



## Innovation in Fish Cake Production: Proportions of Dory fish (*Zeus faber*) and Cassava (*Manihot esculenta*) with the Addition of Water Clover (*Marsilea crenata*)

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**Abstract Background:** This research is intended to increase national fish consumption, which is currently uneven, through the production of fish cakes using Dory fish and cassava as the main ingredients. This innovation aims to minimize production costs while enhancing the nutritional content of the fish cakes. **Purposes:** This research aims to develop an innovative fish cake product by utilizing John Dory (*Zeus faber*), cassava (*Manihot esculenta*), and the addition of water clover leaves (*Marsilea crenata*) as alternative ingredients that are both nutritious and economical. **Methods:** The research method employed is a true experimental design featuring three treatment proportions of John Dory and cassava—80%:20%, 70%:30%, and 60%:40%—with the addition of 50 grams of water clover to each treatment. **Result:** There were significant differences across all organoleptic aspects for each treatment. The best results were achieved with the proportion of 80% John Dory and 20% cassava, which received the highest scores in appearance (19.4), color (20.76), texture (22), aroma (21.2), and flavor (20.44).

**Conclusion:** The addition of cassava and water clover in the proper proportions can produce an innovative fish cake with good organoleptic quality and the potential to increase fish consumption among the public.

## INTRODUCTION

Currently, food developments in Indonesia are highly diverse and on the rise. However, alongside modern culinary trends, food has become more than just a consumable product; it has become a lifestyle for the community. This is evident from the increasing number of culinary businesses and innovations. In 2017, data from the Ministry of Industry showed that growth in the food and beverage industry reached 9.23%, compared to 8.46% in 2016 (Yasmin, 2018). The growth of the food industry increased again in the third quarter of 2022, reaching 3.57%, which was higher than the 3.49% recorded in 2021.

Based on food trends and data indicating low fish consumption on the island of Java, an innovation has been developed for a popular contemporary snack: the fish cake. Fish cake is a surimi derivative product made from minced fish meat with the addition of hydrocolloids and seasonings through several processing stages. This Korean snack is widely sold in various locations, ranging from street food stalls to restaurants and beyond.

Fish cakes are quite similar to *otak-otak*; the primary difference between the two lies in the use of coconut milk during the *otak-otak* production process. Fish cakes offer several variations, such as the inclusion of fillings like mozzarella or sausage. Typically, Spanish mackerel (*ikan tenggiri*) is used in the making of fish cakes due to its distinct and characteristic flavor.

There are various types of fish cakes, including kamaboko, chikuwa, odeng/eomuk, meatballs, sausages, fish *otak-otak*, *pempek*, and others. These processed foods originate from Asia. The most representative among soft products is the fish cake (Kwon & Lee, 2013).

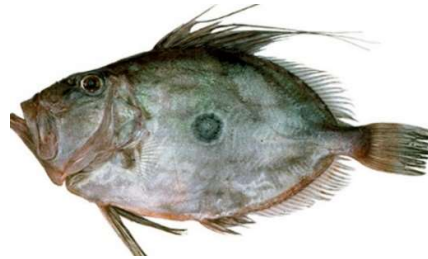
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In general, 'fish cake' is translated into Indonesian as *otak-otak ikan*. *Otak-otak* belongs to a group of fish products processed into meat paste. The fish is seasoned with various spices and shaped according to consumer preference, representing a variation of meatball and *kamaboko* products (Gusmanto et al., 2016; Nurjanah et al., 2005).

This innovation replaces the Spanish mackerel (*ikan tenggiri*) typically used in fish cake production with John Dory. According to research, John Dory contains unsaturated fatty acids (Omega-3) such as DHA and EPA, as well as iodine, iron, magnesium, taurine, selenium, fluoride, and more. Furthermore, John Dory contains antioxidants that protect unsaturated fats from oxidation both before and after digestion. The protein, vitamin, mineral, and Omega-3 fatty acid content provide beneficial effects for the eyes, heart, digestion, muscles, and brain development in toddlers.

