	0.330	**0.874**	
Perceived Value	0.455	0.610	0.578	0.343	0.301	0.663	0.434	**0.834**

3.1.2 R-Square Value

The R-square value, also known as the coefficient of determination, quantifies the proportion of variance in the dependent latent variable that can be explained by the independent latent variables within a statistical model. Changes in the R-square value are used to assess the substantive influence of certain independent variables. The R-square values are presented in Table 2.

Table 2. R-Square Value

Variabel	*R-square*	*R-square adjusted*
Buying Intention	0.632	0.583
Perceived Quality	0.237	0.189
Perceived Value	0.437	0.362

Based on the data in Table 2, it can be interpreted that 63.2% of the variation in purchase intention toward green tea is explained by the model, while the remaining 36.8% is attributed to factors outside the model. The variance in perceived quality towards green tea is explained by the model at 23.7%, with the remaining 76.3% influenced by external factors. In addition, the variance in perceived value of green tea is explained by the model at 43.7%, while the remaining 56.3% is explained by factors outside the model.

3.1.3 Significance Test of Path Coefficient

The final result of the PLS-SEM analysis is the significance of the path coefficient. Bootstrapping is used to determine the path coefficient values in the model used in the study. If the t-statistic value exceeds the t-table value (at a significance level 5%- = 1.96), the effect of the path coefficient is considered significant. The path coefficient values and corresponding t-statistics in this study are presented in Table 3.

As shown in Table 3, the criteria for determining whether a hypothesis is supported are based on the original sample, T-Statistic, and P-value. The hypothesis is accepted if the P-value is less than 0.05. The following conclusions can be drawn from Table 3.

Table 3. Significance Test of Path Coefficient

Variable	Path coefficient	T statistic	P value	Hypothesis	Description
Product Form Attributes → Perceived Quality	-0.090	0.491	0.312	H2	Not supported
Product Packaging Attributes → Perceived Quality	0.599	3.902	0.000	H3	Supported
Price → Buying Intention	0.062	0.356	0.361	H4b	Not supported
Price → Perceived Value	0.534	2.836	0.002	H4a	Supported
Trust → Buying Intention	-0.017	0.101	0.460	H5b	Not supported
Trust → Perceived Value	-0.008	0.044	0.482	H5a	Not supported
Health Benefits → Buying Intention	0.399	2.874	0.002	H1b	Supported
Health Benefits → Perceived Value	-0.103	0.485	0.314	H1a	Not supported
Perceived Quality → Perceived Value	0.341	2.098	0.018	H6	Supported
Perceived Value → Buying Intention	0.535	3.861	0.000	H7	Supported

a. Influence of Health Benefits

Currently, consumer awareness of the adverse effects of chemicals used in food and beverage production is increasing, leading to a greater interest in natural products, such as green tea, which is produced without the use of chemicals [23]. Green tea is also believed to promote health among its consumers. According to De Mejia et al. [23], the prevalence of hypertension in Indonesia reached 34.1% in 2018, an increase from 25.8% in 2013. Hypertension complications can affect various target organs including the heart, brain, kidneys, eyes, and peripheral arteries, depending on the severity and duration of uncontrolled and untreated high blood pressure. Cardiovascular disease contributes to more than 50% of total deaths worldwide [3]. However, one study found that the risk of cardiovascular disease decreased among patients who reported regularly consuming green tea [24]. Several studies on organic products have identified health benefits as a key factor influencing green tea consumption and consumer preferences, positioning green tea as a supplement for a healthy lifestyle [2].

b. Influence of Product Form Attributes

Product form attributes refer to the features and utilities of a product designed to satisfy customer needs through the product itself [11]. These attributes are closely related to the nutritional content and quality of the product. Therefore, product form attributes are considered factors influencing consumers' perceived quality of green tea products. However, research data indicate that product form attributes do not significantly influence consumers' purchase intention toward green tea. This may be because consumers are more influenced by other factors such as brand image, price, availability, or health benefits, rather than the physical appearance or form of the product. In the case of Likicha green tea, although it offers a unique form and taste, these characteristics may not be effectively communicated or recognized by consumers, thus reducing their impact on purchasing decisions.

c. Influence of Product Packaging Attributes

Packaging is a key factor in maintaining product quality. According to Kotler and Armstrong [25], packaging serves not only as a product protector but also as a marketing tool. Bukhari [26]

states that nearly 80% of new product launches fail due to insufficient attention to consumer preferences. Visually attractive packaging creates the impression of a product that stands out from others, thereby influencing consumers' purchasing intentions [27]. Therefore, product packaging attributes are considered important factors in shaping consumers' perceived quality of green tea products.

