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Original Article



Evaluating the Attributes Affecting Customer Preferences for Fresh Pork Products: An Application of Kano Model and Conjoint Analysis

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Abstract

The case study company manufactures and distributes a range of food products aimed at general consumers and restaurant and hotel businesses. The company needs to develop and improve its fresh pork products to meet the requirements of the customers who are restaurateurs in Chiang Mai province, Thailand, with the plan to increase market share, which is currently low in this segment. This study presents the use of the Kano Model combined with Conjoint Analysis (CA) to study the attributes that affect customer preferences for restaurateurs when making purchase decisions for fresh pork products. The research is in two principal phases. The first phase is an analysis using the Kano Model to determine fresh pork products' attributes and attribute levels. The six attributes obtained are then used further in the second phase, the CA to find the attributes affecting customer preferences in purchasing fresh pork products. In the CA part of this study, data were collected from a total of 100 restaurateurs in Chiang Mai. The results of this research found that the attributes most important to restaurateurs were freshness and cleanliness: very fresh and clean; followed by standards certification labeling: a government guarantee of quality; color of pork: pinkish red; amount of fat: 3%; price: 125 baht/kg and sliced: sliced by machine.



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1. Introduction

The case study company is in Thailand and carries out the manufacture and distribution of a diverse range of food products, from fresh hen's eggs, chicken meat, and pork to ready-to-cook and ready-to-eat products, including flavorings and seasonings (Belasco & Horowitz, 2011). The company distributes its products to both general consumers and catering businesses, such as restaurants and hotels, to support the growth of the food business. The segment of fresh pork products (see Figure 1) is sold in a range of different formats, such as clear-pack trays of 250g, 500g, and 1 kg, and clear-pack PE bags of 1kg, 5kg, and 10kg, as well as customized packs according to the needs of each consumer.

In the case of fresh pork products, the case study company found that among the restaurateur group of customers in Chiang Mai province, located in northern Thailand, the company had a market share of only 5.38%, meaning only 85 restaurants from the total of

1,580 in Chiang Mai province. The company thus needed to develop and improve its fresh pork products to meet the needs of the restaurateur segment of customers in Chiang Mai province as much as possible, with the expectation of increasing market share.



Figure 1. Fresh pork products of the case study company

To create an understanding of consumers' needs, one model that has been extensively cited is the Kano Model, created by Kano (2001). The Kano Model explains the relationship of consumer satisfaction with the product quality response. In the Kano Model (Kano, 2001), consumer satisfaction is divided into 5 (five)

categories: (1) Must-be (M), the basic product attributes which consumers expect and take for granted, which, if lacking, cause dissatisfaction for the consumer, (2) One-dimensional (O), product attributes desired by consumers whose satisfaction scales with this attribute, (3) Attractive (A), product attributes which exceed consumers' expectations and give a good impression, but if it is lacking, consumers do not feel dissatisfied in any way, (4) Indifferent (I), a product attribute with no effect on increasing or decreasing consumer satisfaction, and (5) Reverse (R), a product attribute which makes a consumer dissatisfied if they receive this attribute from a product.

The Kano Model gives knowledge about the attributes of a product or service that affect consumer satisfaction, which also helps with setting priorities for product development. Conjoint Analysis (CA) is a technique that analyzes which key attributes of a product and at which levels will stimulate the consumer to desire to buy (Green & Rao, 1971). The CA technique gets consumers to consider the importance of many attributes simultaneously rather than considering each attribute separately. The CA technique yields important information that can be used to design and improve the product and formulate suitable marketing strategies.

Previous research studies have found that the Kano Model and CA have been combined to analyze key product attributes, with diverse methods to combine the techniques. For instance, Min et al. (2011) studied factors making e-books successful in the Korean market, using the Kano Model to help select the key attributes of e-books from all previous attributes compiled from past studies concerning consumers' behaviors in using e-books. The analysis divided attributes into three groups: A: four attributes; O: five attributes; and M: four attributes. The attributes in group M were not taken for further study with the CA procedure as they were basic required attributes of the product. After that, A and O group attributes were selected to inspect for limitations in the feasibility of being appropriate for the population in Korea. The research selected three and one attribute for the A and O groups, respectively. Then, all four attributes were taken to determine attribute levels and analyzed using CA. The research found that it was possible to get foreign companies to understand better the attributes of Korean people's e-book usage needs.

