

Developing the Quality Function Deployment Method by Integrating Kano Model and Sensory Profile Analysis into the House of Quality Matrix

Pengembangan Metode Quality Function Deployment dengan Integrasi Model Kano dan Analisis Profil Sensoris dalam Matriks House of Quality

Gusti Fauza^{1*}, Viska Wandhira Wimaryana¹, Hari Prasetyo², Setyaningrum Ariviani¹, Dimas Rahadian Aji Muhammad¹, Dian Rachmawanti Affandi³

¹Food Product Development Research Group, Faculty of Agriculture, Sebelas Maret University, Surakarta 57126, Indonesia

²Department of Industrial Engineering, Faculty of Engineering, Muhammadiyah Surakarta University, Surakarta 57162, Indonesia

³Department of Food Science and Technology, Faculty of Agriculture, Sebelas Maret University, Surakarta 57126, Indonesia

*E-mail: gustifauza@staff.uns.ac.id

Submitted: 2 Juni 2025; Accepted: 15 September 2025

ABSTRACT

This study aims to enhance the effectiveness of the Quality Function Deployment (QFD) method for food product development by integrating the Kano model and sensory profile analysis using Quantitative Descriptive Analysis (QDA) into the House of Quality (HOQ) matrix. The Kano model was applied to identify and categorize customer expectations, while QDA was used to characterize the sensory attributes of four steamed brownie samples—one of which was the target for improvement. Twelve quality attributes were identified, comprising both intrinsic (taste, aroma, texture, appearance) and extrinsic (packaging, labeling, branding, distribution) factors. Kano analysis revealed that two attributes were classified as Attractive, eight as One-dimensional, and two as Indifferent. Sensory profiling showed key differences between the developed product and a superior competitor. HOQ analysis indicated that improvements in formulation (composition of ingredients) and packaging design were critical for increasing consumer satisfaction. Unlike conventional QFD, which primarily translates customer requirements into technical specifications, the proposed integrative approach explicitly distinguishes attributes based on their impact on satisfaction (via Kano) and links them to measurable sensory characteristics (via QDA). This combination provides clearer prioritization and more actionable insights for product developers. Therefore, this study offers a structured and consumer-focused strategy that strengthens QFD's applicability in the food industry by improving both accuracy and relevance in decision-making.

Keywords: Kano model; QFD; HOQ; QDA; sensory analysis; steamed brownies

ABSTRAK

Penelitian ini bertujuan untuk meningkatkan efektivitas metode Quality Function Deployment (QFD) dalam pengembangan produk pangan melalui integrasi Model Kano dan analisis profil sensori menggunakan Quantitative Descriptive Analysis (QDA) ke dalam matriks House of Quality (HOQ). Model Kano digunakan untuk mengidentifikasi dan mengategorikan harapan konsumen, sedangkan QDA digunakan untuk memetakan atribut sensori dari empat sampel brownies kukus—salah satunya menjadi target perbaikan. Sebanyak dua belas atribut mutu berhasil diidentifikasi, mencakup faktor intrinsik (rasa, aroma, tekstur, penampakan) dan ekstrinsik (kemasan, pelabelan, branding, distribusi). Analisis menggunakan Kano menunjukkan bahwa dua atribut termasuk kategori Attractive, delapan atribut One-dimensional, dan dua atribut Indifferent. Analisis sensori mengungkapkan perbedaan utama antara produk yang dikembangkan dengan produk pesaing yang memiliki performa lebih tinggi. Hasil HOQ menunjukkan bahwa perbaikan pada formulasi (komposisi bahan) dan desain kemasan sangat penting untuk meningkatkan kepuasan konsumen. Berbeda dengan QFD konvensional yang menterjemahkan kebutuhan konsumen ke dalam spesifikasi teknis, pendekatan integratif yang diajukan secara eksplisit membedakan atribut berdasarkan dampaknya terhadap kepuasan (melalui Kano) serta menghubungkannya dengan karakteristik sensori yang terukur (melalui QDA). Kombinasi ini memberikan prioritas yang lebih jelas serta rekomendasi yang lebih aplikatif bagi pengembang produk. Dengan demikian, penelitian ini menawarkan strategi yang terstruktur dan berorientasi konsumen yang memperkuat penerapan QFD dalam industri pangan melalui peningkatan akurasi dan relevansi dalam pengambilan keputusan.

Kata kunci: Model Kano; QFD; HOQ; QDA; analisis sensoris; brownies kukus

INTRODUCTION

In today's highly competitive food market, continuous product development and innovation are essential for companies to remain relevant and sustainable. Traditionally, many food industries rely on a technology-push strategy, where innovations are driven by technical advancements rather than direct consumer input

(Jreissata & Makatsoris, 2021). However, this approach often leads to a mismatch between what companies offer and what consumers desire, resulting in high product failure rates—up to 50% within the first year (Dijksterhuis, 2016).

