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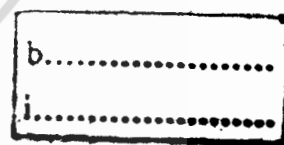
**COMPARISON OF CHOICE-BASED CONJOINT ANALYSIS
AND ANALYTICAL HIERARCHY PROCESS IN CONSUMER
PREFERENCE OF DOG FOOD**



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หัวข้อวิทยานิพนธ์ การเปรียบเทียบเทคนิควิเคราะห์องค์ประกอบร่วมแบบทางเลือกและ
เทคนิคลำดับชั้นเชิงวิเคราะห์ต่อความชอบของผู้บริโภคอาหารสุนัข
สำเร็จรูป

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บทคัดย่อ

งานวิจัยนี้มุ่งเน้นศึกษาความชอบของผู้บริโภคที่มีต่ออาหารสุนัขสำเร็จรูป โดยเปรียบเทียบเทคนิคการวิเคราะห์องค์ประกอบร่วมแบบทางเลือก (Choice-Based Conjoint Analysis: CBC) และเทคนิคลำดับชั้นเชิงวิเคราะห์ (Analytical Hierarchy Process: AHP) ในการประเมินความชอบของผู้บริโภคที่มีต่ออาหารสุนัขสำเร็จรูปในเขตกรุงเทพมหานครและปริมณฑล จากการรวบรวมข้อมูลความชอบผู้บริโภคด้วยแบบสอบถามทั้งสองเทคนิค ต่อลักษณะที่สำคัญของอาหารสุนัขสำเร็จรูปคือ รูปแบบอาหารสุนัขสำเร็จรูป (อาหารสุนัขแบบกระป๋อง แบบซองแพวซ์ และแบบเม็ด) ราคาอาหารสุนัขสำเร็จรูปต่อ 1 กิโลกรัม (85 บาท 135 บาท และ 165 บาท) คุณภาพของอาหารสุนัขสำเร็จรูป (คุณภาพระดับท้องถิ่น คุณภาพทั่วไปทางการค้า และคุณภาพพิเศษเฉพาะ) และคุณค่าทางโภชนาการ มีสารอาหารครบถ้วน บำรุงสุขภาพขนและผิวหนัง และเป็นที่ชื่นชอบของสุนัข) ผลการศึกษาพบว่า การใช้เทคนิควิเคราะห์ทั้งสองวิธีสามารถอธิบายค่าความสำคัญของลักษณะอาหารสุนัขสำเร็จรูปต่อความชอบ โดย แสดงในรูปแบบของค่าความสำคัญเปรียบเทียบ (relative importance) และลำดับความสำคัญของแต่ละลักษณะ (ranking score) โดยพบว่าลักษณะที่สำคัญที่สุดต่อความชอบของผู้บริโภค คือ คุณภาพพิเศษเฉพาะ ลักษณะสำคัญที่ทำให้ผู้บริโภคให้ระดับความชอบเพิ่มขึ้น ได้แก่ บำรุงสุขภาพขน และผิวหนัง มีสารอาหารครบถ้วน และ อาหารสุนัขแบบเม็ด ตามลำดับ ส่วนลักษณะที่ทำให้ผู้บริโภคให้ระดับความชอบลดลง ได้แก่ อาหารสุนัขแบบกระป๋อง อาหารสุนัขแบบแพวซ์ คุณภาพทั่วไปทางการค้า เป็นที่ชื่นชอบของสุนัข และคุณภาพระดับท้องถิ่น ตามลำดับ แต่อย่างไรก็ตามลักษณะทางด้านราคาไม่มีผลต่อระดับความชอบ