Also, Jaipan & Potchanasin (2016) used the Kano Model to analyze consumer satisfaction with various attributes of tomato juice products and then categorize all the attributes into groups with the Kano Model. Attributes were selected from two groups, A and O, totaling five attributes. Attribute levels were then determined for each attribute for further analysis with CA. The research yielded methods to develop the product and give it the attributes that maximise consumer satisfaction while increasing competitive potential.

This study presents the methods and initial results using the Kano model combined with CA to study

attributes affecting customer preferences in decisions to purchase fresh pork products among the group of customers who are restaurateurs in Chiang Mai province, Thailand.

2. Materials and Methods

The research methodology had two principal parts: the first part of analysis with the Kano Model to arrive at attributes and attribute levels of the product, to be used in the second part of CA to find attributes affecting customer preferences in decisions to purchase fresh pork products, with details as follows:

2.1. Using the Kano Model to find attributes and attribute levels of the product

Details of each sub-process are as follows:

2.1.1. Compiling product attributes from past research

The attributes of fresh pork products were compiled from past studies concerned with the quality of meat products and consumer demand for various meat products, such as Andersen (2000) and Rosenvold & Andersen (2003), which stated that a good quality of meat must come from good animal welfare. Thuannadee & Noosuwan (2023) stated that most consumer needs, when deciding to purchase fresh chicken products sold in retail stores in Chiang Mai, were choosing purchases from packaging, price, energy and nutrient information, labels guaranteeing quality and branding, etc. Also, Mahatthanachosit & Chompu-Inwai (2022) stated that the key factors attended to by consumers in Chiang Mai province in the decision to purchase a particular brand of pork were cleanliness, odor, colour and the amount of fat marbling in the meat.

In conclusion, a total of 26 attributes were obtained for fresh pork products. These were: price suitable for quality and amount (A1), ability to bargain the price of fresh pork (A2), warning of price changes (A3), frozen pork products (A4), chilled pork products (A5), quality guarantee labelling and manufacturing standards certification (A6), source of the pork (A7), energy and nutrient information labelling (A8), range of packaging sizes (A9), slicing the pork (A10), subdivisions of packaging sizes (A11), low-fat marbling in the pork (A12), pork with pinkish-red color (A13), delivery of pork (A14), easy access to purchase point (A15), credit terms (A16), discounts and premiums (A17), antibiotic- and chemical-free (A18), free of reddening agents and growth hormones (A19), soft texture of the pork (A20), natural odor, not strong (A21), freshness and cleanliness (A22), date of cutting and packing, including expiry date (A23), animal welfare of pigs (A24), cold chain temperature control (A25), replacement of the defective product by vendor (A26).

2.1.2. Creating a Questionnaire According to the Kano Model and Collecting Data

This study created a questionnaire according to the Kano Model, divided into two parts:

Part 1: consisted of general questions about the restaurant, such as the type of restaurant, opening hours, number of tables, number of seats, average number of diners, average price per menu item, frequency of ordering fresh pork, type of fresh pork used, and spending on fresh pork.

Part 2: consisted of questions about attributes satisfying consumers using the Kano Model. These were both functional and dysfunctional questions. The functional questions inquired about the respondents' feelings about the product having a certain attribute. Dysfunctional questions inquired into the respondent's feelings about the product lacking a certain attribute. Each of the compiled 26 attributes of fresh pork above was incorporated into the questionnaire, and each question had 5 possible responses: (1) I like it that way, (2) It must

be that way, (3) I am neutral, (4) I can live with it that way and (5) I dislike it that way.

This study used a questionnaire designed above to randomly survey 10 restaurateurs in Chiang Mai province who had previously purchased fresh pork products. It was required for the respondents to have the power or responsibility to decide on raw materials, such as the owner, the manager, a chef or, a buying manager, etc.

3. Results and Discussions

3.1. Evaluating the result through the Kano Model

Subsequently, responses to the functional questions and the dysfunctional questions on each attribute of each respondent were compared for meaning with the Kano Evaluation Table 1, which enabled categorizing the responses of each respondent on each attribute into A, O, M, I, R or Q. The Questionable (Q) property only arose in the cases where the respondent misunderstood the questionnaire or that the questionnaire was designed incorrectly.