To bridge this gap, consumer-driven product development strategies have increasingly attracted scholarly attention, as approaches integrating consumer

feedback with structured design tools enhance alignment between market insights and R&D decisions (Sijtsema & Snoek, 2023). Among these, the Quality Function Deployment (QFD) method—realized through the House of Quality (HOQ) matrix—remains a systematic framework for translating the “voice of the customer” into technical requirements or the “voice of the company” in food product contexts (Indraswari et al., 2024). In practical application, QFD has proved effective in aligning consumer expectations with engineering specifications, such as in chocolate beverage development (Indraswari et al., 2024). Moreover, modified QFD frameworks—like the fuzzy-enhanced seven-step model—have improved the precision of technical attribute prioritization in food products like granola bars while incorporating competitive benchmarking (Wang, Hsiao & Sung, 2019). Through constructing the HOQ matrix, QFD enables development teams to operationalize consumer needs into innovations, facilitating informed trade-offs between what customers desire and what companies can deliver.

Despite its advantages, traditional QFD often lacks precision in classifying customer priorities. The Kano model enhances this by categorizing customer requirements into five classes—Attractive, One-dimensional, Must-be, Indifferent, and Reverse—enabling a more nuanced prioritization. Recent studies have shown that combining Kano with fuzzy logic and QFD improves prioritization and decision-making in consumer-oriented product design (Haroglu & Leblebici, 2021). Nevertheless, when applied to food products, QFD and Kano models face limitations due to the complex and sensory-driven nature of food. Recent approaches suggest integrating customer-driven food product development with modern sensory and statistical methods to overcome these challenges (Ruiz-Capillas et al., 2021)

Research related to the implementation of QFD for developing many food products has been carried out, such as an instant functional beverages (Assemay Talgatkyzy & Rakymkulkyzy, 2025), processed chocolate products (Purba et al., 2018), pia edamame (Suryaningrat et al., 2020), confectionery products (Kowalska et al., 2018b, 2018a), organic poultry meat (Naspetti et al., 2015), instant corn rice (Hidayat et al., 2019), smoked fish (Izzhati et al., 2018), coconut jelly drink (Mela & Wijonarko, 2020), and pasteurized milk (Dewi et al., 2020). QFD also has been implemented to improve extrinsic attributes of food products such as designing the black garlic honey packages (Kartini et al., 2023) and improving brownies biscuit packs (Pulungan et al., 2019). The use of QFD has also been combined with other methods to increase its utility (Ali et al., 2022), such as combining QFD with Kano in the development of starch-based food products (Cullano et al., 2025) and chocolate products (Lukman & Wulandari, 2018), then implementing Fuzzy-QFD on granola bars (Wang et al., 2019), Indonesian traditional foods such as *jenang* (Effendi et al., 2018) and *opak* (Ummi et al., 2018), as well as modifying QFD by adding quantitative descriptive analysis (QDA) to describe product sensory as was done in the development of processed chocolate products (De Pelsmaeker et al., 2015; Indraswari et al., 2024).

The application of the QFD method, which is integrated with Kano, is intended to improve accuracy in understanding consumer desires (voice of consumer) (Cullano et al., 2025). While the integration of QDA in QFD is expected to improve the performance of the technical requirement matrix as was done by De Pelsmaeker et al., 2015. Therefore, in this research the QFD is not only integrated with Kano to improve the accuracy and

performance of voice of customer (WHATs) but also QDA to understand the voice of process (HOWs) and make them executable to meet the customer needs. QFD integration with Kano can accommodate linear and non-linear relationships between product innovation performance and customer satisfaction, hence the direction of product development is more measurable and systematic. Meanwhile the use of QDA will strengthen decisions related to product technical specifications related to meeting the consumer needs. This study proposes a novel integration of QFD, the Kano model, and QDA to improve the development process of a steamed brownie product. By embedding consumer perceptions, sensory profiling, and technical specifications within a single framework, this approach aims to guide food manufacturers in making data-driven, customer-oriented product improvements. The model is applied to a case study of steamed brownies produced by a local bakery in Surakarta, Indonesia.

METHODOLOGY

Material

Four steamed brownie samples (labeled A, B, C, and D) were used in this study, with sample A representing the developed product and samples B–D serving as benchmark competitors from commercial bakeries in Surakarta, Indonesia. All products were prepared using standard ingredients, including wheat flour, margarine, eggs, granulated sugar, chocolate bars, cocoa powder, and other baking essentials. The production process involved mixing, molding, steaming, cooling, cutting, and packaging.

Method

This research was conducted through several stages, namely: 1) identifying the voice of customer (WHATs), 2) identifying the voice of company (HOWs), 3) determining the correlation between HOWs attributes, 4) determining the closeness of the relationship between WHATs and HOWs attributes, 5) benchmarking and finally 6) recommendations.