This innovation utilizes a proportion of John Dory and cassava with the addition of water clover. The cassava is processed by grating and steaming, then mixed into the minced John Dory, followed by the addition of boiled water clover. This innovation aims to minimize production costs while enhancing the nutritional content of the fish cake. To determine the quality of this innovation, organoleptic tests and laboratory analyses will be conducted to assess its nutritional value.

Fish cake is a surimi derivative product made from minced fish meat with the addition of hydrocolloids and seasonings through several processing stages. Surimi is a fish myofibrillar protein obtained by filleting, washing, and stabilizing the minced fish meat (Satam, Sharangdhar, Sharangdhar, Sajid, & Sonawane, 2004; Yu et al., 2020).



**Figure 1.** Dory Fish

Dory fish is a type of saltwater fish. In the ocean, this fish can be described as an active predator.



**Gambar 2.** Singkong

Cassava, commonly known as *singkong* or *ubi kayu*, is a tropical and subtropical perennial tree from the *Euphorbiaceae* family.

This research is intended to increase national fish consumption, which is currently uneven. In 2021, according to data from the Ministry of Marine Affairs and Fisheries at [statistic.kkp.go.id](http://statistic.kkp.go.id), the Indonesian public consumed 56.16 kg/capita of fish. Based on culinary trends and data regarding the low consumption of fish on the island of Java, an innovation has been developed for a widely popular snack: the fish cake. Fish cake is a surimi derivative product made from

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minced fish meat with the addition of hydrocolloids and seasonings through several processing stages. This Korean snack is sold extensively in various locations, such as street food stalls, restaurants, and elsewhere.

**METODE**

The research method used by the author is the true experimental method. This study employs a Randomized Block Design (RBD) with three treatments. Within this design, the researcher is able to control all extraneous variables that may influence the course of the experiment.

This research was conducted at the Culinary Arts Laboratory, Vocational Program, State University of Surabaya. The implementation began in March 2023 and continued through January 2023. The following table details the research timeline and activities.

The ingredients for making the fish cake refer to existing fish *otak-otak* recipes; subsequently, a recipe conversion was performed to ensure identical quantities:

**Table 1.** Design of Standardized Recipe Test Materials

Bahan	Jumlah		
	Standar Recipe 1	Standar Recipe 2	Standar Recipe 3
Ikan tenggiri	300	300gr	-
Ikan dori	-	-	300gr
Tepung sagu	50	175gr	75gr
Santan kental	50ml	50ml	-
Kecap ikan	-	-	20gr
Putih telur	60gr	30gr	30gr
Garam	10gr	5gr	10gr
Gula pasir	10gr	15gr	15gr
Bawang putih	-	-	10
Bawang Bombay	-	-	60
Bawang merah	40gr	30gr	-
Kucai	Sek	-	-
Penyedap	-	-	5
Daun bawang	-	Sek	-
Baking powder	-	-	15

The recipes above will be tested, and the one yielding the best results will serve as the benchmark for creating the Innovation of Fish Cake Production based on John Dory (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) and Water Clover (*Marsilea crenata*).

The production of fish cakes requires various tools to be used during the cooking process. The following are the tools that will be utilized.

**Tabel 2.** Table of Equipment

No	Equipment Name	Amount	Specification
A.	Alat Persiapan		
1.	Timbangan	1	Digital
2.	Bowl	1	Kaca
3.	Tray bahan	1	Plastic
4.	Pisau	1	Stainless steel
5.	Cutting board	1	Plastic
6.	Gelas ukur	1	Plastic
7.	Sendok makan	2	Stainless steel
B.	Alat Pengolahan		
1.	Panci	1	Stainless steel
2.	Ladle	1	Stainless steel
3.	Blender	1	Plastic
4	Chopper	1	Plastic

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5	Papping bag	1	Plastic
C.	Kemasan		
1.	Plastic vacuum	1	Plastic