d. Price Influence

Price is the monetary value of a product that significantly influences the consumer decision-making process [10]. It serves as an indicator of a product's quality when external factors or other benefits of a product remain constant. High prices may deter consumers from purchasing a product. This is consistent with the findings of Sumi and Kabir [11], who reported that organic food is unpopular in developing countries due to its high price. This also applies to green tea, which is sold at a relatively high price compared to other teas. Therefore, the perceived price of green tea negatively affects the perceived value of the product.

e. Influence of Trust

Consumer intention to purchase green tea is highly dependent on consumer trust. In many cases, trust increases consumer reliability and serves as an effective tool to reduce uncertainty regarding product trials. Trust in organic food reflects the importance of organic food consumption and influences consumer attitudes and behavior [11]. The study found that clear and visible labeling on products is an important prerequisite for purchasing organic food. Currently, consumers show particular interest in certification and labeling of green tea products, which increases trust. Consumer trust has a strong positive effect on purchase intention. Therefore, trust is considered to have a positive influence on consumer purchase intention.

f. Influence of Perceived Quality

Consumer perception refers to the consumer's view of a product's superiority relative to similar products and the goals the consumer expects to achieve [7]. Quality perception encompasses all dimensions of product offerings that provide benefits to customers. Producers who attend to the quality dimensions of their products will indirectly create a perception among consumers that the products marketed fulfill their desired expectations [11].

g. Influence of Perceived Value

Perceived value refers to consumers' mental evaluation of products and services based on price, attributes, and other benefits [8]. It is a significant determinant of individual beliefs that influence consumer purchasing decisions. Studies indicate a strong relationship between perceived quality and perceived value, with perceived value reflecting the interaction between consumers and products [27]. Consumers' intention to purchase a product is influenced by their perception of its value. Therefore, perceived quality and perceived value are considered mediating constructs

that significantly influence consumers' purchasing decisions for green tea [11].

3.2. Business Model Mapping

The Likicha green tea business model mapping at PT Mitra Kerinci, using the Business Model Canvas (BMC) method, is summarized in the BMC format, as shown in Fig. 3.

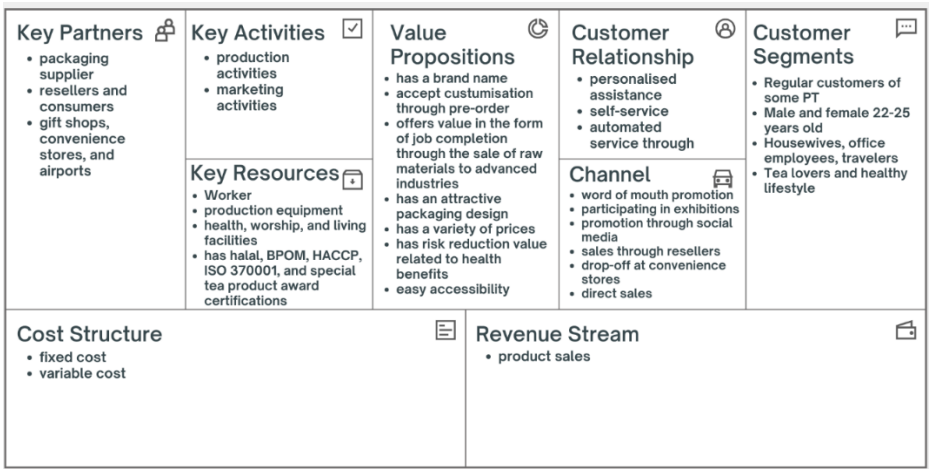

Fig. 3. Likicha Green Tea Business Model Canvas Mapping

Based on Fig. 3, the green tea industry business model at PT Mitra Kerinci is mapped into nine elements. The customer segment targeted in the sale of Likicha green tea consists of men and women aged 22-50 years, from middle to upper economic level, who adopt a healthy lifestyle. The value proposition includes pre orders for blended green tea products, established branding and packaging design, and competitive pricing based on products' grade. The distribution channels used are both online and offline. The main resources include labor, production equipment, and several legalities and certifications. The production cost incurred by the industry is IDR 17,926/kg of finished tea.

The results of the business model mapping of the green tea industry can serve as a foundation for formulating product development strategies that consider both internal and external factors.

3.3. Preparation of House of Quality with QFD Method

The preparation of HOQ in this study involved the integration of PLS-SEM and the BMC. Customer requirements were obtained from the results of the PLS-SEM analysis, while the technical and part requirements were obtained through questionnaires and the BMC.