WHATs identification is carried out through 3 stages, namely a) identification attributes of consumer needs and expectations for brownie production, b) categorization of attributes using the Kano model, c) determination of the importance level of attributes. At stage a, the 12 brownies quality attributes refer to Wimarnaya et al., 2021 are categorized as 4 intrinsic attributes, such as taste (Q₁), aroma (Q₂), texture (Q₃) and appearance (Q₄) and 8 extrinsic attributes, namely labeling and packaging (Q₅, Q₆, Q₇, Q₈, Q₉), trustworthy and brand image (Q₁₀ and Q₁₁) and distribution (Q₁₂). After determining the 12 quality attributes the Kano categorization is established. 35 consumers were asked how did they feel if the attributes appeared or disappeared in the product and based on the responses those attributes were categorized as Attractive (A), One-dimensional (O), Must-be (M), and Indifference (I). Details of this stage can be seen in Wimarnaya et al., 2021. Further, the importance level of the attribute was determined by asking 100 consumers (with an age range of 17-40 years) to rate the level of importance of each attribute using a Likert scale of 1-5 (ranging from 1=very unimportant to 5=very important).

After the WHATs were established, the next step is to design the voice of company attributes or the HOWs attributes. In this study, the HOW attributes were divided into two groups, namely the technical requirement

attributes and sensory attributes. A literature search and intensive discussions with the quality control team of the sample A producers were carried out to define the technical requirements attributes. Meanwhile the QDA method was used to describe the sensory profile of brownie products using 15 trained panelists who examined the intensity of sensory attributes that relate to the quality attributes perceived by the customers (details of the QDA processing steps can be seen in Mardiana et al., 2021).

Determination of the relationship between WHATs and HOWs is carried out to find out how strong the technical aspects could affect the consumer needs. It is carried out through FGDs between researchers and sample A producers. Apart from that, the FGD session also determined the correlation between HOWs attributes and the direction of product improvement. Determination of the correlation value between the HOWs attributes is carried out to observe the behavior between the HOWs attributes if a change is made. While determining the direction of improvement is carried out to find out how to improve attributes so that they are in line with product development targets.

Benchmarking is done to find out the position of observed brownie product compared to other brownie brands. The 100 consumers were involved to measure the performance of the four brownie samples based on the 12 attributes defined in Step 1. A Likert scale of 1-5 was used in this stage where the value 1=very dissatisfied and 5=very satisfied. One way ANOVA followed by DMRT was used to see the differences in the level of consumer satisfaction with the 4 brownie samples based on 12 product quality attributes.

The final stage in preparing the HOQ matrix is setting product development targets. Setting targets for the development of original steamed brownie products is carried out through a literature study, analysis of the results of Step 3-5 as well as discussions with brownie producers.

RESULT AND DISCUSSION

To understand the customers expectation and perception, the VOCs was defined through questionnaire filled by 100 consumer panelists. The demographic profile of panelists can be seen at Table 1. Based on Table 1, the demographic data of respondents in the gender category shows that the percentage of female respondents is 10% greater than that of males. In the Age category, the majority are aged 21-30 years (51%). In the category of average income per month, respondents with income less than 1,000,000 IDR and 1,000,0001-2,500,000 IDR are the most, in respective order 56% and 36% each. In the average spending category per month, respondents with spending less than 1,000,000 IDR are the most (75%). Only 2% of respondent spent money more than 2,500,000 IDR per month.

Kano Model Results and Attribute Prioritization

The 35 panelists are asked to complete the Kano questionnaires and the result can be seen in Table 2. As can be seen in Table 2, two attributes (Q₁ and Q₅) are categorized as Attractive (A), 8 attributes Q₂, Q₃, Q₆, Q₇, Q₈, Q₁₀, Q₁₁, Q₁₂ are in One-dimensional (O) group and the rest Q₄ and Q₉ are noted as Indifference (I). Ten attributes that are categorized in Attractive and One-Dimensional (as seen in Table 2), will be put in the WHATs room of the HOQ as they are related to the customer satisfaction while two Indifference attributes will be

dismissed as improving these attributes would not affect the customer satisfaction.

Further, 100 panelists were asked to rate the importance level of the attributes as well as evaluate the performance of each sample. The importance level result will be put in the weight relative section of the WHATs room showing that not all attributes are equally important for customers. On the other side, the performance evaluation of 4 samples is placed on the benchmarking section of the HOQ. Table 3 represents the summary of importance level and performance measurement from 100 panelists. As seen in Table 3, among the ten attributes, customers consider Q₁ (intrinsic attribute related to taste of brownies) as the most important with relative weight 12%. Meanwhile sample B (competitor product) has better performance than the developed product (sample A) in all quality attributes criteria.

