

## USE OF THE KANO MODEL AND CONJOINT ANALYSIS TO EVALUATE ATTRIBUTES AFFECTING RESTAURATEUR PREFERENCES FOR FRESH PORK PRODUCTS

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**Abstract:** This paper studies a company that is a manufacturer and distributor of a range of food products aimed at general consumers, as well as restaurant and hotel businesses. The company has a need to develop and improve its fresh pork products to best meet the requirements of a group of customers, who are restaurateurs in Chiang Mai province, Thailand, with a plan to increase its market share, which is currently low in this segment. The Kano model, combined with conjoint analysis (CA), was used to study the attributes that have an effect on restaurateur preferences in making purchase decisions for fresh pork products. The study was conducted in two principal phases. The first phase is an analysis using the Kano model to arrive at the attributes and attribute levels of the fresh pork products. The six attributes obtained are then used further in the second phase, which is the CA, to find the attributes that have an effect on customer preferences in decisions to purchase fresh pork products. In the CA part of this study, data were collected from 100 restaurateurs in Chiang Mai. It was found that the attributes most important to restaurateurs were freshness and cleanliness (very fresh and clean), followed by standards certification labelling (government guarantee of quality), the colour of pork (pinkish-red), the amount of fat (3%), the price (125 Thai baht/kg) and the slicing method (sliced by machine).

Keywords: Kano model, conjoint analysis, customer preference, fresh pork, attribute, restaurateur.

Abbreviations: Conjoint Analysis (CA).

### Introduction

The company that is the focus of this paper is located in Thailand and it manufactures and distributes a diverse range of food products, from fresh chicken eggs, chicken meat and pork, to ready-to-cook and ready-to-eat products, as well as flavourings and seasonings. 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 fresh pork product segment (Figure 1) is sold in a range of different formats, such as clear-pack trays of 250 g, 500 g and 1 kg and clear-pack PE bags of 1 kg, 5 kg and 10 kg, as well as customized packs according to the needs of each consumer.



Figure 1: An example of a fresh pork product of the case study company

In the case of fresh pork products, the company found that among the restaurateur group of customers in Chiang Mai province, in northern Thailand, it had a market share of only 5.38%, which is only 85 of the 1,580 restaurants in the province. The company thus had a need

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.

To gain understanding of consumer needs, one model that has been extensively cited is the Kano model, created by Kano (1984). The model explains the relationship between consumer satisfaction and the product quality response. In the Kano Model, consumer satisfaction is divided into five categories (Kano, 1984): (1) Must-be (M), the basic product attributes that consumers expect and take for granted, which if lacking can cause consumer dissatisfaction, (2) One-dimensional (O), product attributes desired by consumers, whose satisfaction scales with this attribute, (3) Attractive (A), product attributes that exceed consumer 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 that makes a consumer dissatisfied if they receive this attribute from a product. The Kano model provides information on the attributes of a product or service that has an effect on consumer satisfaction, which also helps with setting priorities for product development.

Historical studies found that the Kano model has been applied in a wide range of industries, including the manufacturing and service industries, as well as the tourism and healthcare industries. It has also been applied in the food industry, such as by Leerattanakorn (2011), who studied consumer behaviour and the marketing mix influencing their purchase decisions for cold-climate organic vegetables in Chiang Mai, Thailand. Using the Kano model enabled a greater expansion of the consumer market for organic vegetables and, at the same time, provided insight into consumer preferences for organic vegetables.

Similarly, Jantest *et al.* (2013) used the Kano Model to find out consumer preferences for mango tablets. A group of consumers who

consumed fruit tablets in the Bangkok area of Thailand were surveyed. The research was able to distinguish different attributes affecting consumer preferences in two groups, which were (1) O, include moisture resistant packaging, have a clear mango flavour, with no artificial flavouring or colouring and beneficial to health and (2) A, include smooth mouth feel, sour in taste, have other health benefits and come small packs and/or an aluminium zipper storage bag. The satisfaction of consumers in different age cohorts also had an effect on their different preferences.

Furthermore, Pongwiritton *et al.* (2018) have also used the Kano model to design cereal grain products to match the demand of consumers in Thailand. They found that cereal grain products could be adapted in many aspects, with an emphasis on supporting FDA standards and labelling to show health concerns, together with production and sell-by dates on the packaging, to give consumers the greatest satisfaction.

Conjoint Analysis (CA) is a technique that analyses which key attributes of a product and which levels will stimulate consumer to have a 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 a product, as well as formulate suitable marketing strategies.

CA has been previously applied to research studies in the food industry. This technique finds key attributes of a product that are used to build product concepts so that the product could better cater to consumer preferences. For example, Nantajit *et al.* (2020) used CA to find the attributes of coffee beans affecting purchase decisions of non-franchise coffee shop operators in Chiang Mai, Thailand. The survey found that the three attributes affecting the purchase of coffee beans were the growing location, price and promotions. They further found out that if the coffee bean growing location was suitable for

growth, the result was high quality coffee beans, which were the most desired by consumers.