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จากการเปรียบเทียบเทคนิควิเคราะห์ทั้งสอง พบว่าเทคนิควิเคราะห์องค์ประกอบร่วมแบบทางเลือกสามารถแสดงลักษณะบางลักษณะที่มีอิทธิพลหลักต่อความชอบของผลิตภัณฑ์เป็นพิเศษ (overestimation) เมื่อแนวคิดของผลิตภัณฑ์ประกอบด้วยลักษณะทางด้านคุณภาพพิเศษเฉพาะ ทำให้ผู้บริโภคมีความชอบเพิ่มขึ้นหากแต่คำนึงถึงคุณลักษณะอื่นของผลิตภัณฑ์ลดลง แตกต่างกับเทคนิคลำดับชั้นเชิงวิเคราะห์ซึ่งมีข้อดีทางด้านความสามารถประเมินความชอบของผลิตภัณฑ์ที่ประกอบด้วยลักษณะ และระดับของลักษณะจำนวนมาก และสามารถตรวจสอบความสอดคล้องในการตอบแบบสอบถามของแต่ละบุคคล (individual consistency) อย่างไรก็ตามเทคนิคทั้งสองสามารถอธิบายถึงลักษณะที่สำคัญของอาหารสุนัขที่มีผลต่อความชอบของผู้เลี้ยงสุนัข และช่วยให้นักพัฒนาผลิตภัณฑ์สามารถสร้างผลิตภัณฑ์ที่มีศักยภาพตรงตามความต้องการของผู้บริโภค



| | |
|-----------------------|--|
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ABSTRACT

This research focused on accessing the consumer preferences on dog food product by comparing two different methods of Choice-Based Conjoint Analysis (CBC) and Analytical Hierarchy Process (AHP). In this study, the CBC and AHP questionnaires were conducted to elicit information on the consumer who resides in Bangkok and suburban areas, regarding four attributes (format, price, quality brand and nutrition) with three elements of dog food (canned dog food, pouch dog food, dry dog food for format; with pricing 85, 135, 165 Baht per 1 Kg; unbranded quality, commercial quality, premium quality for quality brand; fulfilled nutrition, silky hair and skin condition, dog's preference for nutrition). Both methods had successfully demonstrated the potential to measure the consumer preference by estimating the relative importance and ranking scores of attributes on dog food product. The results from CBC and AHP suggested that "premium quality" was the most important element to increasing of preference score, followed by "silky hair and skin condition", "fulfilled nutrition" and "dry dog food" respectively, while these elements of "canned dog food", "pouch dog food", "commercial quality", "dog's preference" and "unbranded quality" would associate the lowering preference score of the product. There was no difference in preference score corresponding to "price" element. The comparison of CBC and AHP analysis from this research showed that CBC trended to be overestimated when valuing the complex good because it was found that the "premium" element included in the product profile led the respondents to give increasing of preference but ignoring the rest other elements. In contrast, AHP showed the less constraint for amount of attributes and the consistency could be checked individually for each respondent. This study provided useful insights, high-potential product identification and consumer preference trends on dog food product.