Defining Technical Aspects (HOWs)

The consumers' quality attributes in Table 3 are translated into technical aspects that are measurable or executable and put in HOWs' room. From literature searching and focus group discussion, technical factors that are related to the consumers quality attributes were defined and put in instrument analysis section in HOWs room. They are: mixing sequence of materials (X₁), stirring time of egg and sugar (X₂), composition of materials (X₃), quality of main raw materials (X₄), steaming time (X₅), steaming temperature (X₆), and steaming equipment design (X₇). Meanwhile, using 15 trained panelists, the sensory quality attributes of brownies that are related to the intrinsic quality (Q₁, Q₂ and Q₃) were defined and compared as seen in Table 4.

As seen in Table 4, panelists evaluate that the developed brownie (sample A) is like sample B in term of chocolate burnt taste, chocolate paste aroma and hardness. Meanwhile the intensity of sweet and bitter chocolate taste as well as the chocolate powder aroma of sample B is higher than sample A. Further, the panelist also perceived that sample A has more intense sweet taste and aroma compared to sample B. Since customers perceive sample B is outperformed sample A in all intrinsic attributes and the sensory characteristic could be the factors which are responsible for this, hence the sample A producer may need to improve the sensory characteristic of their product.

Table 1. Respondent demographic profile

No.	Categories	Remark	Percentage
1	Gender	Male	45
		Female	55
2	Age	17-20	27
		21-30	51
		31-40	22
3	Income (in million IDR)	<1	56
		1-2.5	36
		>2.5	8
4	Expenses per month (in million IDR)	<1	75
		1-2.5	23
		>2.5	2

The relationship between the intrinsic quality (Q₁-Q₃) in WHATs room and factors in HOWs room were determined through extensive literature and focus group discussion where the result can be seen in Figure 1. As presented by Figure 1, weight relative of HOWs that are related to the intrinsic quality is 63% while X₃, the composition of materials, contributes 9% followed by X₄ and X₆ which contribute 4%. It means that X₃ becomes the priority for improvement compare to other factors. As seen at the roof of Figure 1, modifying the composition would affect the sensory attributes (X₈-X₁₀ and X₁₂-X₁₆).

The superior performance of Sample B can be attributed to its balanced sweetness and higher intensity of cocoa aroma, which may result from optimized sugar-to-cocoa ratios and the use of higher-quality cocoa powder. In contrast, Sample A exhibited excessive sweetness and lower chocolate aroma, suggesting that reformulating with reduced sugar content and enhancing cocoa concentration could improve consumer acceptance. For example, as sweetness level of sample B is lower than

sample A, reducing sugar content in sample A formulations could be one way to improve the taste that perceived by customer. It means that, though X₃ only contributes 9% of weight relatives, successfully execute this factor may affect 29% of weight relative that belong to sensory analysis attributes (attributes X₈-X₁₀ and X₁₂-X₁₆). Further, X₃, X₁₈ and X₁₉ have strong relationship with Q₁ which is the attractive quality of Kano and is perceived as the most important attribute by customers. It means that successfully improving Q₁ could exponentially increase the customer satisfaction. Additionally, the smoother texture of Sample B may be related to differences in mixing sequence and steaming parameters that promote better aeration and crumb uniformity. These findings indicate that Sample A producers should adapt formulation strategies—such as adjusting sugar levels, improving ingredient quality, and refining processing conditions—while avoiding excessive sweetness that can reduce consumer preference.

Table 2. Kano categorization for each quality attribute

Code	List of quality attributes	A	O	I	M	R	Q	Total	Category
Q ₁	balance taste of sweet-chocolate combined	18	1	7	0	2	7	35	A
Q ₂	aroma of sweet-chocolate combined	9	3	14	1	1	7	35	O
Q ₃	soft and smooth texture	9	0	19	1	0	6	35	O
Q ₄	fresh appearance within the display period	7	4	6	0	3	15	35	I
Q ₅	additional information on package (e.g. social media, tagline, and storage suggestion)	15	4	9	0	1	6	35	A
Q ₆	information on packaging following the standard required by Indonesian FDA	6	3	14	2	1	9	35	O
Q ₇	packaging's ability to protect the product	7	4	6	0	3	15	35	O
Q ₈	unique design of packaging (handy and eye catching)	10	2	16	0	1	6	35	O
Q ₉	non-sticky material product wrapping	1	2	1	11	1	19	35	I
Q ₁₀	trustworthy label claims	3	5	20	0	1	6	35	O
Q ₁₁	product brand image	12	2	16	0	1	4	35	O
Q ₁₂	product is easy to find	11	1	18	1	0	4	35	O