Nunthasen and Nunthasen (2020) also carried out a study on factors affecting consumer decisions to purchase organic Cavendish bananas in smart label packaging in Chiang Mai, Thailand. They used CA to obtain product attributes that most greatly matched consumer preferences. There were four attributes of bananas that affect consumer purchases the most: certification, packaging, ripeness indicator and price. The results of the study were applied as guidelines for developing products suitable for consumers, while reducing the gap between producers and consumers.

Previous studies have found that the Kano model and CA have been combined to analyse key product attributes, with a diverse range of methods to combine the techniques. For instance, Min *et al.* (2011) studied factors that made e-books successful in the South Korean market, using the Kano model to help select the key attributes of e-books from all previous attributes that have been compiled from past studies concerning consumer behaviours in using e-books. The analysis was able to divide attributes into three groups, which are A, with four attributes, O, with five attributes and M, with four attributes. The attributes in group M were not further studied with the CA procedure as they were basic required attributes of the product. Thereafter, the attributes in groups A and O were selected to inspect for limitations in feasibility in being appropriate for the population of South Korea. The research was able to select three and one attributes for the A and O groups, respectively. Then all four attributes were taken to determine the attribute levels and analysed with CA. It was found that it was possible to get foreign companies to better understand the attributes of South Korean people's e-book usage needs.

Wang and Wu (2014) combined CA with the Kano model to find the product attributes of smartphones that give the overall highest satisfaction to consumers. They proposed a three-phase approach, combining customer

preferences and customer perceptions and applied to the decision process to specify product configurations and evaluate alternatives for identified segments. Also, Choudhury and Gulati (2020) did a similar study, combining the Kano model with CA to study the product attributes of mobile phones that affect customers' perceptions and satisfaction in Delhi, India. The results of the study were beneficial to mobile phone manufacturers in developing products most preferred by customers.

Suzianti *et al.* (2015) analysed customer preferences in fashion online shops in Indonesia using the Kano model combined with CA to design the service attributes of online stores to match customer preferences, which led to increased sales. In the study, the Kano model was used to find key service attributes for developing and improving online stores. Meanwhile, CA was used to gain insight into customer preferences, calculating preference values statistically.

Also, Jaipan and Potchanasin (2016) used the Kano Model to analyse consumer satisfaction with various attributes of tomato juice products and then categorised all the attributes into groups with the Kano model. The attributes were then selected from two groups, A and O, totalling five attributes. The attribute levels were then determined for each attribute for further analysis with CA. The study yielded methods to develop the product and give it the attributes that provide it with the maximum consumer satisfaction and increase competitive potential.

This study thus presents the research methods and initial results in 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.

## **Research Methodology and Results**

The research methodology had two principal parts: The first part of the analysis involved the Kano Model to arrive at the attributes and

attribute levels of the product, which are used in the second part of CA to find attributes affecting customer preferences in decisions to purchase fresh pork products, with details as follows:

### ***Using the Kano Model to Find Attributes and Attribute Levels of the Product***

Details of each sub-process are as follows:

#### ***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 (Chananontawat, 2006; Cherdsatirakul, 2003; Chiramethasiri, 2014; Font-i-Furnols & Guerrero, 2014; Issanchou, 1996; Kunlayanajaree, 2008; Lai *et al.*, 2018; Marin, 2008; Meyerding *et al.*, 2018; Moeller, 2013; Ngapo *et al.*, 2018; Papanagiotou *et al.*, 2013; Tahkomtib, 2011; Wu *et al.*, 2015). For example, Moeller (2013) stated that a good quality of meat must come from good animal welfare. Tahkomtib (2011) also stated that most consumer needs, when deciding to purchase fresh chicken products sold in retail stores in Chiang Mai, were choosing purchases based on packaging, price, energy and nutrient information, labels guaranteeing quality and branding, etc. Also, Kunlayanajaree (2008) 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, odour, colour and the amount of fat marbled in the meat.

In conclusion, a total of 26 attributes were obtained for fresh pork products. These were price suitable for the quality and amount (A1), ability to bargain the price of fresh pork (A2), advance warning of price changes (A3), frozen pork products (A4), chilled pork products (A5), quality guarantee labelling and manufacturing standards certification (A6), source of pork (A7), energy and nutrient information labelling (A8), range of packaging sizes (A9), slicing of the pork (A10), subdivisions of packaging sizes (A11), low fat marbling in the pork (A12), pork

with pinkish-red colour (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 odour and 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) and replacement of defective product by the vendor (A26).