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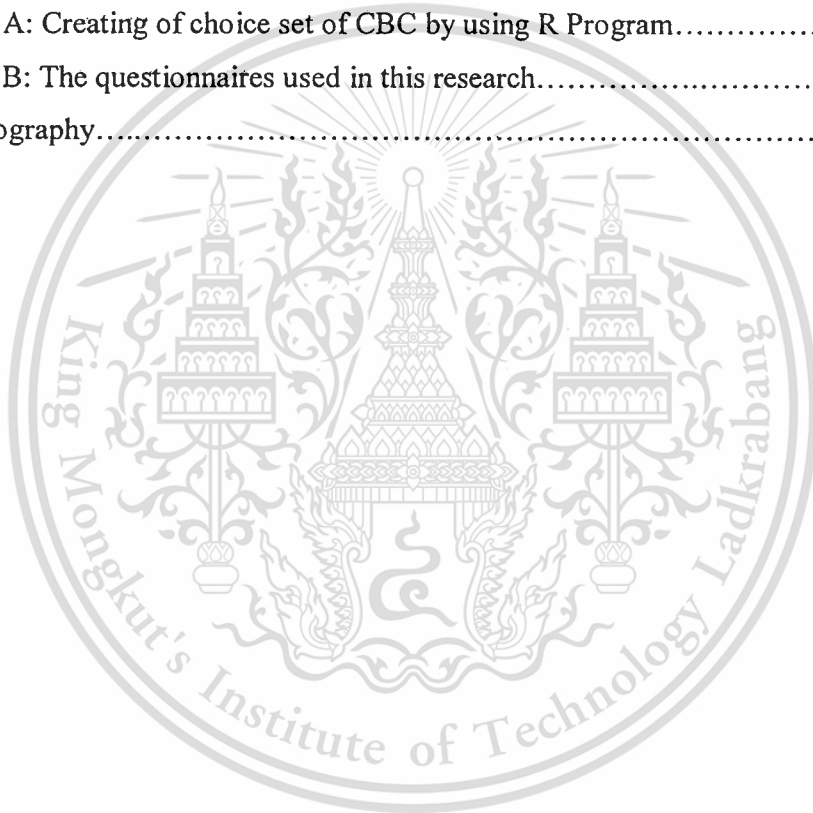
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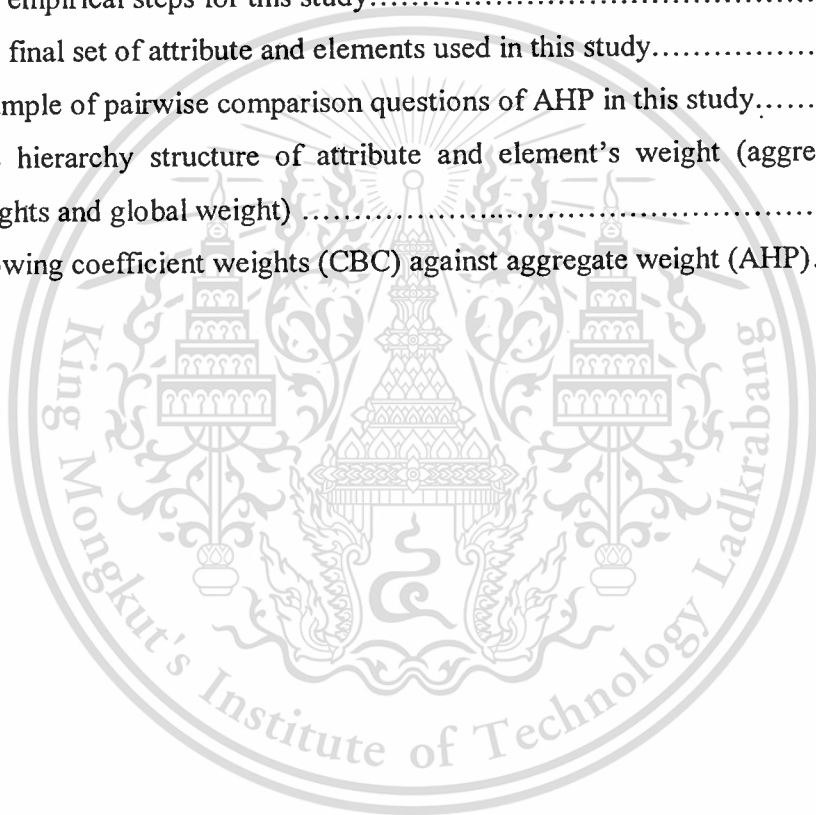


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CHAPTER 1

INTRODUCTION

1.1 Background

The pet food market has been considered to grow positively in Thailand. In 2011, the Bank of Thailand (BOT) had reported the export value of pet food product compared to the previous year from 25,402 to 28,148 million Baht or increased up to 10.81 %. Furthermore, in 2012 the export value had dramatically increased to 34,200 million Bath (Prachachard Bussiness, 2013) or increased around 4,399 million Bath annually. The consumption of dog food in Thailand had been continually growth due to the global trends from consumer forward to dog food products. Many studied reported the increasing consumption of dog food was driven by humanization and premiumisation trend. Similar to human trend, the dog owners consider the dog as one of important members of family. They now believe that the food feed their dogs should be as good as the food they consume themselves, which is better quality and healthier product (Agriculture and Agri-food Canada, 2010; Euromonitor International, 2012). In addition of expansion of urban life style, consumers were increasing their demands on the products, which are wide availability products and convenience to use (Naksuwan, 2006; Euromonitor International, 2013). Increasing of these demands, the pet food manufactures need to focus on product innovation and product development. Consequently, the researchers need to understand the relevant characteristics of dog food that corresponding to the consumer preference in order to improve the characteristics of product and develop innovative products. The evaluation of consumer preferences on products will provide product developers useful insight, identify high-potential products concept and explain gross trends in each attribute influence to consumer preferences.