Table 1. Summary of Kano evaluation thresholds

Customer Requirements		Response to Dysfunctional Question				
		Like	Must be	Neutral	Live with	Dislike
Response to Functional Question	Like	Q	A	A	A	O
	Must be	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live with	R	I	I	I	M
	Dislike	R	R	R	R	Q

Source: Berger et al. (1993)

The data from the previous stage was then used to find a frequency value for the number of responses in each group (A, O, M, I, R or Q) for each attribute, as shown only for attributes A1, A2, A3 and A26 in table 2. For example, attribute A1: price suitable for quality and amount had percentage responses of O, M and I of 40% 20% and 40%, respectively. Subsequently, frequencies for only A, O, M and I of each attribute were used to calculate values for Customer Satisfaction Coefficient, Customer Dissatisfaction Coefficient and Customer Satisfaction Index: CSI, using Eq. (1) - (3) respectively (Berger et al., 1993).

$$\text{Satisfaction Coefficient} = \left(\frac{A + O}{A + O + M + I} \right) \quad (1)$$

$$\text{Dissatisfaction Coefficient} = \left(\frac{O + M}{A + O + M + I} \right) \times 1 \quad (2)$$

$$\text{CSI} = \left(\frac{\text{Dissatisfaction}}{\text{Satisfaction}} \right) \quad (3)$$

Table 2 also shows examples of results for calculating the satisfaction coefficient, dissatisfaction coefficient, and CSI for attributes A1, A2, A3, and A26. Of

this, the Satisfaction Coefficient of each attribute ranges from 0 to 1, and the Dissatisfaction Coefficient ranges from 0 to -1. If satisfaction values are close to 1, this shows great satisfaction, while conversely, dissatisfaction values close to -1 show great dissatisfaction (Matzler & Hinterhuber, 1998).

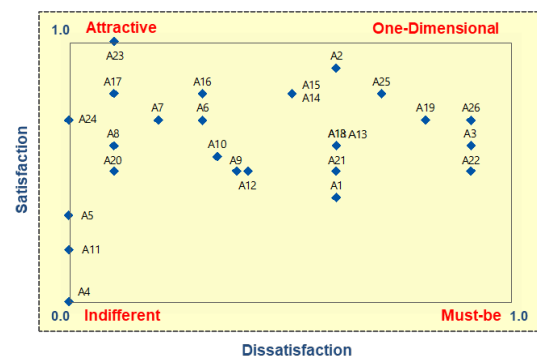


Figure 2. Categorizing attributes of fresh pork products into groups A, O, M or I

Satisfaction Coefficient and Dissatisfaction Coefficient values of each attribute were then graphed to show consumers' satisfaction and dissatisfaction to compare the results obtained with the Kano Model to see whether each of the 26 attributes was in groups A, O, M or I, with the y-axis showing satisfaction and the x-axis

dissatisfaction (Berger et al., 1993). Figure 2 displays all 26 attributes; it was possible to categorize them as:

1. Attractive (A) a total of 10 attributes: A6, A7, A8, A10, A12, A16, A17, A20, A23 and A24.
2. One-dimensional (O) a total of 11 attributes: A2, A3, A13, A14, A15, A18, A19, A21, A22, A25 and A26.
3. Must-be (M) just only one attribute, A1.
4. Indifferent (I), a total of 4 attributes: A4, A5, A9 and A11.

Table 2. Frequency of respondent groups (A, O, M, I, R or Q) for attribute and satisfaction, dissatisfaction coefficients and CSI.