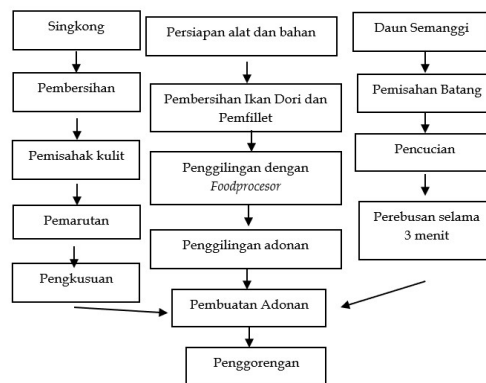
The production process for the Innovation of Fish Cake based on Dory fish (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) and Water Clover (*Marsilea crenata*) begins with the preparation of tools and materials. The next steps involve washing the fish, cleaning the entrails, and filleting the Dory fish.

Wash the water clover thoroughly before use. Boil the water clover for 5 minutes once the water has reached a rolling boil. Drain the water clover until dry.

The filleted Dory fish is then minced using a food processor along with the other batter ingredients. The mixing is performed gradually in the food processor and ground for approximately 5 minutes until the batter is evenly combined; then, set it aside.

The cassava to be used is first cleaned and then peeled. The cassava is then finely grated, placed into a steamer, and steamed for approximately 10 minutes.

The next step is to add the cooked grated cassava into the fish cake batter using a spatula until evenly combined. Transfer the mixture into a piping bag, then fry in hot oil. The following is the production flowchart for the Innovation of Fish Cake based on John Dory (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*).



**Figure 3.** fish cake making process

The experimental design trial structure was carried out as follows:

**Table 3.** Formulir Penelitian

Proportion (X1)	Addition (X2)	Organoleptic properties				
		R	A	W	B	T
80% and 20%	50 gr					
70% and 30%	50 gr					
60% and 40%	50 gr					

Keterangan:  
R: Flavor  
A: Aroma  
W: Color  
B: Shape  
T: Texture

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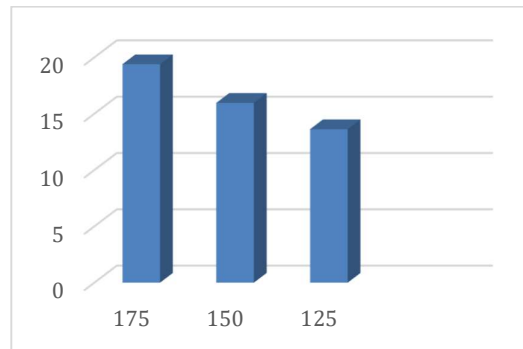
The data collection technique used is observation through questionnaires in the form of an instrument. This study utilizes a one-way ANOVA analysis.

**RESULT AND DISCUSSION**

The sensory quality test for the fish cake product was conducted by observing the samples. The resulting observation data were analyzed using SPSS version 26, followed by Duncan’s Multiple Range Test (DMRT). The analysis results are deemed accepted if the sig. value is >0.05 and not accepted if the sig. value is <0.05, indicating a significant effect or difference between variables. The purpose of the sensory quality test is to determine qualities including texture, taste, color, and aroma. The data were obtained from 30 respondents, consisting of 5 trained panelists and 25 semi-trained panelists.

Based on the sensory testing for shape, the production of fish cake based on Dory fish (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) yielded a highest average score of 19.4 and a lowest average of 13.63. The highest average was obtained from the 175 treatment, with a proportion of 80% Dory fish and 20% Cassava.

The lowest average was obtained from the 125 treatment, with a proportion of 60% John Dory and 40% Cassava. The average values for sensory quality can be seen in Figure 4.1 below.