#### ***Creating a Questionnaire According to the Kano Model and Collecting Data***

Researchers then created a questionnaire according to the Kano model, divided into two parts:

Part 1 consists 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 the amount spent on fresh pork.

Part 2 consists of questions about attributes satisfying consumers using the Kano model. These were both functional and dysfunctional questions. The functional questions inquired into the feelings of the respondent about the product having a certain attribute. Dysfunctional questions inquired into the feelings of the respondent about the product lacking a certain attribute. Each of the compiled 26 attributes of fresh pork above were incorporated into the questionnaire and each question had five 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.

Researchers used this questionnaire as designed above to randomly survey a sample group of 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.

**Analysis and Evaluation of Results**

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 (Table 1), which enabled categorising 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 that the respondent misunderstood the questionnaire, or that the questionnaire was designed incorrectly.

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 in Table 2. As an example, the attribute A1, price suitable for the quality and amount, had percentage responses for 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 the customer satisfaction coefficient, customer dissatisfaction coefficient and customer satisfaction index (CSI) using equations (1) to (3), respectively (Berger *et al.*, 1993).

Satisfaction Coefficient (CS+)  

$$= (A+O)/(A+O+M+I) \tag{1}$$

Dissatisfaction Coefficient (CS-)  

$$= (-1)(O+M)/(A+O+M+I) \tag{2}$$

Customer Satisfaction Index (CSI)  

$$= |Dissatisfaction|/Satisfaction \tag{3}$$

Table 2 also shows the results of calculating the Satisfaction coefficient, dissatisfaction

coefficient and customer satisfaction index for each attribute. The satisfaction coefficient of each attribute is in a range of 0 to 1 and dissatisfaction coefficient ranges from 0 to -1. If the satisfaction values are close to 1, this shows great satisfaction and dissatisfaction values close to -1 show great dissatisfaction (Matzler & Hinterhuber, 1998).

The satisfaction coefficient and dissatisfaction coefficient values of each attribute were then graphed to show consumer 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) as shown in Figure 2.

From Figure 2, it can be seen that from all 26 attributes, it was possible to categorise them as:

1. Attractive (A) involved a total of 10 attributes: quality guarantee labelling and manufacturing standards certification (A6), source of the pork (A7), energy and nutrient information labelling (A8), slicing of the pork (A10), low fat marbling in the pork (A12), credit terms (A16), discounts and premiums (A17), soft texture of the pork (A20), date of cutting and packing, including expiry date (A23) and animal welfare of pigs (A24).
2. One-dimensional (O) involve a total of 11 attributes: Ability to bargain the price of fresh pork (A2), advance warning of price changes (A3), pork with pinkish-red colour (A13), delivery of pork (A14), easy

Table 1: Kano evaluation table (Berger *et al.*, 1993)

	Customer Requirements	Answer to Dysfunctional Question				
		Like	Must be	Neutral	Live with	Dislike
Answer 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

Table 2: Frequency of respondents in each group (A, O, M, I, R or Q) for each attribute and calculations of the satisfaction coefficient, dissatisfaction coefficient and CSI

Attributes	A	O	M	I	R	Q	CS+	CS-	CSI
A1: price suitable for the quality and amount	0.0	40.0	20.0	40.0	0.0	0.0	0.40	-0.60	1.50
A2: ability to bargain the price of fresh pork	30.0	60.0	0.0	10.0	0.0	0.0	0.90	-0.60	0.67
A3: advance warning of price changes	10.0	50.0	40.0	0.0	0.0	0.0	0.60	-0.90	1.50
A4: frozen pork products	0.0	0.0	0.0	50.0	50.0	0.0	0.00	0.00	0.00
A5: chilled pork products	30.0	0.0	0.0	60.0	10.0	0.0	0.33	0.00	0.00
A6: quality guarantee labelling and manufacturing standards certification	40.0	30.0	0.0	30.0	0.0	0.0	0.70	-0.30	0.43
A7: source of the pork	60.0	10.0	10.0	20.0	0.0	0.0	0.70	-0.20	0.29
A8: energy and nutrient information labelling	50.0	10.0	0.0	40.0	0.0	0.0	0.60	-0.10	0.17
A9: range of packaging sizes	20.0	20.0	10.0	30.0	20.0	0.0	0.50	-0.38	0.75
A10: slicing of the pork	30.0	20.0	10.0	30.0	10.0	0.0	0.56	-0.33	0.60
A11: subdivisions of packaging sizes	10.0	0.0	0.0	40.0	50.0	0.0	0.20	0.00	0.00
A12: low fat marbling in the pork	30.0	20.0	20.0	30.0	0.0	0.0	0.50	-0.40	0.80
A13: pork with pinkish-red colour	20.0	40.0	20.0	20.0	0.0	0.0	0.60	-0.60	1.00
A14: delivery of pork	30.0	50.0	0.0	20.0	0.0	0.0	0.80	-0.50	0.63
A15: easy access to purchase point	40.0	40.0	10.0	10.0	0.0	0.0	0.80	-0.50	0.63
A16: credit terms	50.0	30.0	0.0	20.0	0.0	0.0	0.80	-0.30	0.38
A17: discounts and premiums	80.0	0.0	10.0	10.0	0.0	0.0	0.80	-0.10	0.13
A18: antibiotic and chemical free	20.0	40.0	20.0	20.0	0.0	0.0	0.60	-0.60	1.00
A19: free of reddening agents and growth hormones	10.0	60.0	20.0	10.0	0.0	0.0	0.70	-0.80	1.14
A20: soft texture of the pork	50.0	0.0	10.0	40.0	0.0	0.0	0.50	-0.10	0.20
A21: natural odor and not strong	10.0	40.0	20.0	30.0	0.0	0.0	0.50	-0.60	1.20
A22: freshness and cleanliness	10.0	40.0	50.0	0.0	0.0	0.0	0.50	-0.90	1.80
A23: date of cutting and packing, including expiry date	90.0	10.0	0.0	0.0	0.0	0.0	1.00	-0.10	0.10
A24: animal welfare of pigs	70.0	0.0	0.0	30.0	0.0	0.0	0.70	0.00	0.00
A25: cold chain temperature control	20.0	60.0	10.0	10.0	0.0	0.0	0.80	-0.70	0.88
A26: replacement of defective product by the vendor	10.0	60.0	30.0	0.0	0.0	0.0	0.70	-0.90	1.29