Similar to the infant, the dogs lack the linguistic capabilities to express themselves and they have their owners to determine the food acceptable before serving (Koppel, 2014). Most studies about the dog food in Thailand have been conducted the questionnaires to relate the buying behavior and preference of consumers and to typically inquire about gender, aged, income, educational level,

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marital status, occupation, number of pet and the consumer attitudes forward dog food products. However, most of studies did not provide adequate information about dog food oriented to product development. This result showed the importance of studying product attributes of dog food on the owner preferences.

Recently, many studies have been used Choice-Based Conjoint analysis (CBC) and Analytical Hierarchy Process (AHP) to measure consumer preferences by using questionnaires to determine the main factors of product and identify the potential product concepts on consumer preferences. Meißner and Decker (2009) conducted a study about coffee brewer machine and tried to relate the 6 products' characteristics to the preference (price, brand, material, design, system and price per cup of coffee). They found that the lowest price (99 Euro), price of 12 cent per cup and stainless steel material were what the consumer would prefer and were the main factors. Their results also showed the similar result determined by CBC and AHP on individual of attribute level. Another study was conducted by Kallas et. al. (2011) used the CBC and AHP to acquire about importance of origin, format, brand and price on rabbit meat preference. They found that the relative importance attributes of rabbit meat products that consumer preferred were entire rabbit meat format, origin from Catalonia region and quality brand. Then both methods had shown the possibility to measure the preference of complex products. It is very interesting to study the link between dog food characteristics toward the owner preferences by using both methods to provide additional information to pet food manufactures and product developers.

Therefore, the aims of this research were to study consumer preferences by using two different methods, Choice-Based Conjoint Analysis and Analytical Hierarchy Process. Both methods have been used to acquire the relevant importance of product characteristics on the owner preferences. Accessing the dog food preferences would provide the relative importance of dog food attributes from perception of dog owners toward the dog food products.

1.2 Objectives of research The objectives of this study were

- 1.2.1 To study the dog food preferences by using Choice-Based Conjoint Analysis
- 1.2.2 To study the dog food preferences by using Analytical Hierarchy Process
- 1.2.3 To compare results between Choice-Based Conjoint Analysis and Analytical Hierarchy Process

1.3 The scope of the research

This study was focused on measuring the consumer preference on the dog food product. The CBC and AHP questionnaire were conducted to determine the main factors and relative importance of attributes and elements. The target consumer was the dog owner who resided in Bangkok and suburban district area. In addition, the respondents were chosen to do the questionnaires by asking about their dog food buying behavior (the dog owner aged more than 15 years old who usually treats their dog by pet food product)

1.4 Research and methodology

1.4.1 Identify and screening attributes

The first step was to review the literatures in order to identify attributes of the dog food that may affect consumer preference. The list of selected attributes was re-checked to the dog food that available in local market place. Then, the main important attributes from previous research were selected by considering the amount of attributes that could be measured effectively. Moreover, the guided for analyzing CBC and AHP data also were reviewed and the R statistical program (R Development Core Team, 2010), additional software packages had been acquired.

1.4.2 Define the target respondent

After a list of attributes was identified, the second step was to define the target respondents. In this study, the target respondents were the dog owner who lived in Bangkok and suburban area. In order to obtain the consistent of target group, the consumer who attended pet exhibition venues was chosen. Thus, before doing the consumer survey, the request of permission needs to be prepared and send to exhibitors for consideration.

1.4.3 Creating the questionnaire

The questionnaire was divided into three parts (demographic data, CBC and AHP questionnaire). The questions of demographic data typically inquire about gender, aged, income, educational level, marital status, occupation, number of pet and the consumer attitudes forward dog food products. For CBC questionnaire, R statistical program (R Development Core Team, 2010) with Algdesign package (Wheeler, 2011b) were used to create the alternatives and choice set by fractional factorial experimental design. For AHP questionnaire, simple pairwise comparison $(n - (n-1))/2$ to create the choice set was conducted.