3.3.1. House of Quality QFD Stage 1

The preparation of HOQ begins with the identification of customer requirements, which in this study were obtained through the results of the PLS-SEM analysis. Subsequently, the planning matrix will be developed as follows:

a. Customer Importance Level

The level of consumer importance reflects the extent of consumer expectations regarding a product's attributes [28]. Attributes considered important by consumers serve as benchmarks for

evaluating the overall product. The level of consumer interest in green tea products is presented in Table 4.

Table 4. Level of Consumer Importance of Green Tea

No	Attribute Importance and Consumer Needs	Total Score	Level of Importance
1	May increase endurance	161	4.60
2	May help with weight loss	156	4.46
3	Antioxidant content for beauty	151	4.31
4	Attractive packaging	135	3.86
5	Affordable price	143	4.09

b. Consumer Satisfaction Level

This measurement aims to determine the level of consumer satisfaction and provide an overview of the manufacturer's performance as assessed by consumers of Likicha green tea products. According to Altuntas et al. [16], it represents consumers' evaluation of how well the products provided by the company meet their expectations. The level of consumer satisfaction with Likicha green tea is presented in Table 5.

Table 5. Level of Consumer Satisfaction with Likicha Green Tea

No	Attribute Importance and Consumer Needs	Total Score	Satisfaction Level
1	May increase endurance	146	4.17
2	May help with weight loss	126	3.60
3	Antioxidant content for beauty	127	3.63
4	Attractive packaging	128	3.66
5	Affordable price	152	4.34

c. Benchmarking

Altuntas et al. [16] state that benchmarking is a method for assessing the level of satisfaction with competitors. Data collection methods used to evaluate customers satisfaction can be adapted to assess consumers' opinions of competing products. This approach, known as competitive benchmarking, involves gathering and analyzing data on consumer perceptions of rival products to identify areas for improvement and differentiation. The level of consumer satisfaction with competing products is presented in Table 6.

Table 6. Customer Satisfaction Level with Competitor Products

No	Attribute Importance and Consumer Needs	Total Score	Satisfaction Level
1	May increase endurance	112	3.20
2	May help with weight loss	105	3.00
3	Antioxidant content for beauty	108	3.09
4	Attractive packaging	107	3.06
5	Affordable price	110	3.14

d. Goals

The target value indicates the expected level of customer satisfaction that the company aims to achieve in order to meet consumer needs [29]. This value is derived from the highest level of consumer satisfaction attributes of Likicha green tea products. The target values are presented in Table 7.

Table 7. Goal Value of Consumer Desire for Likicha Green Tea

No	Attribute Importance and Consumer Needs	*Goal*
1	May increase endurance	5
2	May help with weight loss	5
3	Antioxidant content for beauty	5
4	Attractive packaging	5
5	Affordable price	5

e. Sales Point Value

Sales points are of particular interest for planning, as they represent the highest values obtained from the survey results [28]. Sales points indicate the level of importance assigned to each attribute for development. The sales point values are presented in Table 8.

Table 8. Sales Point Value

No	Attribute Importance and Consumer Needs	*Respondents answered 4 & 5*	*Sales Point*
1	May increase endurance	35 respondents	1.5
2	May help with weight loss	32 respondents	1.5
3	Antioxidant content for beauty	27 respondents	1.2
4	Attractive packaging	25 respondents	1.2
5	Affordable price	26 respondents	1.2

f. Improvement Ratio Value

The improvement ratio is a value that compares the target value by the manufacturer with the actual level of consumer satisfaction with a product [28]. This value represents the extent of effort required by the company to enhance product quality. A higher improvement ratio indicates greater effort required by the producer to improve the product quality, and vice versa. The improvement ratio values are presented in Table 9.

Table 9. Improvement Ratio Value

No	Attribute Importance and Consumer Needs	*Goal*	Satisfaction Level	Improvement Ratio
1	May increase endurance	5	4.17	1.199
2	May help with weight loss	5	3.60	1.389
3	Antioxidant content for beauty	5	3.63	1.377
4	Attractive packaging	5	3.66	1.366
5	Affordable price	5	4.34	1.152

Table 10. Raw Weight Value

No	Attribute Importance and Consumer Needs	Satisfaction Level	*Sales Point*	Improvement Ratio	*Raw Weight*
1	May increase endurance	4.60	1.5	1.199	8.273
2	May help with weight loss	4.46	1.5	1.388	9.292
3	Antioxidant content for beauty	4.31	1.2	1.377	7.122
4	Attractive packaging	3.86	1.2	1.366	6.327
5	Affordable price	4.09	1.2	1.152	5.654

g. Raw Weight

The priority weight of the product attributes needs to be determined. Raw weight refers to the value assigned to each attribute based on its level of importance and customer satisfaction. By

determining the priority of product attribute development, the sequence in which attributes should be enhanced and expanded can be identified. The raw weight values are presented in Table 10.

h. Normalized Raw Weight

Normalized raw weight is the raw weight value expressed as a percentage. The normalized raw weight values are presented in Table 11.