**Gambar 4.** Shape Mean Value Diagram Fishcake

**Table 4.** Anova Result Shape

**ANOVA**

Shape					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	504.867	2	252.433	6.926	.002
Within Groups	3171.133	87	36.450		
Total	3676.000	89			

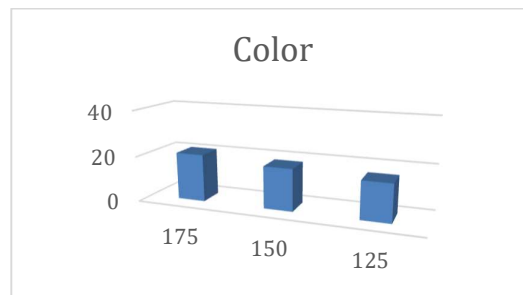
The results of the one-way ANOVA test in the table above indicate that there is a significant difference in the production of Fish Cake based on Dory fish (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) and Water Clover (*Marsilea crenata*). This is evidenced by the F-value of 6.926 with a significance level of <.001. Furthermore, to determine the effect of the proportions of Dory fish and Cassava, a Duncan’s test was conducted. The results of the Duncan’s test are presented in Table 4.2: Duncan’s Test on Fish Cake Shape with Proportions of Dory fish and Cassava.

**Table 5.** Duncan Test Result

Duncan <sup>a</sup>		Shape	
		Subset for alpha = 0.05	
Perlakuan	N	1	2
60:40	30	13.6333	
70:30	30	15.9667	
80:20	30		19.4000
Sig.		.138	1.000

Based on the Duncan’s test results above, it can be concluded that the shape of sample code 125, with a proportion of 60%:40%, differs significantly from sample codes 150 and 175. This indicates that the products with sample codes 150 and 175 meet the criteria for a square and neater shape, thus they are declared the best.

Based on the instrument, the 80:20 proportion yields a shape that tends to be square and neater compared to the 70:30 and 60:40 proportions. The 80:20 shape is able to maintain better neatness due to the higher protein content derived from the Dory fish compared to the other proportions.



**Figure 5.** Color Diagram Result

The data were then processed through a one-way ANOVA test to determine whether there is an effect on the fish cake. The results of the fish cake color ANOVA test are presented in Table 4.3 below

**Table 6.** Anova Color Test

Color	ANOVA				
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	282.756	2	141.378	3.827	.026
Within Groups	3213.700	87	36.939		
Total	3496.456	89			

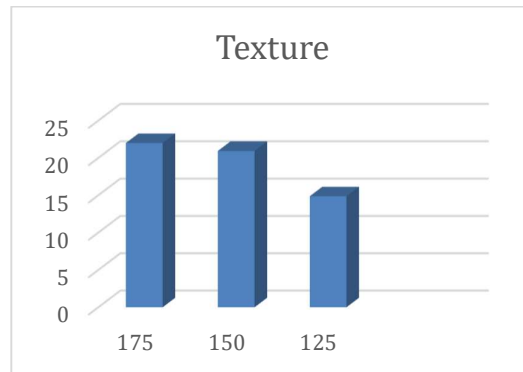
The results of the one-way ANOVA test in the table above indicate that there is a difference in the production of Fish Cake based on John Dory (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) and Water Clover (*Marsilea crenata*). This is demonstrated by an F-value of 3.827 with a significance level of <.001. Furthermore, to determine the effect of the proportions of John Dory and Cassava, a Duncan’s test was conducted. The results of the Duncan’s test are presented in Table 4.4: Duncan’s Test on Fish Cake Color with Proportions of John Dory and Cassava.

Based on the Duncan’s test results above, it can be concluded that the color of sample code 125, with a 60%:40% proportion, yielded results different from sample codes 150 and 175, whereas the results for sample code 150 (70:30) were nearly identical. This indicates that the

product with sample code 175 met the criteria for a golden-brown color, and was therefore declared the best.

Based on the sensory testing for shape, the production of fish cake based on John Dory (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) achieved a highest average score of 22 and a lowest average of 14.86. The highest average was obtained from the 175 treatment, with a proportion of 80% John Dory and 20% Cassava. The lowest average was obtained from the 125 treatment, with a proportion of 60% John Dory and 40% Cassava. The average values for sensory quality can be seen in Figure 4.3 below.

Based on the instrument, the 80:20 proportion yields a color that tends to be more golden brown compared to the 70:30 and 60:40 proportions. The color of the 80:20 proportion is more golden brown due to the higher protein content derived from the John Dory fish compared to the other proportions.



