

Implementing Design Thinking For Beverage Product Design

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Abstract

Product design needs to grasp the customer needs and realized it through a product to achieve customer satisfaction. As the small business often not knowing why their products are not achieve good sales number in the market, is because of the low customer satisfaction. Therefore, this research of Implementing Design Thinking for Beverage Product Design to be a reference and guide for product design specially beverage products. Using the Design Thinking as the framework of thinking, using the Kano Model and QFD as the tools to grab the customer needs and realize it through the beverage prototype to find customer needs and has a good sale value. The purpose of this research as the reference on how the small entrepreneur design their product, so it could be accepted by the market and get the business profits from their activities. Kano Model and QFD were used as tools in the design thinking framework in this research. The results shown that fruit taste and toppings (nata de coco/jelly/chia seeds) serve as attractive category, and cold serving as the must-be attributes. The prototype produced from this research, got an average score of 4.2/5 maximum scale and a potential 34% of gross profits if it was sold by the price sale value from the respondents. Implementing design thinking as the framework, helps Kano Model define the important attributes and implementing it with QFD to produce a product with high customer satisfaction and make it profitable.

Keywords: Design Thinking, Product Design, Kano Model, QFD.

1. INTRODUCTION

Competition in business cannot be avoided, therefore entrepreneur had to be able to understand the customer needs and fulfilled them to achieve customer satisfaction to win the competition. It is said to be one of the key success factors to be competitive on the market [1]. Therefore, it is necessary for entrepreneur to know and use the best method to understand customers need.

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What customer wants/needs was known as voice of customer, need to be identified as a group of customer requirement. Since not all of customers can express the desired product that he/she wants, it is necessary to use a technique to identify the relevant customer requirement. One of the effective methods is Kano Model in categorizing customer requirements [2].

Kano Model categorize the customer needs into Must-Be, Attractive, One Dimensional, Indifferent for reversal. The attributes defined as attractive and one dimensional could increase the customer satisfaction to the higher level. Although Kano Model can identify what customer needs to achieve customer satisfaction, the identified attribute needs to be realized. The method which is widely used for this is *QFD*. It is said to be the most suitable method in terms of realize the identified customer needs to the engineering characteristic [3].

The powerful tools can be an optimal usage, if utilized by the optimum framework of thinking. One of the known frameworks are Design Thinking. It can solve problems faster and accurately because it is analyzing the actual conditions, take a picture from various point of view, utilize the correct tools/instrument to create an idea, and apply the idea to the actual condition, to achieve the suitable solution in problem solving. The *design thinking* contributes on how we are interacting with computer, on the health services, and how the banking activities could be done from anywhere [4].

From this research, we want to define, what attributes that is important on this type of beverage. Also produce the beverage prototype which can be sold to the market and give profits for business/entrepreneurships.

2. LITERATURE REVIEW

2.1. Design Thinking

Design Thinking consists of 5 stages: Empathize, Define, Ideate, Prototype, and Test as shown in Figure 1.

The first stages of **Empathize**: go on site to feel and know the issues and define what is needed to solve. Second is **Define**: identify and define what customer needs from various point of view. Third step is **Ideate**: generates the idea based on what is needed on the Define stages. Fourth stage is **Prototype**: realizing the idea through prototype so the idea can be visualized and get feedbacks to improve. Fifth/Final stage are **Test**: the prototype tested on the real condition and find how it is performed [4].

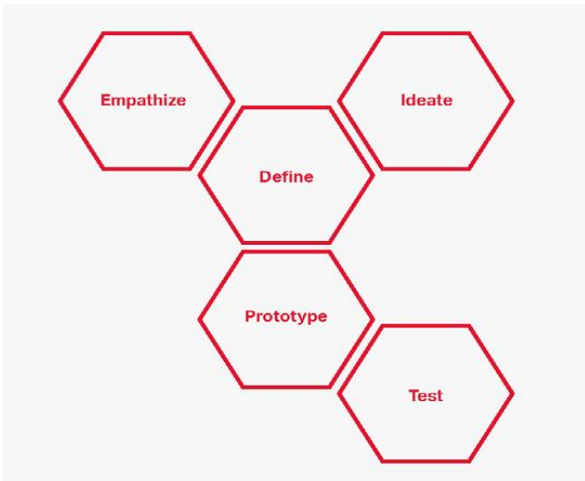


Figure 1. Stage of Design Thinking [4].