Table 11. Normalized Raw Weight Value

No	Attribute Importance and Consumer Needs	*Raw Weight*	*Normalized Raw Weight*
1	May increase endurance	8.273	0.226
2	May help with weight loss	9.292	0.253
3	Antioxidant content for beauty	7.122	0.194
4	Attractive packaging	6.327	0.173
5	Affordable price	5.654	0.154

Furthermore, technical requirements were identified through questionnaires with experts based on the analysis results from the BMC method. Once the technical requirements are identified, a relationship matrix is developed between technical requirements and customer requirements. This matrix is useful for calculating technical correlation. The technical correlation values are presented in Table 12.

Table 12. Technical Correlation Value

No	Technical Requirements	*Technical correlation*	Ranking
1	Proper processing technique	6.141	1
2	Proper brewing technique	3.273	4
3	Reliable product legality	3.660	2
4	Attractive packaging design	3.393	3
5	Competitor price comparison	1.969	5
6	Effective distribution	0.534	6

The overall assessment is subsequently incorporated into the House of Quality (HOQ) diagram. The QFD stage 1 HOQ diagram is presented in Fig. 4.

Based on Fig. 4, the order of priority for improving technical requirements is as follows: Rank 1 – the correct processing technique, with a relative importance value of 0.327; Rank 2 – product legality and trustworthiness, with a relative importance value of 0.195; Rank 3 – attractive packaging design, with a relative importance value of 0.180; Rank 4 – the correct brewing technique, with a relative importance value of 0.174; Rank 5 – competitor price comparison, with a relative importance value of 0.105; and Rank 6 – effective distribution, with a relative importance value of 0.028.

3.3.2 House of Quality QFD Stage 2

The preparation of HOQ for QFD stage 2 was conducted using the same steps as in HOQ QFD stage 1. The difference between the two stages lies in the respondents involved; in stage two, five respondents participated. The preparation of HOQ QFD stage 2 aims to further explore which technical requirements should be prioritized to improve first and which part requirements can be

used to achieve these improvements based on QFD calculations and expert opinions. The stage 2 QFD house of quality diagram is presented in Fig. 5.