access to purchase point (A15), antibiotic and chemical free (A18), free of reddening agents and growth hormones (A19), natural odour and not strong (A21), freshness and cleanliness (A22), cold chain temperature control (A25) and replacement of defective product by the vendor (A26).

- Must-be (M) involve just only one attribute, price suitable for the quality and amount (A1).

- Indifferent (I) involve a total of 4 attributes: frozen pork products (A4), chilled pork products (A5), range of packaging sizes (A9) and subdivisions of packaging sizes (A11).

**Determining Attributes and Attribute Levels**

In the CA procedure, if the number of attributes is excessive, they may confuse respondents.

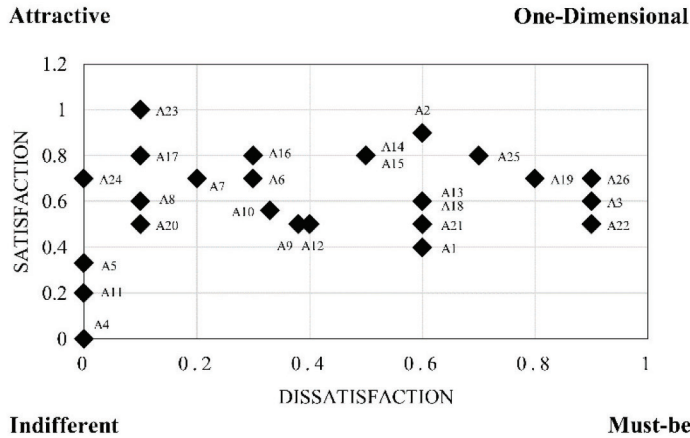


Figure 2: Categorising attributes of fresh pork products into groups A, O, M or I

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 I group, as these attributes have no effect on increasing or decreasing consumer satisfaction.
2. Selecting attributes in the M group as they are basic required attributes of the product and restaurateurs expect to find them in fresh pork products. If these attributes are not found, consumers will be dissatisfied.
3. For attributes in the O group, these are ranked by CSI values from high to low and then the two to three most important attributes are selected, as they are the attributes which restaurateurs require in the product and the greater these attributes, the greater the satisfaction of the restaurateurs.
4. For attributes in the A group, these are ranked by CSI values from high to low and then the two to three most important attributes are selected, as they are the product attributes that consumers require to make them impressed. These are key attributes to attract customers or stimulate interest from restaurateurs and create differentiations for fresh pork products.

It was possible to determine attributes for fresh pork products for restaurateurs that could be used in the CA as shown in Table 3. From there, researchers held a meeting with the case

study company to determine practically feasible attribute levels.

***Using CA to Analyse Product Attributes Affecting Customers’ Purchase Decisions***

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 deciding to purchase fresh pork products, with details as follows:

***Creating the Questionnaire and Collecting Data***

This research randomly surveyed a sample of 100 restaurateurs in Chiang Mai city from the total of 1,580. From calculating the sample size at a 10% margin of error and 95% level of confidence, a sample size of 94 was obtained (Yamane, 1967). 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 three parts:

Parts 1 and 2 were questions concerned with general data about the restaurants (details as show in section 2.1.2) and behaviours in selecting purchases of fresh pork products.