2.2. Kano Model

Kano Model can define the attribute of customer need as Attractive (A), One Dimensional(O), Must-Be(M), Indifferent (I), Questionable(Q), and Reversal (R). Kano models define the attribute by analyze the questionnaire which consist of functional dan dysfunctional questions. The response for the questionnaire is set to have a scale in each question function which consist of answer Like, Must, Neutral, Can live with it, or Dislike [1].

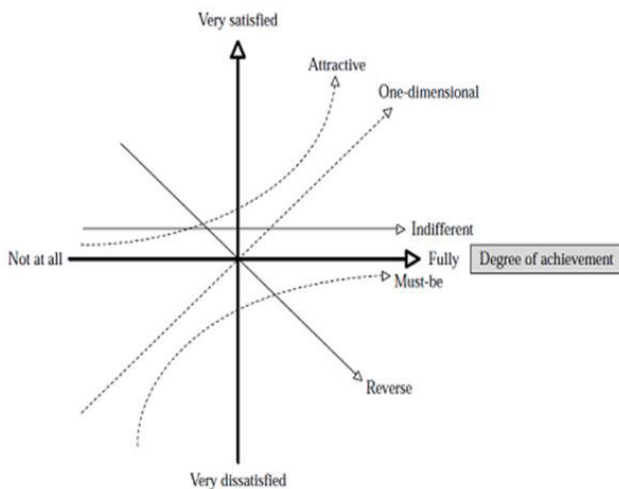


Figure 2. Kano Model [1].

The Kano Evaluation Matrix is shown on Table 1.

Attribute category:

- A: and O: added high customer satisfaction level if been fulfilled.
- M: needed to be complete as standard,
- I: not increase or decrease the satisfaction if being fulfilled.

After the attributes defined from respondents, use the Blauth formula to define what is the attribute relusts from

respondents [5] it is defined with 3 conditions:

- If the $O + A + M$ is $>$ than the $I + R + Q$, then choose the highest amount from (O/A/M).
- If the $O + A + M$ is $<$ than the $I + R + Q$, then choose the highest amount from (I/R/Q).
- If the $O + A + M$ is $= I + R + Q$, then choose the highest amount from (O/A/M/I/R/Q).

Table 1. Kano Evaluation Matrix [1].

Customer (Users) Requirements		Dysfunctional (Negative)				
		Like	Must	Neutral	Can live with it	Dislike
Functional (Positive)	Like	Q	A	A	A	O
	Must	R	I	I	I	M
	Neutral	R	I	I	I	M
	Can live with it	R	I	I	I	M
	Dislike	R	R	R	R	Q

2.3. Quality Function Deployment (QFD)

QFD was developed by Yoji Akao and Shigeru Mizuno (*late*) from Japan and were known worldwide as the effective methods for developing product and process [6]. From [7], explained that QFD process are make a house of quality that runs in steps of:

- Identify the Customer Requirement (CR)
- Identify the product and the Engineering Characteristic (EC)
- Make the relations of the Engineering Characteristics (EC)
- Make an order/prioritized from the Customer Requirement (CR).
- Compare the Engineering Characteristic and made a specifications comparison with the competitor.
- Make a correlation matrix of Engineering Characteristics can affect the Customer Requirements, using symbols (shown in Table 2).
- Make prioritize order from Engineering Characteristic base on response to the Customer Requirement.
- Make a comparison with competitor for the performance of the product/process.

As the result, House of Quality are shown in Figure 3.