1.4.4 Developing the questionnaire

To ensure that respondents understand the each part of questionnaires, the questionnaire was developed by conducting a pilot study. The demographic data, CBC and AHP questionnaires were tested by small group of consumers ($n= 40$) who attended the pet exhibition venue. The respondent's opinions were used to develop the form of questionnaire and the description of dog food attributes.

1.4.5 Data collecting and data analysis

The developed questionnaires (demographic data, CBC and AHP) were used at the pet exhibition venue. After gathering the questionnaire of all respondents, the demographic data, CBC and AHP data were converted into data

file in excel program as one of statistical programs conducted to analyze the data. The relative importance of attributes and elements was determined. For CBC, the relative importance of elements within each attribute was determined by coefficient value in condition logistic model. For AHP, the relative importance of attribute and element was determined by priority weight with main eigenvector and geometric mean.

1.4.6 Presentation the results

The demographic data were reported as the table of frequency and percentage. For CBC, the relative importance of attributes and elements was shown in the table of coefficient values and utility equation. For AHP, the weight importance of attributes and elements was demonstrated by aggregate weight and global weight in hierarchical structure. The results from both methods were compared and reported in a table of relative importance of attribute and level. At final, ideal concept of dog food was identified.

1.5 The expected benefits

- 1.5.1** Elicitation the relevant importance of dog food attributes and to identify the potential concept that affected the consumer preferences by using CBC and AHP method.
- 1.5.2** Comparing the results between both methods and knowing the advantage and disadvantage of using CBC and AHP methods for measuring the preference of dog food product.
- 1.5.3** Knowing the main important attributes and ideal potential product concepts would provide product developer an insight and useful information for improving existed products and creating the innovative products.
- 1.5.4** The results obtain from CBC and AHP can be used as guide line for product development as the high potential responding to consumer preference.

1.6 Glossary of terms used in this research

Canned dog food The moist food or wet food high in water content, usually 60% to 70% of moisture content, packed in can container and go through the process of sterilized in retort to kill the pathogenic bacteria. In addition, canned dog food requires the addition of starch or gums to maintain the consistency.

Commercial quality The dog food that is produced by using the by-product of animal organs which has moderate of protein content.

Dog food The food product that eaten by or intended to be eaten by domesticated dogs.

Dog's preference The characteristic of dog food product which has the flavor that preferred by dog.

Dry dog food The dog product that is low in water content from 9% to 12 %, usually formed through a process called extrusion or though baking, flaking, pelleting and crumbling of foods to achieve a dry form.

Fulfilled nutrition The dog food which is formulated to provide dogs with nutritional that adequate for requirements of dog.

Format The types of dog food product. In this study, format of dog food is separated into three types, canned dog food, pouch dog food and dry dog food.

Pouched pet food The moisture food or wet food that is high in water content (60 to 70%), contained in the pouch packaging.

Unbranded quality The dog food that is produced from low content of protein. This kind of quality usually added ingredients with bones and blood of animals.

Premium quality Dog food that produced by using ingredient that high in protein content and uses the same grade as the human food or better.

Silky hair and skin condition The dog food product providing the specific function that nourish the dog's hair and skin.

Source : Chanworachet, 2003; Udomwansuktawi, 2005; Zicker et.al, 2008; Sornlam, 2008



CHAPTER 2

LITERATURE REVIEW

Dog food product is one of most important product in Thailand. The measurement the preference of dog food product is still challenge since the dog lack of linguistic capabilities to express themselves and pets have their owner to determine if the food is acceptable before serving (Koppel, 2014). Many studies about the dog food in Thailand have been conducted the consumer-level questionnaires to relate the buying behavior and preference of consumers, and to typically inquire about gender, aged, income, educational level, marital status, occupation, number of pet and the consumer attitudes forward dog food products.