Part 3 inquired about the satisfaction of respondents to suites of attributes (concepts) using the full profile design method. This involved the preparation of cards containing

illustrations with descriptions of each concept, making a total of 27 concept cards. All concept cards were presented simultaneously for the respondents to rank from most satisfaction to least. To collect data, researchers interviewed each respondent, getting the respondent to rank concept cards laid on the table according to their preference. The respondents were asked to rank the concept cards in 27 ranks from maximum satisfaction to minimum satisfaction and then to summarise their responses in the questionnaire.

From Table 3, if the number of attribute levels of all six attributes are multiplied together, a total number of 648 feasible concepts were obtained. However, in presenting concepts to questionnaire respondents to rank by satisfaction, if there were too many concepts, it could confuse the respondents. Therefore, the researchers reduced the number of concepts with the Orthogonal Design method to just 27 concepts, with examples of the concepts shown in Table 4.

The researchers reduced the number of concepts as appropriate by removing the

unfeasible concepts and those that confused the respondents. After consultation and orthogonal design was implemented with the statistics software, it was possible to reduce the number of concepts. The statistics programme sought out independent or orthogonal concepts and removed the others to leave only 12 to 30 concepts. In the statistics software, researchers were also able to specify the number of required concepts for themselves (Piriyakul, 2012).

This study used the method of measuring satisfaction with the concepts presented by getting respondents to rank the concept cards. Regression analysis least-Squares method was used to estimate the values of satisfaction with the product attributes.

#### ***Determining the Preference Model***

For the five key attributes, the amount of fat marbling in the pork, colour of the pork, cutting/slicing of 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

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) Colour of the pork	(1) Pinkish-grey
	(2) Pinkish-red
	(3) Pinkish-dark red
(3) Slicing of 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 a government agency
	(2) From a private agency
	(3) From overseas
	(4) No certification
(6) Price	(1) 125 Thai baht/kg
	(2) 135 Thai baht/kg
	(3) 145 Thai baht/kg



Table 4: Examples of concepts used in the research

Card ID	Amount of Fat Marbling in the Pork	Colour of the Pork	Slicing of the Pork	Attributes Showing Freshness and Cleanliness of the Pork Products	Standards Certification and Quality Guarantee Labelling	Price (baht 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
27	6%	Pinkish-grey	Cutting/slicing by hand with knife	Somewhat fresh and clean	No certification	125

discrete model. The discrete model method is a method for estimating a utility model in which relationships of satisfaction with attribute levels are independent of each other, that is when changes in attribute levels occur, it is not possible 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, that is when price levels are highly increased, satisfaction values will decrease. The linear model shows relationships of satisfaction to attribute levels that are connected. When changes occur in attribute levels, it is possible to tell which direction the satisfaction obtained will change in a linear fashion (Green *et al.*, 2001).

**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, the methods of logit, probit, hybrid, tobit and ordinary least squares (OLS) would be used. Regarding this, Green and Srinivasan (1978) has stated that

the OLS method is widely popular and can be used to both measure satisfaction in the forms of ranking priorities and giving satisfaction points. Moreover, Darmon and Rouziès (1994) have said that the results obtained from the OLS method have very little distortion compared with other methods.

**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), indicating a strong and significant correlation between the actual and predicted preference ranking data.

Table 5 shows the results of the analysis of the importance values of the product attributes and the utility estimates of each attribute level. It can be seen that standards certification and quality guarantee labelling is the attribute on which restaurateurs place more importance than other attributes, with an importance value of 31.477%. This was followed by the colour of the pork, attributes showing freshness and cleanliness of the fresh pork products, price, amount of fat marbling in the pork and the cutting/slicing of the pork.

Subsequently, the 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 shown in equation (4):

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

From Table 5, it is possible to explain the results of the analysis of each attribute and attribute level as in the following example. When considering the attribute of 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

Table 5: The importance values of the product attributes and utility estimates of the attribute levels