Table 3. The value of weight relative and performance

Type of the quality attributes	Code	Weight Relative		Performance*			
		core	percentage	A	B	C	D
Intrinsic	Q ₁	4.4	12%	3.93 ^b	4.42 ^a	2.97 ^c	3.26 ^d
	Q ₂	3.5	9%	3.63 ^b	4.27 ^a	3.16 ^c	3.11 ^c
	Q ₃	4.34	11%	3.97 ^b	4.47 ^a	3.75 ^{bc}	3.63 ^c
Extrinsic	Q ₅	3.38	9%	4.25 ^b	4.49 ^a	2.77 ^c	2.75 ^c
	Q ₆	4.18	11%	3.96 ^b	4.31 ^a	2.72 ^c	3.16 ^d
	Q ₇	4.12	11%	4.09 ^b	4.34 ^a	3.67 ^c	3.84 ^c
	Q ₈	3.4	9%	4.19 ^b	4.67 ^a	3.31 ^c	3.41 ^c
	Q ₁₀	4	10%	4.04 ^b	4.32 ^a	3.22 ^c	3.37 ^c
	Q ₁₁	3.56	9%	4.07 ^b	4.67 ^a	3.27 ^c	3.35 ^c
	Q ₁₂	3.26	9%	4.21 ^b	4.59 ^a	3 ^c	3.23 ^c

*Values in rows followed by the different letters indicate that they are significantly different based on the DMRT at 5% significance level

Table 4. Sensory characteristics of brownie sample

Sample of Brownies	The intensity of Taste*				The intensity of Aroma*			The intensity of Texture*	
	sweet (X ₈)	sweet chocolate (X ₉)	bitter chocolate (X ₁₀)	burnt chocolate (X ₁₁)	sweet (X ₁₂)	chocolate powder (X ₁₃)	chocolate paste (X ₁₄)	hardness (X ₁₅)	smoothness (X ₁₆)**
A	7,92 ± 0,98 ^c	7,85 ± 1,14 ^c	4,12 ± 1,39 ^c	1,18 ± 0,78 ^b	6,64 ± 1,21 ^c	4,43 ± 1,01 ^b	6,38 ± 0,98 ^b	4,16 ± 1,36 ^a	3,65 ± 1,00 ^b
B	6,88 ± 1,46 ^b	9,64 ± 1,49 ^d	6,29 ± 1,18 ^d	1,42 ± 0,78 ^b	4,99 ± 1,31 ^b	8,46 ± 1,03 ^d	5,73 ± 1,11 ^b	3,22 ± 1,17 ^a	2,73 ± 1,18 ^a
C	5,74 ± 1,24 ^a	4,32 ± 1,37 ^a	0,85 ± 0,38 ^a	0,00 ± 0,00 ^a	5,53 ± 1,30 ^b	2,05 ± 0,89 ^a	7,80 ± 1,03 ^c	9,63 ± 1,39 ^c	8,38 ± 1,14 ^d
D	5,76 ± 1,17 ^a	6,61 ± 1,61 ^b	1,69 ± 1,18 ^b	2,21 ± 1,10 ^c	2,28 ± 1,01 ^a	6,53 ± 1,06 ^c	3,42 ± 1,04 ^a	5,39 ± 1,41 ^b	5,85 ± 1,11 ^c

*Values in columns followed by the different letters indicate that they are significantly different based on the DMRT at 5% significance level