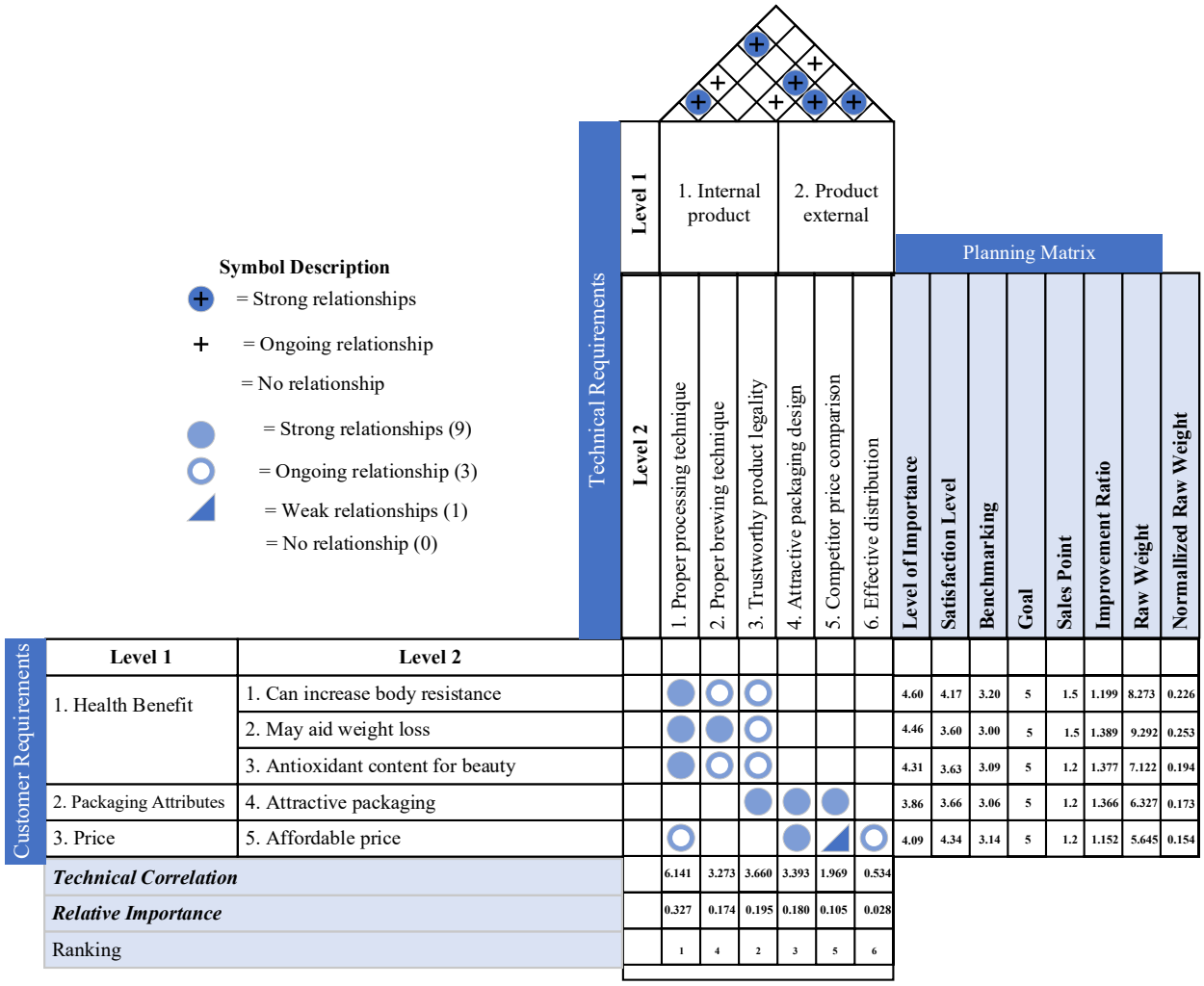

Fig. 4. *House of Quality* QFD Stage 1

Based on Fig. 5, the order of priority for the improvement of part requirements is as follows: (1) Picking and sorting of raw materials (relative importance value: 0.156), (2) Chemical content analysis (relative importance value: 0.154), (3) Drying techniques (relative importance value: 0.143), (4) Composition, time, and brewing temperature (relative importance value: 0.116), (5) Drying techniques (relative importance value: 0.093), (6) Product sorting (relative importance value: 0.093), (7) The correctness of product legality (relative importance value: 0.087), (8) The distribution process (relative importance value: 0.071), (9) Packaging and storage techniques (relative importance value: 0.049), (10) The suitability of colors, fonts, and images (relative importance value: 0.048), and (11) Completeness of information (relative importance value: 0.039).

3.4 Prioritization Identification of Alternative Strategies to Increase Green Tea Sales Volume with AHP Method

The AHP method is employed to achieve the fourth research objective in this study, which is to determine the appropriate green tea development strategy at PT Mitra Kerinci based on consumer preferences. In this study, the goal of the AHP method is to identify a strategy that can

effectively increase the sales volume of green tea at PT Mitra Kerinci.