**Figure 6.** Average Results of Texture Test

The data were then processed through a one-way ANOVA test to determine the presence or absence of an effect on the fish cake. The results of the fish cake texture ANOVA test are presented in Table 4.3 below

**Table 7.** Anova Texture Test

ANOVA					
Texture	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	888.267	2	444.133	14.854	.000
Within Groups	2601.333	87	29.900		
Total	3489.600	89			

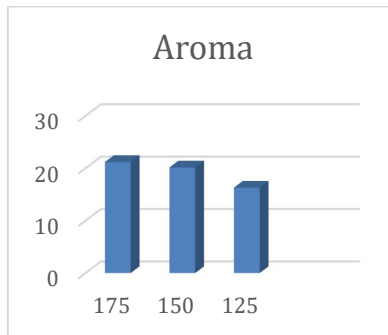
The results of the one-way ANOVA test in the table above indicate that there is a difference in the production of Fish Cake based on Dory fish (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) and Water Clover (*Marsilea crenata*). This is demonstrated by an F-value of 14.854 with a significance level of <.001. Furthermore, to determine the effect of the proportions of Dory fish and Cassava, a Duncan’s test was conducted. The results of the Duncan’s test are presented in Table 4.6: Duncan’s Test on Fish Cake Texture with Proportions of Dory fish and Cassava.

Based on the Duncan’s test results, it can be concluded that the texture of sample code 125, with a 60%:40% proportion, yielded results different from sample codes 150 and 175. Meanwhile, sample code 175 achieved a higher value compared to sample codes 150 and 125. This indicates that the product with sample code 175 possesses the best texture criteria, which is firm/dense.

Based on the instrument, the 80:20 proportion has a firmer and springier texture compared to the 70:30 and 60:40 proportions. The texture of the 80:20 proportion is firmer and springier

due to the higher protein content obtained from the John Dory fish compared to the other proportions.

Based on the sensory testing for aroma, the production of fish cake based on Dory fish (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) yielded a highest average score of 21.2 and a lowest average of 16.3. The highest average was obtained from the 175 treatment, with a proportion of 80% Dory fish and 20% Cassava. The lowest average was obtained from the 125 treatment, with a proportion of 60% Dory fish and 40% Cassava. The average values for sensory quality can be seen in Figure 4.4 below.



**Figure 7.** Average Aroma Test Results

**Table 8.** Anova Aroma Test

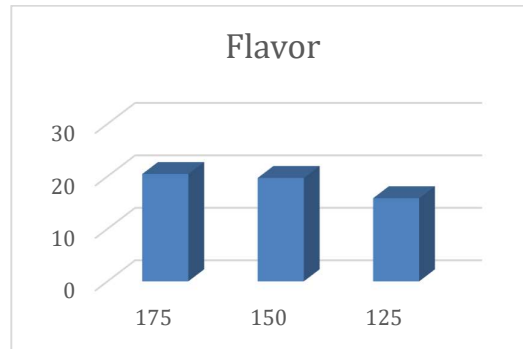
ANOVA					
Aroma	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	400.289	2	200.144	6.460	.002
Within Groups	2695.267	87	30.980		
Total	3095.556	89			

The results of the one-way ANOVA test in the table above indicate that there is a difference in the production of Fish Cake based on Dory fish (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) and Water Clover (*Marsilea crenata*). This is demonstrated by an F-value of 6.460 with a significance level of  $<.001$ . Furthermore, to determine the effect of the proportions of Dory fish and Cassava, a Duncan's test was conducted. The results of the Duncan's test are presented in Table 4.8: Duncan's Test on Fish Cake Aroma with Proportions of John Dory and Cassava.

Based on the Duncan's test results, the aroma of sample code 125, with a 60%:40% proportion, yielded results different from sample codes 150 and 175. Meanwhile, sample code 175 achieved a higher value compared to sample codes 150 and 125. This indicates that the product with sample code 175 meets the best aroma criteria, which is a pleasant fragrance without a fishy smell.