However, most of studies did not provide adequate information about dog food oriented to product development. This result showed the importance of studying product attributes of dog food on the owner preferences. Understanding the main importance attribute provided the pet food manufacture and product developer additional information, in order to improve exist product and create the innovative product.

In recently, many studies have been used Choice-Based Conjoint analysis (CBC) and Analytical Hierarchy Process (AHP) to measure consumer preferences by using questionnaires to determine the main factors of product and identify the potential product concepts on consumer preferences. Meißner and Decker (2009) conducted a study about coffee brewer machine and tried to relate the 6 products' characteristics to the preference (price, brand, material, design, system and price per cup of coffee). Another study was conducted by Kallas et. al. (2011) used the CBC and AHP to acquire about importance of origin, format, brand and price on rabbit meat preference. Both studies have shown the potential to measure the consumer preference in term of relative importance of attributes and elements Moreover. CBC and AHP have shown the possibility to measure the preference of complex products. It is very interesting to study the link between dog food characteristics toward the owner preferences by using both methods to provide additional information to pet food manufactures and product developers.

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2.1 Conjoint Analysis (CA)

Conjoint analysis is a technique for measuring psychological judgments. It has been used frequently in marketing research to measure consumer preferences. CA also is called trade-off analysis (Raz et al., 2008). CA has been used in various fields such as new product planning for determining the preference effect of innovation, improvement existing product, pricing policies, advertising and distribution fields (Gustafsson et al., 2007). This method is extensively used in marketing research to evaluate industrial products and services and is being increasingly used in the study of food choice by consumers (Raz et al., 2008). The reasons of this growth are introduction of efficient, easy-to-use, reliable, and preferable and are also commercially available software and estimation approaches that produce estimates on individual level (Halme and Markku, 2011).

The typical objectives of CA study are as follows (Raz et al., 2008):

- to measure the importance for consumer of the various attribute for the definition of a product (i.e. the formulation, the brand or the type of packing)
- to measure the respective utilities of the levels or elements taken by a given attribute for the consumers. The level of an attribute is either a degree of intensity or an option (i.e. the valorization of a brand compared to others considered to be less attractive)
- to describe and quantify the prospect customers for a given product
- to determine the characteristics of an ideal product for a group of consumers.

Conjoint analysis (CA) has been marketer's favorite methodology for eliciting consumer preferences. Ranking, rating and choice-based types of CA have been developed as well as different techniques to estimate part-worth utilities (Meißner and Decker, 2009). After identifying relevant attributes from consumer interviews, the basis of approach is to define realistic elements (or levels) for each of these attributes, combining them into a factorial design. The attribute combinations are derived from the factorial design define a set of product concepts or profiles to be

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tested. A survey is then conducted where respondents are confronted with the product profiles in the form of a verbal description and/or pictures and ask to indicate respondent preferences (Jaeger and MacFie, 2010). The preferences will be explained and predicted by estimating all product concepts in which varied specific attributes. The products are evaluated by respondents to measure the consumer preferences. Accordingly, each product profile is assigned with a specific overall benefit value. The estimation of each attributes (partial benefits) that make to overall preference by using logistic regression approach considering product attributes, which will be estimated for utility score (Haaijer and Wedel, 2007).

Conjoint analysis produced two important results (Chee, 2004) below:

- Utility of attribute: is a numerical expression of the value consumer place in an attribute level or element. It represents the relative “worth” of the attribute. Low utility indicates less value, high utility indicated more value.
- Relative importance or priorities weights: It can be calculated by examining the difference between the lowest and highest utilities across the level or element of attribute.

There are two different methods in types of conjoint analysis when considering the data requirements (Jaeger and MacFie, 2010). The traditional method called “conjoint analysis” (CA) is a method which needs the respondents to rate or rank the product profiles in the metric scale in term of preference, and another method called “choice-based conjoint analysis” (CBC) is the method, which the questions are designed in order to provide respondents choose the most preference choice among alternative choices that offered.