**The higher values represent the more intense attributes were detected by trained panels

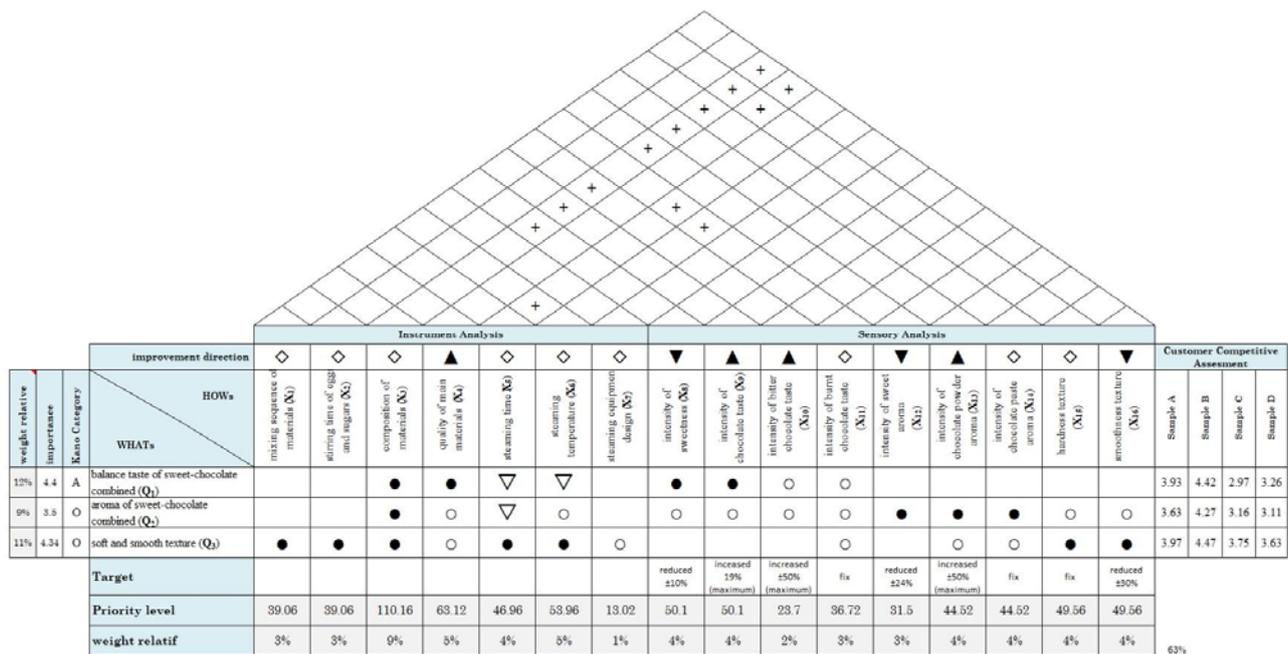


Figure 1. House of quality matrix of intrinsic quality attributes

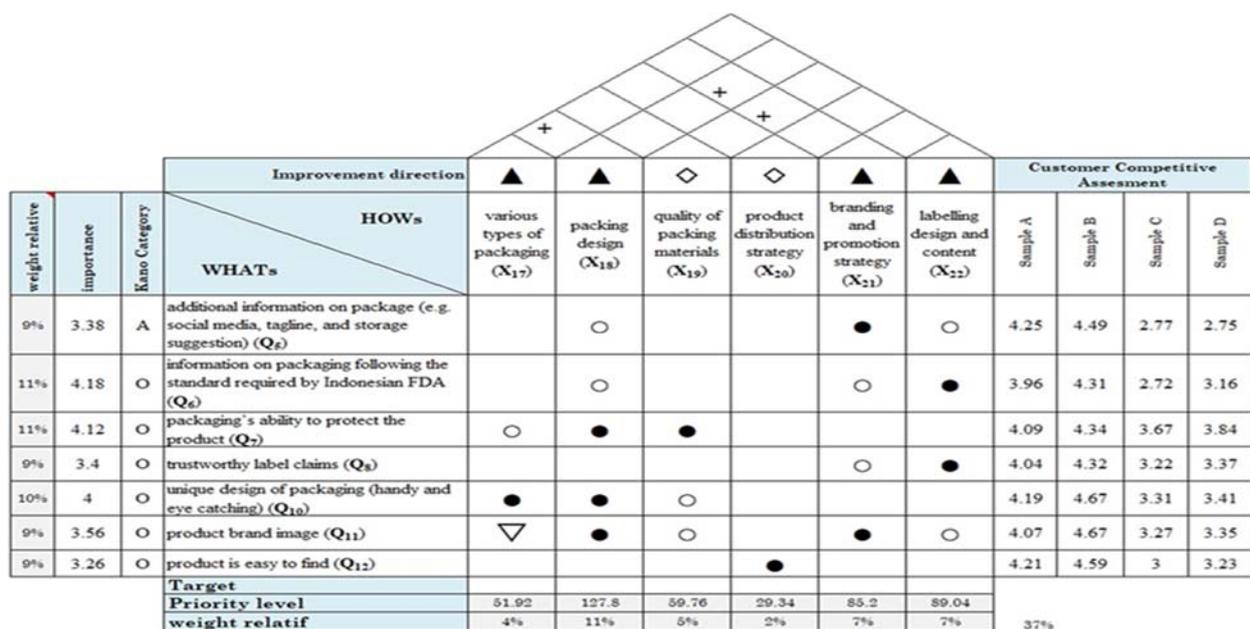


Figure 2. House of quality matrix of extrinsic quality attributes

Moreover, using the same approach, factors in WHATs room that are related to the external quality attributes were identified. They are: various types of packaging (X17), packing design (X18), quality of packing materials (X19), product distribution strategy (X20), branding and promotion strategy (X21), and labelling design and content (X22). The relationship between the intrinsic quality (Q5-Q12) in WHATs room and factors in HOWs room were determined through extensive literature and focus group discussion where the result can be seen in Figure 2. As seen in Figure 2, packing design (X18) contributes 11% in weight relatives for HOWs attributes that are related to extrinsic quality. It is followed by branding and promotion strategy (X21) and labelling design and content (X22). Since WHATs attributes of sample B that have strong relationship to X18 also outperform sample A, producers of sample A could learn from sample B packing design to improve Q7, Q10 and Q11 of sample A. Q7, Q10 and Q11 are categorized as one-dimensional attributes in Kano, hence successfully improving the performance of those attributes could linearly increase the customer satisfaction on sample A

CONCLUSION

This study demonstrates that integrating the Kano model and Quantitative Descriptive Analysis (QDA) into the Quality Function Deployment (QFD) framework enhances its utility for food product development. Among the twelve quality attributes identified, two were categorized as Attractive, eight as One-dimensional, and two as Indifferent based on consumer perceptions. Sensory profiling revealed that competitor products outperformed the developed brownie sample in key intrinsic attributes such as taste, aroma, and texture.