Table 2. QFD Relation Symbol Matrix. [6]

Symbol	Score	Relation
(blanks)	0	Unrelated
▽	1	Weak
○	3	Moderate
●	9	Strong

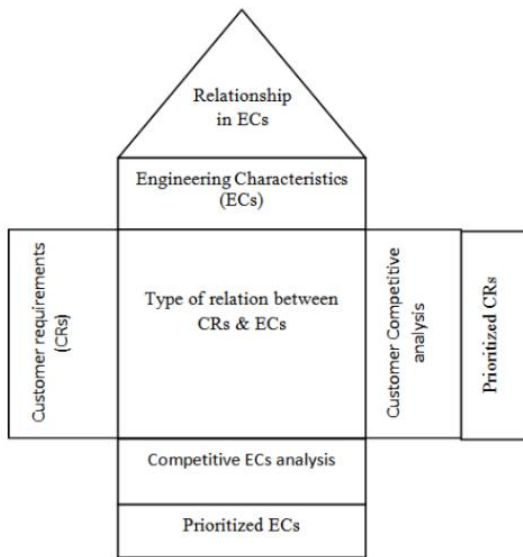


Figure 3. House of Quality in QFD [8].

2.4. Integration of Kano – QFD

Use of Kano Model on identifying Voice of Customer, made as an input to the QFD on making the House of Quality. The integration of Kano and QFD helps the designer to make sure the customer requirements are identified and conducted in the research. For the easier explanations, [9] made an integrative framework shown in Figure 4.

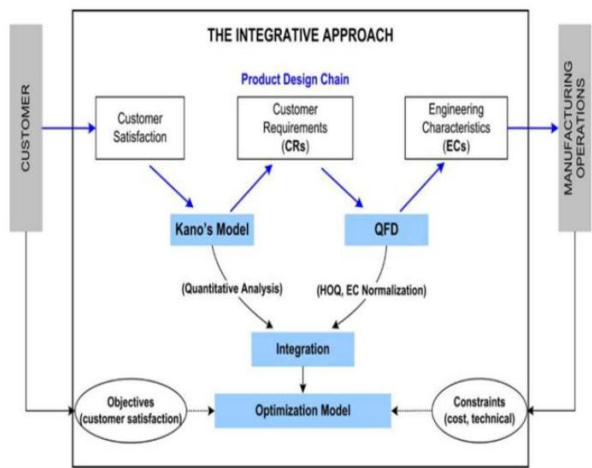


Figure 4. Integrative Framework for QFD and Kano Model. [9]

3. METHODOLOGY

This research using Design Thinking as the framework, so the flow diagram of the research was made to understand what steps by Design Thinking are used in the Research Steps, as shown in Figure 5.

3.1. Research Steps (Flow)

As shown in **Figure 5**, the framework was adapted from Design Thinking process. As the interview, conducting the necessary attribute for the soft drink emphasize what the respondents think of the beverage. Attribute comes from Result of the interview, then used as the source to build the Kano Questionnaire. It is the step when define the attributes.

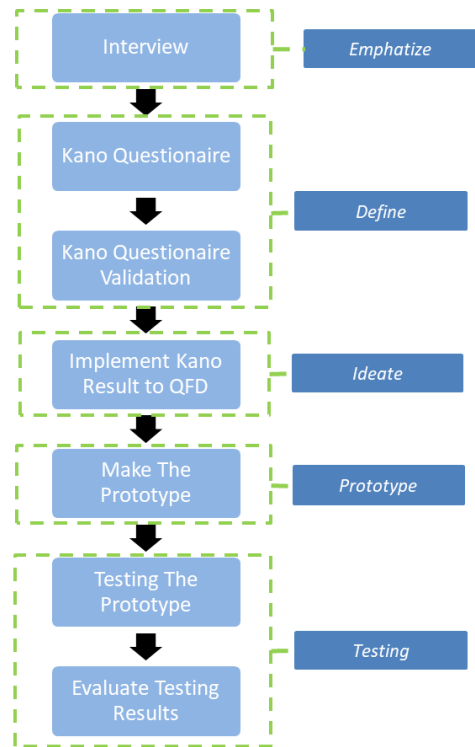


Figure 5. The Research Framework

After using a questionnaire, validation of the questionnaire also necessary, therefore the data we are using is a valid data. After the questionnaire stated valid (have Cronbach alpha $>0,7$ and the Pearson Correlation from questionnaire $>$ Pearson Correlation from table), we grab the Attractive, One Dimensional, and Must-Be attributes to be the customer requirement for QFD. The process is generating idea of how to match the customer requirement.

As the QFD are done, the next process is making the prototype which has the attributes (Attractive/Must Be/One Dimensional) from the customer requirement. After the prototype were made, we conduct a test and have all the respondents of their opinions about the prototype trough a questionnaire. After all the answers were collected, evaluation from the results is made.