Attribute	Attribute Level	Importance Values	Utility Estimate	Std. Error	t	Sig
Amount of fat marbling in the pork	0% ( $X_{11}$ )	15.423	0.136	0.351	0.534	0.594
	3% ( $X_{12}$ )		0.883	0.351	5.686	0.000*
	6% ( $X_{13}$ )		-1.019	0.420	-3.759	0.000*
Colour of the pork	Pinkish-grey ( $X_{21}$ )	15.806	-2.346	0.351	-10.028	0.000*
	Pinkish-red ( $X_{22}$ )		1.404	0.351	7.267	0.000*
	Pinkish-dark red ( $X_{23}$ )		0.943	0.420	6.339	0.000*
Slicing of the pork	Cutting/slicing by machine ( $X_{31}$ )	5.788	0.200	0.257	1.460	0.148
	Cutting/slicing by hand with knife ( $X_{32}$ )		-0.200	0.257	-1.460	0.148
Attributes showing freshness and cleanliness of the pork products	Very fresh and clean ( $X_{41}$ )	15.796	1.601	0.351	7.046	0.000*
	Somewhat fresh and clean ( $X_{42}$ )		0.719	0.351	4.647	0.000*
	Product does not show great freshness or cleanliness but is edible ( $X_{43}$ )		-2.321	0.420	-8.435	0.000*
Standards certification and quality guarantee labelling	From government agency ( $X_{51}$ )	31.477	1.561	0.385	4.458	0.000*
	From private agency ( $X_{52}$ )		0.086	0.477	0.262	0.794
	From overseas ( $X_{53}$ )		0.687	0.477	1.381	0.170
	No certification ( $X_{54}$ )		-2.334	0.477	-5.582	0.000*
Price	125 Thai baht/kg ( $X_{61}$ )	15.710	-23.577	4.206	-6.689	0.000*
	135 Thai baht/kg ( $X_{62}$ )		-25.463	4.542	-6.689	0.000*
	145 Thai baht/kg ( $X_{63}$ )		-27.349	4.879	-6.689	0.000*
Constant		100.00	37.263	4.485		
Pearson's R (Sig)		0.960 (0.000)				
Kendall's tau (Sig)		0.820 (0.000)				

enquiries with the restaurateurs, they stated that the optimal amount of fat marbling resulted in tender meat, which when cooked, would give the tastiest meat texture. If a t-test has level of significance or P-value < 0.05, this means that the attribute is related to consumer satisfaction in a statistically significant way. Analysis results for other attributes were done using the same method.

Meanwhile, for the attribute of the cutting/slicing of 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 related to consumer satisfaction in a statistically significant way, as the P-value > 0.05, that is whether slicing by machine or by hand with a knife did not cause a significant change in the utility score.

Besides this, it was possible to calculate the utility scores for each concept using equation (4). For instance, in Table 4, concept 1 was 3% fat marbling in the pork, pinkish-dark red in colour, cut/sliced by machine, somewhat fresh and clean, certification by a private agency and 125 Thai baht/kg in price. When the values were put into equation (4), the utility score was obtained from equation (5).

$$U_k = 37.263 + 0.883 + 0.943 + 0.2 + 0.719 + 0.086 - 23.577$$

$$= 16.517 \quad (5)$$

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.

## Conclusion and Discussion

This research has presented methods of combining the Kano model with CA. The first phase of this study was analysis with 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 to perform a CA on all six attributes affecting customer preferences in deciding to purchase fresh pork products. Data was collected from 100 restaurateurs in Chiang Mai, Thailand. The research found that the most important attribute for restaurateurs was showing freshness and cleanliness (fresh and clean), followed by having standards certification and quality guarantees from the government, pinkish-red in color, amount of fat marbling should be around 3%, a price of 125 Thai baht/kg and sliced by machine.

## Limitations of the Study

There are many methods to compile the attributes of a product that may affect consumers' purchase decisions. These include compiling past research, surveying the market and consumer behaviour, inquiring with a sample group or target group, using questionnaires, holding group meetings and recording consumer complaints. This research has compiled attributes of fresh pork products from past studies relating to meat product quality and consumer preferences for various kinds of meat products. This method provides insight into consumer preferences in a short space of time. The attributes obtained are consumer preferences, covering every aspect of the product and have already been screened by other researchers. However, compiling product attributes in this manner may excessively frame or guide consumers too much. Furthermore, the product attributes may not cover the true preferences of customers. Therefore, to obtain additional attributes to get the most coverage and be the most current, there should be parallel interviews of consumers. In this, considerations are that the methods of interview, group meetings or answering questionnaires may be more complicated, requiring time to consolidate ideas as the data are words spoken from feelings and that the data obtained may not yet cover all the topics of the product.

The next limitation from compiling product attributes from past studies is that they yield a large number of attributes and the attributes to which consumers give higher priority cannot be

distinguished. Product designers cannot meet all consumer requirements simultaneously, so product attributes must be prioritised. In this research, the Kano model has been employed to select and rank the attributes of fresh pork products, in which there must not be too many product attributes used in studies with the Kano model. This is because respondents to the questionnaire may get fatigued and dissatisfied with the product instead. However, past studies found that using the Kano model to prioritise and select product attributes used a range of different methods in each research. Besides the Kano model, another method may be used instead, such as the analytic hierarchy process (AHP), to analyse which attribute of the product consumers gave a higher priority. AHP is a comparison of product attributes in pairs. It has the good points of being a clear method in which it is possible to calculate the weight of importance of each attribute clearly. However, in conducting AHP, if there is a large number of product attributes, this can also create confusion for respondents to the questionnaire.