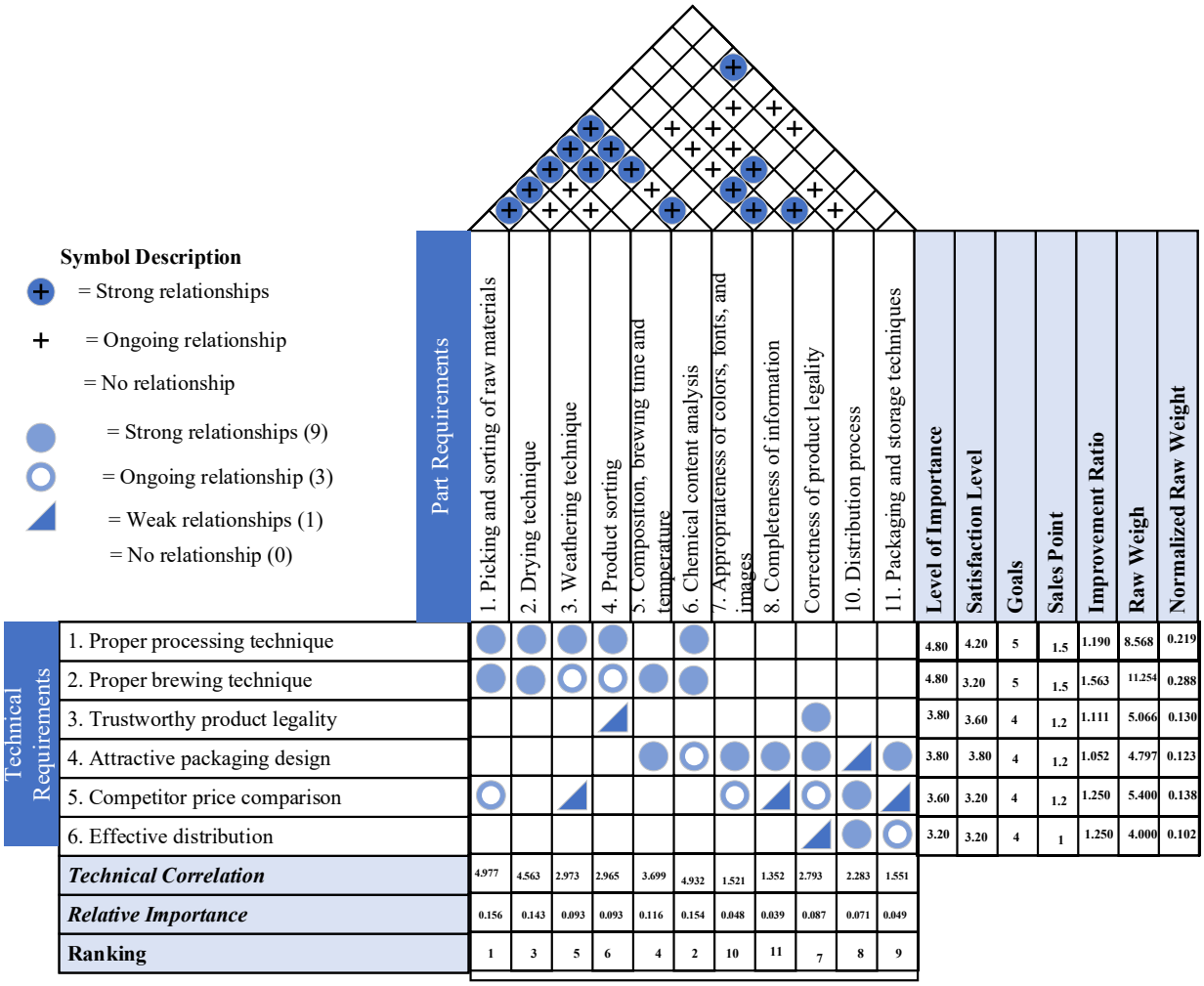

Fig. 5. *House of Quality* QFD Stage 2

3.4.1 Determining Criteria and Alternatives

The determination of criteria and alternatives using the AHP method is conducted by identifying internal and external factors, involving expert knowledge to ensure the relevance of the selected criteria and alternatives in achieving the research objectives. According to previous research [30], the identification of criteria and alternatives was based on the results of a SWOT analysis. In this study, however, the criteria and alternatives are derived from the results of the PLS-SEM, BMC, and QFD methods. Specifically, the criteria are obtained from the findings of objective 1, which utilized the PLS-SEM method, and objective 2, which applied the BMC method, while the alternatives are drawn from the results of objective 2 (BMC method) and objective 3 (QFD method). The criteria derived from the previous research objectives are as follows:

1. Product quality criteria
2. Product packaging design
3. Product Marketing

The alternatives proposed in this study are also based on the findings of previous research

objectives, are outlined as follows:

1. Cultivating the appropriate raw materials and implementing proper processing techniques.
2. Conducting chemical content analysis of each green tea production batch
3. Educating consumers about green tea
4. Designing Attractive packaging and that aligns to consumer desires
5. Implementing online promotional strategies, such as influencer endorsements and creating advertisements on social media.
6. Performing offline promotions, such as participating in bazaars in several agencies.

3.4.2 Prioritizing the Strategy

The creation of a hierarchical structure aims to facilitate the decision-making process by describing the problem into a structured hierarchy. The structure begins with the overall goal or objective, followed by the criteria, and finally the available alternatives. The hierarchical structure developed in this study is illustrated in Fig. 6.