Attributes	A	O	M	I	R	Q	Satisfaction coefficient	Dissatisfaction coefficient	CSI
A1	0	40	20	40	0	0	0.4	-0.6	1.5
A2	30	60	0	10	0	0	0.9	-0.6	0.67
A3	10	50	40	0	0	0	0.6	-0.9	1.5
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A26	10	60	30	0	0	0	0.7	-0.9	1.29

Note:

- A1 = price suitable for quality and amount
 A2 = ability to bargain the price of fresh pork
 A3 = advance warning of price changes
 A26 = replacement of the defective product by vendor

3.2. Determining attributes and its level

In the CA procedure, if the number of attributes is excessive, they may confuse respondents. Therefore, it is required to select key attributes, and not too many of them to perform the CA, with researchers using the following method:

- (1) Not selecting attributes in the Indifferent (I) group, as these attributes did not affect increasing or decreasing consumer satisfaction
- (2) Selecting attributes in the Must-be (M) group as they were basic required attributes of the product and restaurateurs expected to find them in fresh pork products. If these attributes were not found, consumers would be dissatisfied.
- (3) For attributes in the One-dimensional (O) group these were ranked by CSI values from high to low. Then, the 2-3 most important attributes were selected, as they were the attributes that

restaurateurs required in the product, and the greater these attributes, the greater the satisfaction of the restaurateurs.

- (4) For attributes in the Attractive (A) group these were ranked by CSI values from high to low, and then the 2-3 most important attributes were selected, as they were the product attributes that consumers required to make them impressed. These were key attributes to attract customers or stimulate interest from restaurateurs and create differentials for fresh pork products.

It was possible to determine the attributes of fresh pork products that could be used in the CA for restaurateurs, as shown in Table 3. The authors met with the case study company from there to determine practically feasible attribute levels.

3.3. Analyzing the product attributes that affect the customers' purchase decisions using conjoint analysis

When the product attributes and attribute levels had been obtained, the next step was analysis by CA to find product attributes affecting customer preferences in purchasing fresh pork products, with details as follows.

Table 3. Attributes and attribute levels used in the CA

Attribute	Attribute Level
(1) Amount of fat marbling in the pork	(1) 0% (2) 3% (3) 6%
(2) Color of the pork	(1) Pinkish-grey (2) Pinkish-red (3) Pinkish-dark red
(3) Slicing the pork	(1) Cutting/slicing by machine (2) Cutting/slicing by hand with knife
(4) Attributes showing freshness and cleanliness of the pork products	(1) Very fresh and clean (2) Somewhat fresh and clean (3) Product does not show great freshness or cleanliness but is edible
(5) Standards certification and quality guarantee labelling	(1) From government agency (2) From private agency

Attribute	Attribute Level
(6) Price	(3) From overseas
	(4) No certification
	(1) 125 Thai Baht/Kilogram
	(2) 135 Thai Baht/Kilogram
	(3) 145 Thai Baht/Kilogram

3.3.1. Creating the questionnaire and collecting data

This research randomly surveyed a sample of 100 restaurateurs in Chiang Mai city from a total of 1,580. From calculating sample size at 10% margin of error and 95% level of confidence, this was equivalent to a sample of 94 (Yamane, 2016). The survey was conducted by questionnaire, with the respondents required to be persons with the power or responsibility to make decisions on purchasing raw materials. The questionnaire was divided into 3 parts:

Parts 1 and 2: were questions concerned with general data about the restaurant (details as shown in section 2.1.2) and behavior in selecting purchases of fresh pork products. Part 3: Inquiring about respondents' satisfaction with suites of attributes (concepts) using the Full Profile Design method. This involved preparing cards with illustrations and descriptions of each concept and making 27 concept cards. All concept cards were presented simultaneously for the respondents to rank from most satisfaction to last.

From Table 3, if the number of attribute levels of all six attributes are multiplied, the total number of 648 feasible concepts is obtained. However, presenting concepts to questionnaire respondents to rank by satisfaction could confuse the respondents if there were too many concepts. Therefore, the researchers reduced the number of concepts with the Orthogonal Design method to just 27, with examples of concepts shown in Table 4. This study measured satisfaction with the concepts presented by getting respondents to rank the concept cards. Regression Analysis The least-squares method was used to estimate the satisfaction value of the product attributes.

3.3.2. Determining the preference model

For the 5 key attributes: the amount of fat marbling in the pork, color of the pork, cutting/slicing the pork, attributes showing freshness and cleanliness of the fresh pork products, and standards certification and quality guarantee labelling, the preference model used was the discrete model. The discrete model method estimates a utility model in which satisfaction relationships with attribute levels are independent of each other. When changes in attribute levels occur, it is impossible to tell whether the satisfaction obtained will change in an increased or decreased direction (Green et al., 2001).