3.2. Research Design

As for the section 3.1. explain about the flow process, on this point, will give the design of the research, to whom we deliver the questionnaire, how many respondents we are using, what is their age, their job, etc. This was important, because for the business, you need to state which market you are aiming for and made the right product to sell.

In this research, totals of 3 Questionnaires were distributed along the total of respondents of each Questionnaire are shown in Table 3.

Table 3. Research Design

No.	Criteria	Information
1	Age	20-35 years old
2	Gender	Men/Women
3	Jobs	Student/General employees/Entrepreneur/Freelance/etc.
4	Interview Respondents	15 Men and 15 Woman
5	Kano Questionnaire	100 Respondents
6	Sample Testing & Importance level	30 Respondents
7	Prototype Test	30 Respondents

4. RESULTS

4.1. Interview Results

The interview was conducted with respondent criteria shown in Table 4. The interview consists of 3 minutes for each respondent. From the results are chosen, which is appear > 2 times, As the results are shown in Table 5.

Table 4. Interview Results

No.	Answers	f
1	Cold Servings	30
2	Have Toppings (jelly/nata de coco)	13
3	Fruit Flavor (passion fruit/lemon)	14
4	Added real fruit chunks	5
5	Have a tea flavor mix	5
6	Have an attractive colors	4

The most frequent item came out is Cold Serving the beverages. The second and third appear the most are Toppings and Fruit Taste. With all the respondents said want cold serving, so it is defined as Must-Be attribute on the fermented milk soft drinks.

4.2. Kano Questionnaire

As the cold serving defined as the must be attribute, so there are 5 items left to be tested by Kano Questionnaire. In Kano Questionnaire, each item was divided into 2 questions, which consist of functional and dysfunctional question. Therefore, in totals, there are 10 questions for each respondent. The questionnaire was distributed via WhatsApp and social media private messages. Respondents consist of 56 Man and 44 Woman, it is found, that dominant respondents (59 peoples) were 24-25 years old and most of the respondents, 67 peoples are General employees. The results are shown in Table 5 with the result column was defined with Blauth formula.

Table 5. Kano Questionnaire Results

Item	A	M	O	OAM	I	R	Q	IRQ	Result
Topping	46	4	5	55	19	26	0	45	A
Fruit Chunks	38	1	9	48	37	15	0	52	I
Fruit Flavor	54	4	8	66	22	12	0	34	A
Tea Flavor	23	2	9	34	25	41	0	66	R
Attractive Colors	27	2	7	36	51	11	2	64	I

Topping and Fruit flavor become the Attractive attribute, so if they were fulfilled, it will give a higher customer satisfaction. For the fruit chunks and attractive colors are Indifferent attributes, so they will not have any effects, either they were fulfilled or not. Therefore, there is no need to develop attractive colors or adding fruit chunks to the beverage for cost reduction. It is also found that tea flavor is reversal attribute, it was predicted that 24-25 years old respondent taste didn't match when fermented milk soft drinks have a tea flavor. Therefore, only 3 attributes defined as customer requirements.

4.3. Sample and Importance Level Testing

After it is defined by the Kano questionnaire results in section 4.2, topping and fruit taste as attractive and the cold serving as the must-be attribute, 3 samples were made with the fulfillment of 3 attributes and packed in a 250ml PET Bottle. The flavor of passion fruit was chosen against lemon, because considering it will not trigger the gastric pain. The fulfillment was differentiated among them as shown in Table 6, and Sample on Figure 6.

Table 6. 3 Sample Differentiation

Material	#1 Sample	#2 Sample	#3 Sample
Syrup:water	1:10	1:10	1:3,33
Yakult (ml)	65	65	65
Nata de doco (g)	10	0	15
Chia Seed (g)	10	15	15
Fruit Jelly (g)	10	15	0



Figure 6. The 3 Beverage Samples

Total of 30 respondents were contributed to this testing, which is dominant by 24 – 25 years old (18 peoples). As for the results score and importance level are shown in Table 7.