CBC approaches have recently increased in popularity (Halme and Markku, 2011) because CBC was created to overcome several critical assumptions inherent in the CA design that could lead to incorrect predictions. CBC seems to be more realistic and natural for respondents including ability to modeling interaction, cross-elasticity and multiple constant alternatives (Kallas et al., 2011). Moreover, CBC has some advantages when it is compared with traditional conjoint analysis (CA). The choice sets of CBC are more realistic than ranking or rating task of CA, so respondents can evaluate a large number of profiles (Haaijer and Wedel, 2007).

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Because of its realism in mimicking individual choice processes, CBC is most often used in market simulations to predict market shares and used to develop pricing strategies (Meißner and Decker, 2009).

2.2 Choice-Based Conjoint Analysis (CBC)

As mention above, the CBC is one of most methods frequently used in the exploration of consumer preferences. The CBC can be applied to “complex goods” that comprise with several attributes and elements as well as CA, such as food products (Kallas et al., 2011; Meißner and Decker, 2009). The advantage of CBC method is created for overcome several critical assumptions inherent in the conventional method (CA) that could lead to incorrect prediction by rating or ranking score (Kallas et al., 2011). Moreover, the task of CBC method seems to be more realistic and natural for respondent to make a decision on buying products since the CBC simulates what the consumer actually do in market place. The consumer doesn't face only one product they prefer but many competitive products on the shelf.

2.2.1 The structure of choice set in CBC

In the CA, all product concepts were presented to the respondents to rating or ranking on their preference, while in the CBC the product concepts were formed into a choice set. In addition, the product concept is constructed from product attributes and its levels or elements and each product concept is also called “alternative choice” (Haaijer and Wedel, 2007). In empirical analysis, CBC method offers choice sets which have two or more “alternative choice” to respondents. The choice sets are generated by experimental design typically is fraction factorial design (Aizaki and Nishimura, 2008; Kallas et.al., 2011; Aizaki, 2012). Respondents are asked to choose only one alternative choice that they most prefer in each choice set. The example of choice set is shown in the **Table 2.1**.

Table 2.1 an example of a choice set in CBC

| Attributes | Alternative “A” | Alternative “B” | Alternative “C” |
|----------------|----------------------------|----------------------------|----------------------------|
| Format | Dry | Pouch | Neither dog’s |
| Price per 1 kg | 135 baht | 165 baht | pet food A nor B |
| Quality Brand | Unbranded | Commercial Brand | is preferred |
| Nutrition | Fulfilled nutrition | Dog preference | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |

In addition, a based-alternative choice called “no-choice” is often added to each choice set. An advantage of the choice-based approach is that this based-alternative choice for product is under qualified for consumer preference (Haaïjer and Wedel, 2007). However, it should be noted that respondents may choose “no-choice” because the element they expected is not included in the alternative of choice set. Furthermore, a reason to choose the “no-choice” maybe means that respondents are not interested at all to do the task. Finally, it may find that the choice is too difficult and may choose the “no-choice” if they don’t spend more time on the choice task in order to avoid the difficult choice. In these cases, researchers need to be careful how to interpret the estimated no-choice probability (Haaïjer and Wedel, 2007).

2.2.2 The methodology of CBC

The CBC methodology is based on Lancaster’s Theory of Value which stated that utilities for products or services can be decomposed into separable utilities for their attributes (Kallas, 2011) and Random Utility Theory (McFadden, 1973) where the utility is divided into two components, systematic and random component (Aizaki and Nishimura, 2008). The systematic component is the utility value that is measurable or observable from the empirical study and the random component or error term is the utility value that unobservable from the empirical study. The comparison of this indirect utility functions (systematic and random) can be determined where respondent choose the alternative that leads to the higher level of

utility (Ryan and Gerard, 2003). The utility function of individual n for alternative i is presented as **Equation 2.1** below:

$$U_{in} = V_{in}(Z_i) + \varepsilon_{in} \quad (2.1)$$

Where U_{in} represent the utility value provided by alternative i for individual n , V_{in} is the systematic component or measurable component of utility, Z_i is a vector of attributes of alternative such as “format”, “price”, “quality-brand” and “product”. ε_{in} is the random term error or unobservable factors (Ryan and Gerard, 2003; Kallas et.al, 2011). The probability that individual n choose the alternative i denoted by $\Pr(i | C_n)$ rather than the alternative j or utility of alternative i (U_{in}) is greater than utility of alternative j (U_{jn}) is represented in **Equation 2.2** and it can be transformed into **Equation 2.3** as below:

$$\Pr(i | C_n) = \Pr [U_{in} > U_{jn}] = \Pr [V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}] \quad (2.2)$$

$$\Pr(i | C_n) = \Pr [V_{in} - V_{jn} > \varepsilon_{jn} - \varepsilon_{in}] \quad (2.3)$$