Apart from this, in combining the Kano model with CA, there is a diverse range of approaches to combine the two techniques. In previous research, there were no clear-cut criteria for selecting attributes, but they were adapted to be appropriate for each research. Most previous research proposed bringing together all attributes and categorising them into attribute groups A, O, M, I, R and Q according to the Kano model, then selecting a fewer number of attributes to perform the CA. However, methods to select fewer attributes are also diverse in each study.

### ***Managerial Implications***

When the attributes of fresh pork products affecting the purchase decisions of customers in the hotel segment are known, the case study company may use this data to develop and improve the product to better meet the requirements of hotel operators. The case study company may also specify the marketing strategies suitable for each customer segment.

These data can be used in managing production plans and product marketing, as well as determining product prices, advertising and public relations. Attracting customers to the product eventually enlarges the customer base of hotel operators.

It is also possible to use these data in research to develop and improve the production processes to obtain fresh pork products matching customer preferences among the segment of hotel operators. For instance, a common attribute prioritised by customers was “freshness and cleanliness: Very fresh and clean”. Therefore, the case study company should give priority to product transportation and storage processes to maintain freshness and cleanliness. They should stipulate working practices to staff to make a habit of checking the internal temperature of the fresh pork in the cold room to maintain the temperature at the correct level. They could also install sensors to check the temperature in delivery trucks and if the temperature in a cold room does not meet the stipulated criteria, the system will send an instant alert to the factory or relevant persons for immediate investigation and remedy.

The case study company can also adapt this line of research and its results to other customer segments, such as hotel operators, schools, hospitals and ordinary consumers. A more diverse consumer base may yield different attributes affecting satisfaction in their product purchase decisions, which can also be extended to the company’s other products such as chicken.

### ***Future Research***

As for future research, researchers would collect additional data from questionnaires for restaurateurs. The researchers could also use the same approach in this study to examine the needs of other customer groups such as hotels. This would be to study the attributes affecting customer preferences in deciding to purchase fresh pork products for other groups, which may have differing needs. After this, the Quality Function Deployment (QFD) method would be used to develop products and production

processes by translating customer needs into design requirements or technical features catering to customer needs in each aspect. This should result in products that can better meet customer needs. Finally, this should result in increased market share for the case study company.

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### References

- Berger, C., Blauth, R. E., & Boger, D. (1993). Kano's methods for understanding customer-defined quality. *Center for Quality Management Journal*, 2(4), 3-36.
- Chananontawat, C. (2006). *The Concept testing of a stand-alone hygienic pork retail shop in Mueang District, Chiang Mai Province* [Master's thesis, Chiang Mai University, Thailand] Retrieved from <https://search.library.cmu.ac.th/search/d/index.php>
- Cherdsatirakul, P. (2003). *Marketing mix factors affecting pork meat purchasing of pork meat retailers in Amphoe Mueang, Changwat Chiang Mai* [Master's thesis, Chiang Mai University, Thailand]. <https://search.library.cmu.ac.th/search/d/index.php>
- Chiramethasiri, S. (2014). *Factors affecting consumer's willingness to pay for organic pork in Mueang district, Chiang Mai province* [Master's thesis, Chiang Mai University, Thailand]. <https://search.library.cmu.ac.th/search/d/index.php>
- Choudhury, D. K., & Gulati, U. (2020). Product attributes based on customer's perception and their effect on customer satisfaction: The Kano analysis of mobile brands. *Decision*, 47, 49-60.
- Darmon, R. Y., & Rouziès, D. (1994). Reliability and internal validity of conjoint estimated utility functions under error-free versus error-full conditions. *International Journal of Research in Marketing*, 11(5), 465-476.
- Font-i-Furnols, M., & Guerrero, L. (2014). Consumer preference, behavior and perception about meat and meat products: An overview. *Meat Science*, 98(3), 361-371.
- Green, P. E., Krieger, A. M., & Wind, Y. J. (2001). Thirty years of Conjoint Analysis: Reflections and prospects. *Interfaces*, 31(3), S56-S73.
- Green, P. E., & Rao, V. R. (1971). Conjoint measurement for quantifying judgmental data. *Journal of Marketing Research*, 8(3), 355-363.
- Green, P. E., & Srinivasan, V. (1978). Conjoint Analysis in consumer research: Issues and outlook. *Journal of Consumer Research*, 5(2), 103-123.
- Issanchou, S. (1996). Consumer expectations and perceptions of meat and meat product quality. *Meat Science*, 43(1), 5-19.
- Jaipan, T., & Potchanasin, C. (2016). An analysis of optimal tomato juice product attributes for the consumer in Bangkok metropolis. *Journal of Economics Ramkhamhaeng University*, 2(1), 53-76.
- Jantest, S., Suwonsichon, T., & Suwonsichon, S. (2013). Application of Kano Model for customer need in mango tablets. *Proceedings of the 51st Kasetsart University Annual Conference: Agricultural Extension and Home Economics, Agro-Industry, Bangkok, Thailand*, 346-353.
- Kano, N. (1984). *Life cycle and creation of attractive quality*. <http://www.huc.edu/ckimages/files/KanoLifeCycleandAQCanfigures.pdf>.
- Kunlayanajaree, N. (2008). *Consumer behavior towards purchasing Moo-Sawasdee-branded pork in Chiang Mai province* [Master's thesis, Chiang Mai University, Thailand]. <https://cmu.to/CCsGP>
- Lai, J., Wang, H. H., Ortega, D. L., & Widmar, N. J. O. (2018). Factoring Chinese consumers' risk perceptions into their willingness to pay