Table 7. Sample and Importance Level Questionnaire Results

Attribute	#1	#2	#3	Importance level
Taste	3.83	3.83	2.07	3.93
Topping	3.30	2.67	2.83	3.27
Cold Serving	4.17	4.17	4.17	4.33

In Table 7, shown the average score of the samples. The #1 sample get the highest scores of tastes and topping. It was analyzed as the #1 sample come with most variant toppings, and for the taste, it has the right ratio of water and fruit syrup to make fruit flavor on the beverage, therefore the score of taste is the same with sample #2. From topping, were seen that nata de coco produces slightly higher score than the one with fruit jelly, it's predicted because the respondents preferred nata de coco. From this sample testing, #1 sample compositions of water and syrup ratio and toppings were chosen as the best ratio.

4.4. Integrating Kano to QFD

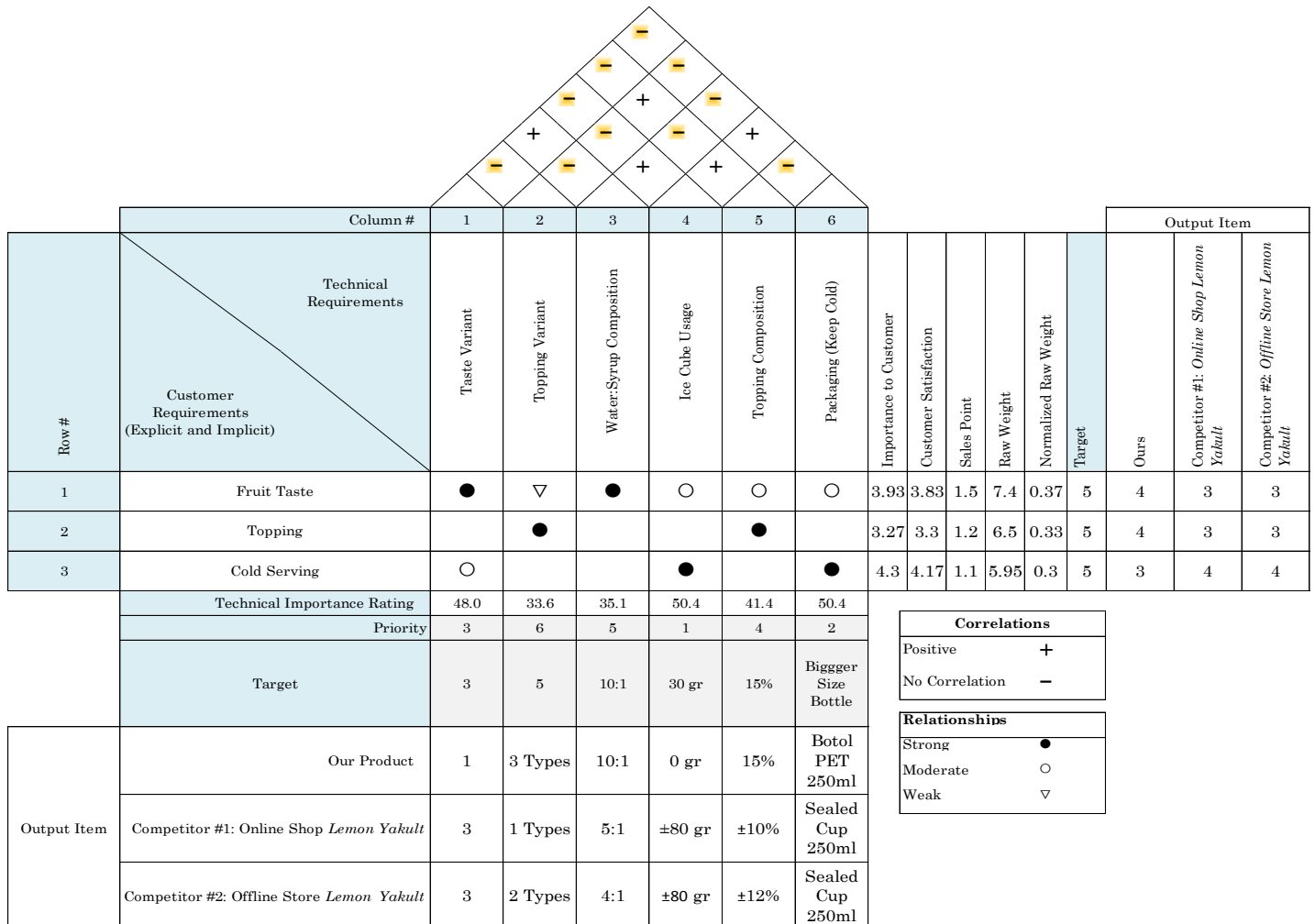


Figure 7. House of Quality

As the #1 sample had been chosen as the representative, it is time to start the QFD and make the House of Quality. The process consists of define the customer requirement, make the planning matrix, and the technical response.