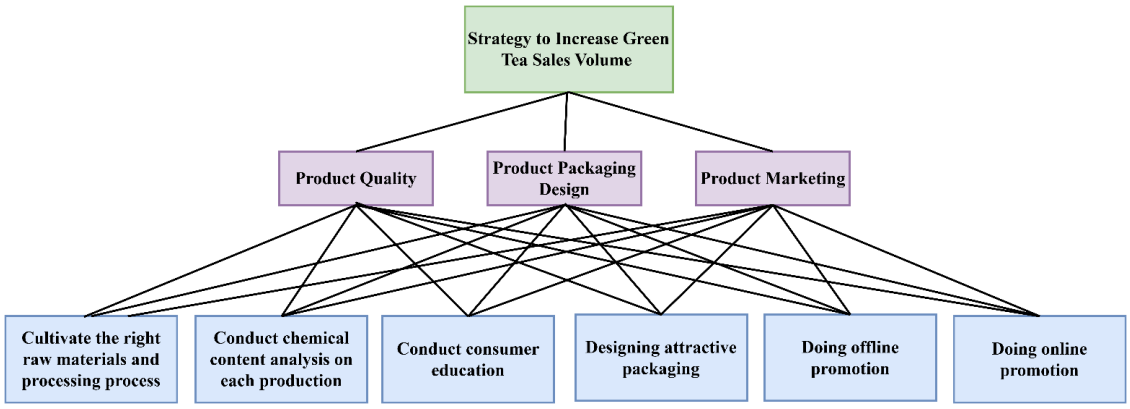

Fig. 6. Hierarchical Structure of Strategies to Increase Green Tea Sales Volume

3.4.3 AHP Data Processing Result

To determine the overall ranking, the initial stage involves calculating the weight of each criterion using the AHP method, as outlined by Amirah [31]. The following section describes the calculation steps applied in the AHP method, utilizing Expert choice 11 software [31].

a. Results of Calculation of Hierarchical Weighting Factors for Criteria

The results of the summarized assessment from the three respondents produced the pairwise comparison matrix for all criteria. The complete matrix is presented in Fig. 7.

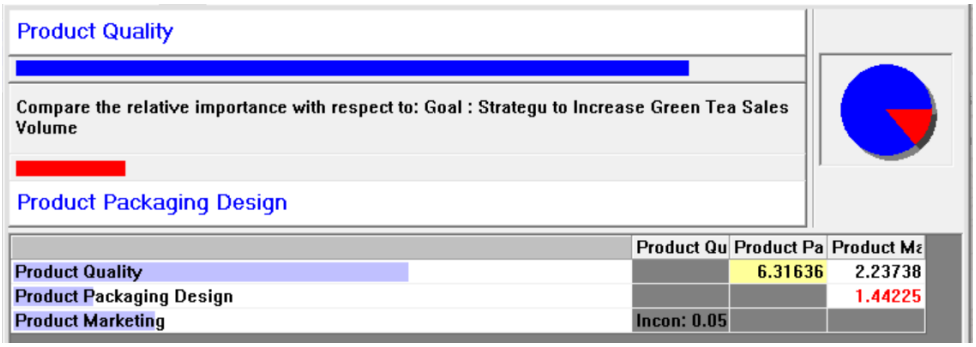

Fig. 7. Pairwise Comparison Matrix Results for All Criteria.

Furthermore, the weighted value of each criterion, generated using the Expert Choice application, are presented in Fig. 8.

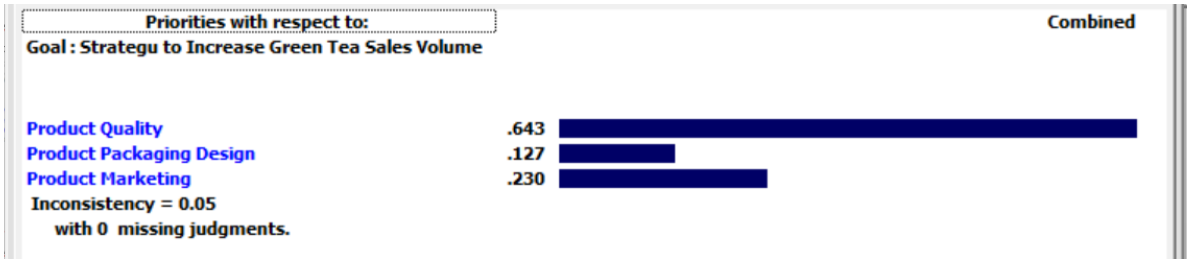

Fig. 8. Hierarchical Weighting Results for All Criteria

Based on Fig. 8, the weighting results for all criteria are as follows. The product quality criterion received the highest weight of 0.643 (64.3%), making it the top priority in selecting strategies to increase the sales volume of green tea. The product marketing criterion received a weight of 0.230 (23.0%), ranking second in priority. Meanwhile, the product packaging design criterion obtained the lowest weight of 0.127 (12.7%), making it the final priority. According to Sumi and Kabir [11], the inconsistency value must be less than <0.1; if it exceeds 0.1, the assessment must be repeated due to data inconsistency. In this study, the inconsistency value was 0.05, indicating that it met the required threshold.

b. Results of Calculation of Hierarchical Weighting Factors for Alternatives

The results of the AHP Final Assessment, conducted using the Expert Choice application, indicate that the research data met the inconsistency requirements, with an overall inconsistency value of 0.04. The results of the AHP final assessment are presented in Fig. 9.