The House of Quality (HOQ) analysis indicated that the most critical areas for improvement were ingredient composition and packaging design. More specifically, reducing sugar levels, increasing cocoa content, and improving mixing/steaming parameters are recommended to achieve a taste and texture profile closer to consumer preference. On the extrinsic side, adopting more innovative and informative packaging design—such as clearer labeling, attractive visuals, and functional packaging materials—could further enhance consumer satisfaction and brand perception.

Beyond practical implications, this study contributes methodologically by demonstrating how the integration of Kano and QDA into QFD overcomes the limitations of conventional QFD, which often treats all consumer attributes equally and lacks measurable links to sensory characteristics. By explicitly distinguishing attributes based on their impact on satisfaction (via Kano) and linking them with sensory measures (via QDA), this approach provides a more accurate prioritization and actionable guidance for food product developers. Future studies could apply this model to other food categories or scale it up in industrial contexts to validate its broader applicability.

ACKNOWLEDGMENT

This research was funded by Universitas Sebelas Maret through the Group Research Grant Scheme under contract number 228/UN27.22/PT.01.03/2023

DAFTAR PUSTAKA

- Ali, M., Gupta, H., & Kumar, S. (2022). Integration of multi-criteria decision-making approaches adapted for quality function deployment: An analytical literature review and future research agenda. *International Journal of Quality & Reliability Management*, 39(9), 2025–2051.
- Assemay Talgatkyzy & Rakymkulkyzy (2025). Application of The Quality Function Deployment (QFD) Method in The Development of Instant Functional Beverages. *International Journal of Environmental Sciences*, 497-502. <https://doi.org/10.64252/2rzncj42>
- Cullano, R. A., Tiu, A. M., Evangelista, S. S., & Ocampo, L. (2025). Informing Starch-Based Food Product Designs With Seaweeds Using an Analytical Kano-Quality Function Deployment Model. *Journal of texture studies*, 56(2), e70007. <https://doi.org/10.1111/jtxs.70007>
- De Pelsmaecker, S., Gellynck, X., Delbaere, C., Declercq, N., & Dewettinck, K. (2015). Consumer-driven product development and improvement combined with sensory analysis: A case-study for European filled chocolates. *Food Quality and Preference*, 41, 20–29. <https://doi.org/10.1016/j.foodqual.2014.10.009>
- Dewi, S. K., Putri, A. R. C., & Rahmawatie, L. (2020). The Implementation of Quality Function Deployment (QFD) Method to Improve Pasteurized Milk Product Quality. *Industria: Jurnal Teknologi Dan Manajemen Agroindustri*, 9(1), 64–72. <https://doi.org/10.21776/ub.industria.2020.009.01.8>
- Dijksterhuis, G. (2016). New product failure: Five potential sources discussed. *Trends in Food Science and Technology*, 50, 243–248. <https://doi.org/10.1016/j.tifs.2016.01.016>
- Effendi, M., Arifa, L. mei, & Mustaniroh, S. . (2018). Pengembangan Jenang dengan Metode Fuzzy Mas'ud Effendi et al Mas'ud Effendi et al Pengembangan Jenang dengan Metode Fuzzy. *Jurnal Teknologi & Industri Hasil Pertanian*, 23(1), 1–12.
- Haroglu, H., & Leblebici, C. (2021). An approach integrating Kano model and fuzzy logic into the planning matrix of quality function deployment: An application for the design of a baby diaper. *Academic Platform Journal of Engineering and Science*, 9(1), 65–73
- Hidayat, K., Mu'tamar, M. F. F., Firmansyah, R. A., & Illahi, W. (2019). Instant Corn Rice Product Development. *Jurnal Teknik Industri*, 20(2), 13. <https://doi.org/10.22219/jtiumm.vol20.no2.13-23>
- Indraswari, S., Fauza, G., Prasetyo, H., Ariviani, S., Muhammad, D. R. A., & Affandi, D. R. (2024). The quality function deployment (QFD) as a strategy for food product development: A case study in chocolate drinks. *AIP Conference Proceedings*, 2838(1), 020005. <https://doi.org/10.1063/5.0189492>.
- Izzhati, D. N., Talitha, T., & Mastriswadi, H. (2018). Identifikasi Kebutuhan Pelanggan Terhadap Ikan Asap (Smoked Fish) Dengan Menggunakan Quality Function Deployment. *Jurnal Ilmiah Teknik Industri*, 17(1), 36. <https://doi.org/10.23917/jiti.v17i1.5203>
- Jreissata, M., & Makatsoris, C. (2021). Towards consumer driven food new product development: a closed-loop platform. *International Journal of Computer Integrated Manufacturing*, 35(2), 183–202.