As for the price attribute, the linear less model was chosen. When price levels are highly increased, satisfaction values will decrease. The linear model shows relationships between satisfaction and connected attribute levels. When changes occur in attribute levels, it is possible to tell in which direction the satisfaction obtained will change linearly (Green et al., 2001).

3.3.3. Estimating satisfaction values of attribute levels (Estimation method)

In choosing approaches to estimate satisfaction values of attribute levels, if satisfaction is measured by ranking priorities, Logit, Probit, Hybrid, Tobit and Ordinary Least Squares (OLS) methods will be used. Regarding this, a study by Green & Srinivasan (1978) stated that the OLS method is widely popular and can be used to measure satisfaction by ranking priorities and giving satisfaction points. Moreover, Darmon & Rouziès (1994) studied that the results obtained from the OLS method have very little distortion compared to other methods.

Table 4. Summary of conceptual study

Card ID	Amount of fat marbling in the pork	Color of the pork	Slicing the pork	Attributes showing freshness and cleanliness of the pork products	Standards certification and quality guarantee labelling	Price (per kg)
1	3%	Pinkish-dark red	Cutting/slicing by machine	Somewhat fresh and clean	From private agency	125
2	0%	Pinkish-grey	Cutting/slicing by hand with knife	Product does not show great freshness or cleanliness but is edible	From government agency	125
3	3%	Pinkish-grey	Cutting/slicing by hand with knife	Very fresh and clean	From overseas	125
4	3%	Pinkish-red	Cutting/slicing by hand with knife	Very fresh and clean	No certification	145

5	3%	Pinkish-red	Cutting/slicing by hand with knife	Somewhat fresh and clean	From government agency	135
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27	6%	Pinkish-grey	Cutting/slicing by hand with knife	Somewhat fresh and clean	No certification	125

3.3.4. Results of the Conjoint analysis

Analysis of all the compiled questionnaire results found that Pearson's R = 0.96, Kendall's Tau = 0.82 and p-value < 0.05 (=0.000) indicated a strong and significant correlation between the actual and predicted preference ranking data. Table 5 shows the results of analyzing the importance values of product attributes and utility estimates for each attribute level. Of this, standards certification and quality guarantee labelling are the

attributes to which restaurateurs give more importance than other attributes, with an importance value of 31.477%. It was followed by the color of the pork, attributes showing freshness and cleanliness of the fresh pork products, price, amount of fat marbling in the pork, and cutting/slicing the pork, respectively. Subsequently, utility estimates were used to create a Linear Regression equation to calculate and obtain the utility scores or satisfaction values towards each format of the product (U_k) as in Equation (4):

Table 5. Importance value of product attribute and utility estimate of attribute level

Attribute	Attribute Level	Importance Values	Utility Estimate	Std. Error	t	Sig
Amount of fat marbling in the pork	0% (X11)	15.423	0.136	0.351	0.534	0.594
	3% (X12)		0.883	0.351	5.686	0.000*
	6% (X13)		-1.019	0.42	-3.759	0.000*
Color of the pork	Pinkish-grey (X21)	15.806	-2.346	0.351	-10.028	0.000*
	Pinkish-red (X22)		1.404	0.351	7.267	0.000*
	Pinkish-dark red (X23)		0.943	0.42	6.339	0.000*
Slicing the pork	Cutting/slicing by machine (X31)	5.788	0.2	0.257	1.46	0.148
	Cutting/slicing by hand with knife (X32)		-0.2	0.257	-1.46	0.148
	Very fresh and clean (X41)		1.601	0.351	7.046	0.000*
Attributes showing the freshness and cleanliness of the pork products	Somewhat fresh and clean (X42)	15.796	0.719	0.351	4.647	0.000*
	Product does not show great freshness or cleanliness but is edible (X43)		-2.321	0.42	-8.435	0.000*
	From government agency (X51)		1.561	0.385	4.458	0.000*
Standards certification and quality guarantee labelling	From private agency (X52)	31.477	0.086	0.477	0.262	0.794
	From overseas (X53)		0.687	0.477	1.381	0.17
	No certification (X54)		-2.334	0.477	-5.582	0.000*
Price	125 Thai Baht/Kilogram (X61)	15.71	-23.577	4.206	-6.689	0.000*
	135 Thai Baht/Kilogram (X62)		-25.463	4.542	-6.689	0.000*
	145 Thai Baht/ Kilogram (X63)		-27.349	4.879	-6.689	0.000*
Constant		100	37.263	4.485		
Pearson's R (Sig)		0.960 (0.000)				
Kendall's tau (Sig)		0.820 (0.000)				