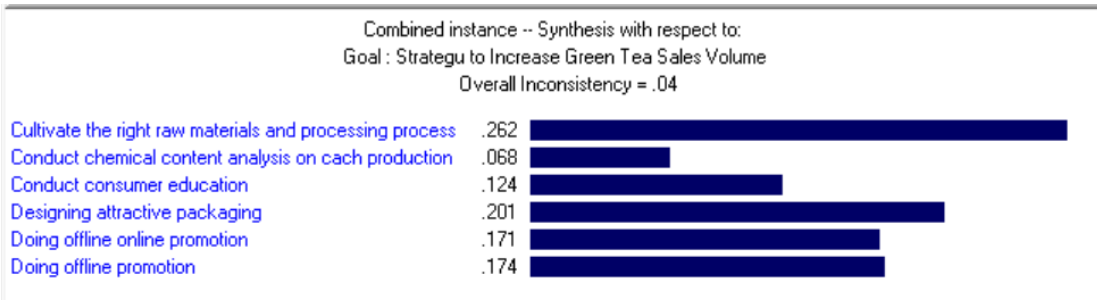

Fig. 9. AHP Final Assessment Results

Based on Fig. 9, the priority ranking of alternative strategies to increase green tea sales volume, as evaluated by three expert respondents. The first priority is given to selecting the right raw materials and optimizing processing methods, with a weight value of 0.262 (26.2%). The second priority is designing attractive packaging that aligns with consumer preferences, with a weight of 0.201 (20.1%). The third priority is conducting offline promotions, which holds a weight of 0.174 (17.4%). The fourth priority is online promotions, with a weight of 0.171 (17.1%). The fifth priority is consumer education, with a weight of 0.124 (12.4%). The lowest priority is analyzing chemical content with a weight of 0.068 (6.8%).

4. Conclusions

Based on the research conducted, several conclusions can be drawn. First, the factors influencing consumer purchase intentions for green tea products at PT Mitra Kerinci, analyzed using the PLS-SEM method, include health benefits, product packaging attributes, and price, with perceived value and perceived quality serving as mediating variables. The results of this analysis provide valuable input for the QFD method, specifically in identifying customer requirements. Second, the business model of the green tea industry at PT Mitra Kerinci, mapped across the nine BMC elements, reveals both the external and internal conditions of the industry. The results of BMC serve as a basis for constructing technical requirements and parts in the QFD method, as well as formulating alternative strategies in the AHP method.

In addition, the results of the QFD method identify the priority order for improving technical requirements in QFD stage I and part requirements in QFD stage II. Among the six technical requirements, proper processing techniques emerged as the top priority for improvement, while among the eleven part requirements, product picking and sorting was the highest priority. The results serve as the foundation for developing strategic alternatives to increase green tea sales using the AHP method. Finally, the AHP results indicate that product quality criteria hold the highest priority in the strategy to increase sales at PT Mitra Kerinci. The suggested alternative is to focus on securing the right raw materials and processing techniques, aligning with the priorities established through AHP analysis for increasing Likicha green tea sales.

This study is limited in scope, as it examines only a few variables influencing consumer purchase intention. Consequently, it may not fully capture broader factors affecting green tea sales, such as brand trust, social influence, or marketing strategies. Despite this limitation, the study successfully identifies a strategy to increase the sales volume of Likicha green tea. Future research is recommended to evaluate the effectiveness of proposed strategy in enhancing business performance, particularly in terms of sales growth. An analysis of the company's development could serve as a benchmark for assessing strategic impact. Moreover, further studies should consider incorporating more variables and conducting strategy evaluations to support the formulations of more comprehensive and adaptive business strategies.

Abbreviations

PLS-SEM	Partial Least Squares–Structural Equation Modeling
BMC	Business Model Canvas
QFD	Quality Function Deployment
AHP	Analytic Hierarchy Process
HOQ	House of Quality
AVE	Average Variance Extracted

Data availability statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. This includes raw questionnaire responses, technical requirement matrices, and analytical results from the PLS-SEM, BMC, QFD, and AHP methods. Due to privacy and proprietary considerations, the full dataset is not publicly available but can be shared upon request for academic and non-commercial purposes.

CRediT authorship contribution statement

Azrifirwan: Conceptualization, Methodology, Supervision, Writing – review and editing. **Irma Ayu Sahanatul Husna**: Data curation, Formal analysis, Investigation, Visualization, Writing – original draft. **Sahadi Didi Ismanto**: Resources, Validation, Project administration, Writing – review and editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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