Customer Requirements was defined by results of the Kano Model, it is the topping, fruit flavor and cold servings. Next step is defining the technical requirement to achieve the customer requirement. After that, it is needed to define

Planning Matrix calculate the fill the importance rating, performance, and average performance rating as the results from Table 7 and the score that appear the most from 3 sample testing questionnaire. After that, defined the Goal/Target score of each attribute and find the improvement and normalized improvement ratio on each of them. After that, define the selling point score by brainstorming and discussion on the teams, calculate raw weight and normalized raw weight. Now you are complete the planning matrix, continue to **Technical Response** by putting the symbol on Table 3 into the relation board of each technical requirement with the customer requirement and the others technical requirement itself. After that, define the importance rating of technical requirement and give the priority. The process almost done, as the last step, put the competitor as a comparison with the products. All the steps are made, the House of Quality shown as the results in Figure 7.

From the Figure 7 it is shown that fruit taste has the highest raw weight. This indicates that improvement on fruit taste will have the biggest effort for improvement. As shown for the cold serving, it is lower and could become the improvement project as the score still lower than competitors. The results were in line with the priority of technical importance which priority is to improve the cold serving, using ice cube. As this also need testing again if adding the ice cube will change the taste.

4.5. Prototype Testing

After the prototype was being compared in the House of Quality with its competitor, it has been tested to the real condition as it was customer order. The prototype also got some addition with how it handles, it is pack with individual plastic straw inside a plastic zipper bag, so it is hygiene enough until it is arrived to the respondents upon the deliveries. As the prototype shown in figure 8.



Figure 8. Prototype Delivered to Respondents

The prototype also came with the stickers as the identity. For the information of the respondents, the prototype was

distributed to the 30 respondents and ask them to score the prototype with a questionnaire. Not only the score, also the questionnaire asked about the price value from the respondents after they try the drink. The results could be the parameters on what price range, the beverage would sell on the market. Also, the questionnaire asked them about what impression (strong point) they get from the prototype beverage and what's need to improve about the prototype.

Results from the prototype testing shown the score in the Table 8.

Table 8. Prototype Score Testing

Items	Avg Score
Taste	4.37
Match Topping	4.47
Topping Volume	3.97
Overall	4.2

Table 8 shown the highest score from the prototype was the Match Topping with the score of 4.47. It is indicated that the toppings which consist of nata de coco, fruit jelly, and chia seeds was a good combination with the soft drinks. By its overall score of 4.2/5, it is shown that this prototype performed well and still can be improve. The results score also shown the volume topping score at 3.97/5, this maybe because of too much topping from the volume of the beverages itself or need some more for some respondents. For questions of price value and how many times they will consume this beverage in a month, shown by the Figure 9 and Figure 10 respectively.