Table 5 captures the analysis results of each attribute and attribute level as in the following example. When considering the amount of fat marbling in the pork, it is found that the sample group of restaurateurs were most satisfied with fresh pork products that had 3% of fat marbling, followed by 0% and 6%, respectively. Fat

marbling of 3% and 0% had utility scores increased by 0.883 and 0.136 units, respectively. However, fat marbling of 6% caused the utility score to drop by 1.019 units. From additional enquiries with the restaurateurs, they stated that the optimal amount of fat marbling resulted in tender meat, when cooked, would give the

tastiest meat texture. If a t-test has a significance level or $P\text{-value} < 0.05$, the attribute is related to consumer satisfaction in a statistically significant way. Analysis results for other attributes were obtained using the same method.

Meanwhile, for the attribute of cutting/slicing the pork, it was found that if the pork was sliced by machine, it would increase the utility score by 0.2 units, while cutting/slicing the pork by hand with a knife made the utility score drop by 0.2 units. However, the attribute of cutting/slicing the pork was not statistically significant about consumer satisfaction, as the $P\text{-value} > 0.05$. That is, whether slicing by machine or hand with a knife did not cause a significant change in the utility score. Besides this, it was possible to calculate utility scores for each concept using Eq. (4).

$$U_k = 37.263 + 0.136X_{11} + 0.883X_{12} - \dots \\ 1.019X_{13} - 2.346X_{21} + 1.404X_{22} + \dots \\ 0.943X_{23} + 0.2X_{31} - 0.2X_{32} + \dots \\ 1.601X_{41} + 0.719X_{42} - 2.321X_{43} + \dots \quad (4) \\ 1.561X_{51} + 0.086X_{52} + 0.687X_{53} - \dots \\ 2.334X_{54} - 23.577X_{61} - \dots \\ 25.463X_{62} - 27.349X_{63}$$

For instance, in Table 4, concept 1 was: the amount of fat marbling in the pork 3%; pinkish-dark red color; cutting/slicing by machine; somewhat fresh and clean; certification by the private agency; price of 125 baht/kg. When values were put into Eq. (4), the utility score was obtained from Eq. (5).

$$U_k = 37.263 + 0.883 + 0.943 + 0.2 + \dots \\ + 0.719 + 0.086 - 23.577 = 16.517 \quad (5)$$

These calculations found that concepts 6 and 8 obtained the highest utility scores of 18.588 and 18.461, respectively, while concept 12 had the lowest utility score of 8.175

4. Conclusions

This study has presented methods of combining the Kano Model with CA. The first phase of this research was an analysis using the Kano Model to arrive at six attributes and attribute levels of fresh pork products (selected from a total of 26 attributes obtained from past research). The second phase was performing a CA on all six attributes affecting customer preferences in purchasing fresh pork products. Data was collected from 100 restaurateurs in Chiang Mai, Thailand. The research found that the most important attribute for restaurateurs was the attribute of showing freshness and cleanliness: fresh and clean, followed by having standards certification and quality guarantees from the government, color of pork should be pinkish red, the

amount of fat marbling should be around 3%, a price of 125 baht/kg and slicing by machine.

In combining the Kano Model with CA, there is a diverse range of approaches to combine the two techniques. Most previous research proposed combining all attributes and categorizing them into attribute groups A, O, M, I, R and Q according to the Kano Model, then selecting fewer attributes to perform the CA. However, methods to select fewer attributes are also diverse in each piece of research.

As for future research, researchers would collect additional data from questionnaires for restaurateurs. In addition, the researchers would use the same approach as in this research to study the needs of other customer groups, such as hotels. This would be to study the attributes affecting customer preferences in purchasing fresh pork products for other groups with differing needs. After this, Quality Function Deployment (QFD) would be used to develop products and production processes by translating customer needs into Design Requirements or Technical Features catering to each aspect. This should result in products that can better meet customers' needs. Finally, this should increase the market share of the case study company.

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