- Kartini, I. M., Mardawati, E., & Pujiyanto, T. (2023). Perancangan Desain Kemasan Black Garlic Honey dengan Metode Quality Function Deployment (QFD). *Teknotan*, 17(1), 1. <https://doi.org/10.24198/jt.vol17n1.1>
- Kowalska, M., Pazdzior, M., & Krzton-Maziopa, A. (2018a). Erratum to: Implementation of QFD method in quality analysis of confectionery products (Journal of Intelligent Manufacturing, (2018), 29, 2, (439-447), 10.1007/s10845-015-1120-y). *Journal of Intelligent Manufacturing*, 29(2), 449–450. <https://doi.org/10.1007/s10845-015-1131-8>
- Kowalska, M., Pazdzior, M., & Krzton-Maziopa, A. (2018b). Implementation of QFD method in quality analysis of confectionery products. *Journal of Intelligent Manufacturing*, 29(2), 439–447. <https://doi.org/10.1007/s10845-015-1120-y>
- Lukman, M., & Wulandari, W. (2018). Peningkatan Kualitas Produk Cokelat Dengan Integrasi Metode Kano Dan QFD. *Jurnal Teknik Industri*, 19(2), 190. <https://doi.org/10.22219/jtiumm.vol19.no2.190-204>
- Mardiana, Fauza, G., Muhammad, D. R. A., Affandi, D. R., & Ariviani, S. (2021). Sensory profile analysis of steamed brownies using Quantitative Descriptive Analysis (QDA). *IOP Conference Series: Earth and Environmental Science*, 828(1). <https://doi.org/10.1088/1755-1315/828/1/012058>
- Mela, E., & Wijonarko, G. (2020). Pengembangan Produk Minuman Jelly Nira Kelapa dengan Quality Function Deployment [Coconut Sap Jelly Drink Product Development with Quality Function Deployment]. *Buletin Palma*, 21(1), 1. <https://doi.org/10.21082/bp.v21n1.2020.1-10>
- Naspetti, S., Alberti, F., & Solfanelli, F. (2015). Quality function deployment in the organic animal food sector: Application to poultry meat. *Italian Journal of Animal Science*, 14(3), 544–550. <https://doi.org/10.4081/IJAS.2015.4050>
- Pulungan, M. H., Hastari, L. D., & Dewi, I. A. (2019). Perbaikan Desain Kemasan Produk Biskuit Brownies Menggunakan Metode Quality Function Deployment (QFD). *Jurnal Teknotan*, 13(2), 39. <https://doi.org/10.24198/jt.vol13n2.2>
- Purba, H. H., Syamsul Maarif, M., Yuliasih, I., & Hermawan, A. (2018). Product development of chocolate with quality function deployment approach: A case study in SMEs chocolate industry in Indonesia. *IOP Conference Series: Earth and Environmental Science*, 209(1). <https://doi.org/10.1088/1755-1315/209/1/012011>
- Ruiz-Capillas, C., Herrero, A. M., & Pintado, T. (2021). Sensory analysis and consumer research in new meat products development. *Foods*, 10(2), 429. <https://doi.org/10.3390/foods10020429>
- Sijtsema, S. & Snoek, H. M. (2023). Involving consumers in food product development: Perspectives on the application of circular food design. *Frontiers in Sustainable Food Systems*, 7, Article 1069278
- Suryaningrat, I. B., Amilia, W., Mayasari, F. R., & Rusdianto, A. S. (2020). Product Quality Analysis of Pia Edamame Using Quality Function Deployment Method. *Industria: Jurnal Teknologi Dan Manajemen Agroindustri*, 9(2), 109–118. <https://doi.org/10.21776/ub.industria.2020.009.02.4>
- Ummi, N., Ferdinant, P. F., S, A. I. M., & Gunawan, A. (2018). *Integration of Quality Function Deployment (QFD) and Fuzzy Theory Model for Improving Quality of Cassava Opak Chips*. 13(3), 309–317.
- Wang, T. Y., Hsiao, H. I., & Sung, W. C. (2019). Quality function deployment modified for the food industry: An example of a granola bar. *Food Science and Nutrition*, 7(5), 1746–1753. <https://doi.org/10.1002/fsn3.1014>
- Wimarmaya, V. W., Fauza, G., Prasetyo, H., Muhammad, D. R. A., Affandi, D. R., & Ariviani, S. (2021). Analysis of Customer Needs for Food Products Using Kano Model, A Case Study of Steamed Brownies. *IOP Conference Series: Earth and Environmental Science*, 828(1), 012057. <https://doi.org/10.1088/1755-1315/828/1/012057>

Halaman ini sengaja dikosongkan