- for pork safety, environmental stewardship and animal welfare. *Food Control*, 85, 423-431.
- Leerattanakorn, N. (2011). *Consumer behavior and marketing mix influence on organic vegetable purchase: temperate vegetables in Chiang Mai province* [Master's thesis, Maejo University, Thailand].
- Marin, K. (2008). *Consuming behavior on pork products of consumers in Wiang subdistrict municipality, Fang district, Chiang Mai province* [Master's thesis, Chiang Mai University, Thailand]. <https://search.library.cmu.ac.th/search/d/index.php>
- Matzler, K., & Hinterhuber, H. H. (1998). How to make product development projects more successful by integretating Kano's model of customer satisfaction into quality function deployment. *Technovation*, 18(1), 25-38.
- Meyerding, S. G. H., Gentz, M., Altmann, B., & Meier-Dinkel, L. (2018). Beef quality labels: A combination of sensory acceptance test, stated willingness to pay and choice-based conjoint analysis. *Appetite*, 127, 324-333.
- Min, S. H., Kim, H. Y., Kwon, Y. J., & Sohn, S. Y. (2011). Conjoint analysis for improving the e-book reader in the Korean market. *Expert Systems with Applications*, 38(10), 12923-12929.
- Moeller, S. J. (2013). *Developing a checklist for pork quality*. <https://www.ipic.iastate.edu/PorkBridge/PB0208PorkQuality.pdf>.
- Nantajit, C., Kosuma, J., Thirapong, K., Potchanasin, C., Wattanutchariya, S., & Iemthanon, K. (2020). Characteristics of marketing strategies effect on purchasing roasted coffee beans of coffee shop owners case study Mueang District, Chiang Mai Province. *Journal of the Association of Researchers*, 25(2), 153-161.
- Ngapo, T. M., Rubio Lozano, M. S., & Braña Varela, D. (2018). Mexican consumers at the point of meat purchase. Pork choice. *Meat Science*, 135, 27-35.
- Nunthasen, K., & Nunthasen, W. (2020). Thai consumers' willingness to pay for organic Cavendish banana in smart label packaging in Chiang Mai province. *Journal of Humanities and Social Sciences Thonburi University*, 15(1), 70-79.
- Papanagiotou, P., Tzimitra-Kalogianni, I., & Melfou, K. (2013). Consumers' expected quality and intention to purchase high quality pork meat. *Meat Science*, 93(3), 449-454.
- Piriyakul, M. (2012). Conjoint analysis. *Ramkhamhaeng Journal*, 29, 252-272.
- Pongwiritton, R., Pakvipas, P., Nithisathain, K., Thopanich, J., & Srichum, S. (2018). The guidelines for the design and development of cereal grain product according to the needs of the customer by applying the Kano Model. *Journal Panyapiwat*, 10(1), 15-28.
- Suzianti, A., Faradilla, N. D. P., & Anjani, S. (2015). Customer preference analysis on fashion online shops using the Kano Model and conjoint analysis. *International Journal of Technology*, 6(5), 881-885.
- Tahkomtib, J. (2011). *Consumers preference for attributes of fresh chicken sold in modern retail stores in Chiang Mai province* [Master's thesis, Chiang Mai University, Thailand]. <https://search.library.cmu.ac.th/search/d/index.php>
- Wang, C., & Wu, C. (2014). Combining conjoint analysis with Kano Model to optimize product varieties of smart phones: A VIKOR perspective. *Journal of Industrial and Production Engineering*, 31(4), 177-186.
- Wu, L., Wang, S., Zhu, D., Hu, W., & Wang, H. (2015). Chinese consumers' preferences and willingness to pay for traceable food quality and safety attributes: The case of pork. *China Economic Review*, 35, 121-136.
- Yamane, T. (1967). *Statistics: An Introductory Analysis* (2nd ed.). New York: Harper and Row.