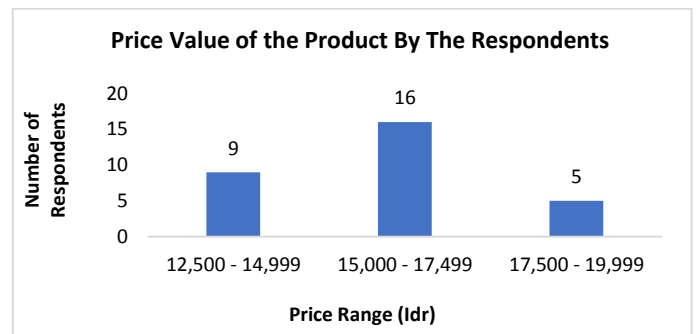


Figure 9. Product Price Value Results

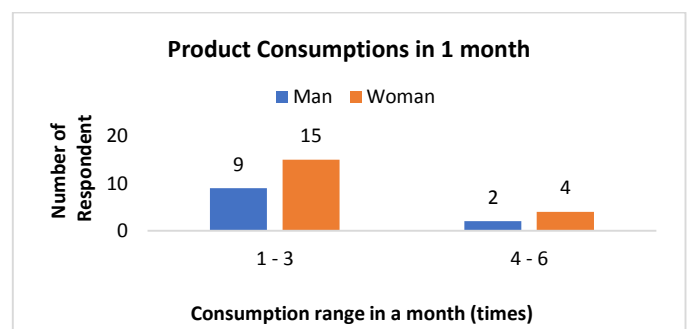


Figure 10. Potential Product Consumptions In 1 Month

As the Figure 9 shown, most of the respondent (16 respondents) said the product could have a price tag of Idr 15,000 – 17,499. The results of the price value were rated good, because in a comparison with the cost itself to produce 1 bottle of beverage, it needs Idr 9,800/bottle along with the straw and zipper plastic bags. Therefore, if the beverage were sold at the lowest price range (Idr 15,000), at least, it could get an Idr 5,200 (34.6%) as gross profits. By the dominants respondent age of 24(10), 25(3), and 28(5) and the profession of general employees shows that most of the respondents (24 peoples) will consume the beverage 1-3 times in a month. It is almost a cycle in a week repurchase and could be a good sign.

As for the Strong point of the product and suggestions from the respondents, shown in Table 9 and Table 10 respectively.

Table 9. Strong Point of The Product by Respondents

No.	Strong Point	<i>f</i>
1	Refreshing Taste	10
2	Strong Taste of Yakult	6
3	Unique and Anti Mainstream	5
4	Balance of Sweet and Sour Taste	5
5	Generous Topping Amount	3

As shown in Table 9, the prototype products top 5 strong points by the respondents. The most comments are the beverages gave them refreshing taste. It is said by the respondents as results of the mix of the drinks with passion fruit flavor, the topping combinations and the cold servings when consumes. As the results also said, this product had the unique point. The prototype products had an impression of a good refreshing taste.

Table 10. Suggestions from Respondents

No.	Suggestions	<i>f</i>
1	Flavour/taste variant	8
2	Bigger topping cut size	3
3	Can improve to be more refreshing	3
4	Others (besides taste, topping and cold servings)	18

Not all products were perfects, so based on the respondent preferences, they want to have a flavor/taste variant. Because the prototype only come with 1 flavor (passion fruits), they want it to choose and have the options when buying the beverage. Respondents also come with others comment that is not related with the attributes that were being developed in this research, so it could be the topic be the next improvement project.

5. CONCLUSION

5.1. Conclusion of the Research

As the results, findings in this research are as follows:

1. The items were identified are Fruit Flavor/Taste and Toppings (nata de coco/chia seeds/fruit jelly) as the **Attractive** attributes, cold serving as **Must-Be** attributes, gimmicks and attractive color as **Indifferent** attributes, and Tea Flavor as **Reversal** attributes.
2. It is found by the House of Quality, the prototype still had room for improvement on the cold serving, using the ice cubes or improvement on packaging that can keep the beverage cool longer.
3. Design Thinking helps by the frameworks, choosing one flavors to test, how the toppings are being cut, and create a hygiene delivery to the respondents.
4. The prototype beverage performs with the overall score from respondents a 4.2/5 with the impressions of having a refreshing taste.
5. The prototype had the potential selling value at the price range of Idr 15,000 – 17,499, with a potential of getting profits of Idr 5,200/Bottle when it uses the lower price tags of Idr 15,000.

From this research with the design thinking, it was found much easier to apply Kano Model and Integrate the Results to the QFD and testing it against the actual respondents. The results can be used to evaluate the prototype to be optimal in actual market condition.

5.2. Suggestion

From this research, authors suggest that next research to do:

1. Research about the Taste/Flavor Variant and Packaging of fermented milk soft drink beverages and arrange it.
2. Research the items of services of the product, such as market channels, delivery, and promotions about fermented milk soft drinks beverage.
3. Create the production method for serve the high product demands.

The suggestions are for completing the product design, hence after the research is done, the product is ready to sell and accommodate customer orders.

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