Based on the instrument, the 80:20 proportion has a fragrant aroma and lacks a fishy smell compared to the 70:30 and 60:40 proportions. The aroma of the 80:20 proportion is more fragrant and less fishy because of the higher protein content derived from the John Dory fish compared to the other proportions; additionally, the presence of cassava and flour helps to mask and reduce the fishy odor.

Based on the sensory testing for flavor, the production of fish cake based on Dory fish (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) achieved a highest average score of 20.44 and a lowest average of 15.83. The highest average was obtained from the 175 treatment, with a proportion of 80% Dory fish and 20% Cassava. The lowest average was obtained from the 125 treatment, with a proportion of 60% John Dory and 40% Cassava. The average values for sensory quality can be seen in Figure 4.5 below.



**Figure 8.** Average Flavor Test Results

**Table 9.** Anova Flavor Test

ANOVA					
Flavor	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	366.489	2	183.244	5.945	.004
Within Groups	2681.833	87	30.826		
Total	3048.322	89			

The results of the one-way ANOVA test in the table above indicate that there is a difference in the production of fish cake based on Dory fish (*Zeus faber*) with the addition of Cassava (*Manihot esculenta*) and Water Clover (*Marsilea crenata*). This is demonstrated by an F-value of 5.945 with a significance level of  $<.001$ . Furthermore, to determine the effect of the proportions of Dory fish and Cassava, a Duncan's test was conducted. The results of the Duncan's test are presented in Table 4.10: Duncan's Test on Fish Cake Flavor with Proportions of Dory fish and Cassava.

Based on the Duncan's test results, the flavor of sample code 125, with a 60%:40% proportion, yielded results different from sample codes 150 and 175. Meanwhile, sample code 175 achieved a higher value compared to sample codes 150 and 125. This indicates that the product with sample code 175 meets the flavor criteria for being savory and having a distinct Dory fish taste.

Based on the instrument, the 80:20 proportion has a fragrant aroma and lacks a fishy smell compared to the 70:30 and 60:40 proportions. The flavor of the 80:20 proportion is more savory and has a distinct Dory fish taste because of the higher protein content derived from the Dory fish compared to the other proportions, as well as the lower ratio of cassava and flour mixture.

Based on the results of the sensory quality analysis, the highest value was obtained from the 175 treatment, with a proportion of 80% Dory fish and 20% Cassava. These are the sensory quality results for the 'Innovation of Fish Cake Production Based on Dory fish (*Zeus faber*) with the Addition of Cassava (*Manihot esculenta*) and Water Clover (*Marsilea crenata*).

Based on the sample assessment results conducted by 30 panelists, Table 4.11 shows that the highest average value for shape quality is sample number 175, with a score of 19.4. This indicates that the sensory quality of the product is highly appropriate, being square and neat. The highest average value for color quality is sample number 175, with a score of 20.76, meaning the sensory quality is highly appropriate, exhibiting a golden-brown color. The highest average value for texture quality is sample 175, with a score of 22, meaning the quality is highly appropriate, being firm/dense. The highest average value for the aroma aspect is sample 175, with a score of 21.2, meaning the quality is highly appropriate, being fragrant with the scent of John Dory fish. The highest average value for flavor quality is sample 175, with a score of 20.44, meaning the quality is highly appropriate, being savory and having a distinct Dory fish taste. From the analysis above, it can be concluded that the product with sample number 175 has a higher overall value

than the other treatments. Therefore, sample number 175 is the best product.

## KESIMPULAN

Based on the research results and discussions conducted during product trials and the analysis of sensory test results, the following conclusions can be drawn: the optimal proportion of Dory fish and Cassava, according to the sensory test results, was obtained from sample 175 with a proportion of 80% Dory fish and 20% Cassava.

To optimize the development of fish cake product innovation based on Dory fish, cassava, and water clover, comprehensive further research covering various technical and managerial aspects is required. This includes safe and innovative packaging standardization, product shelf-life testing, and thorough laboratory analysis to determine the complete nutritional profile. Furthermore, an economic evaluation through raw material cost calculations is a crucial step to ensure the commercial feasibility and production sustainability of the product in the future.

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