The probabilities of individual n will choose alternative i or denoted by $\Pr(i | C_n)$, is given by the probability of the error difference ($\varepsilon_{jn} - \varepsilon_{in}$) is smaller than difference in the systematic utility ($V_{in} - V_{jn}$). The Conditional Logistic (CL) model is commonly used for determine the utility function from the choice-based data (Ryan and Gerard, 2003; Kallas et al., 2011). According the CL model, the functional form of the systematic utility function is assumed by linear utility function (Ryan and Gerard, 2003) as follow.

$$V_{in} = ASC + \sum_k^k \beta_k X_k \quad (2.4)$$

$$\text{Or } V_{in} = ASC + (\beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_{ki}) \quad (2.5)$$

Where V_{in} is the systematic utility of alternative i for individual n ASC is Alternative specific constant, $\sum \beta_k X_k$ is summation of all the coefficient of attribute X_k and $i = 1, \dots, I$ represent the number of alternative. Finally, it can be assumed that the relative values of coefficient is the weight of choosing the higher utility product and related to the consumer preference (Colombo et.al, 2009). The utility function in basic Condition Logistic model for dog food attributes is given by the **Equation 2.6**

$$\begin{aligned}
 \text{Utility score} = & \beta_{\text{CAN}} (\text{CAN}) + \beta_{\text{POU}} (\text{POU}) + \beta_{\text{DRY}} (\text{DRY}) + \beta_{\text{PRI}} (\text{PRI}) \\
 & + \beta_{\text{UNB}} (\text{UNB}) + \beta_{\text{COM}} (\text{COM}) + \beta_{\text{PRE}} (\text{PRE}) + \beta_{\text{FUL}} (\text{FUL}) \quad (2.6) \\
 & + \beta_{\text{SIL}} (\text{SIL}) + \beta_{\text{DOG}} (\text{DOG})
 \end{aligned}$$

2.3 Analytical Hierarchy Process (AHP)

The AHP is a decision support tool which is known as multiple-criteria decision-supporting approach developed by Thomas Saaty in the early 1970. The AHP is a decision support tool which can be used to solve the complex decision problem. This method has been applied extensively in many diverse research areas due to its properties. In the session of doing the questionnaire, the information from the decision-maker or respondent is rather easy to obtain due to pairwise comparison and the simple requirement for mathematical calculation (Triantaphyllou and Mann, 1995). The AHP aims to decompose a complex decision problem or objective problem at the top into a multi-level of hierarchical structure. It decompose the objective problem into predefine number of product attribute (level 1) and level or element corresponding to each attribute (level 2) (Kallas et al., 2011) and alternative at the bottom level of hierarchical structure for guiding the best alternative to solve the objective problem. Some researchers conducted the AHP as a tool for studying the decision making such as the studying of buying decision (Vargas and Thomas, 1981), planning decision (Leung et al, 1998), and elicit the individual preference (Colombo et al, 2009).

2.3.1 The structure of decision problem in AHP

The structure of the objective problem or decision problem in AHP approach consist of number of criteria or attribute n | ($n \in 1, \dots, N$) at level 1, number of sub-criteria or element p | ($p \in 1, \dots, P$) at level 2 and alternative M | ($m \in 1, \dots, M$) at the bottom or level 3. The AHP structure can be presented by the multi-level

hierarchical structure as **Figure 2.1** The relative weight of each decision criteria can be estimated by principle of eigenvalue to determine the best alternative for decision making (Triantaphyllou and Mann, 1995).

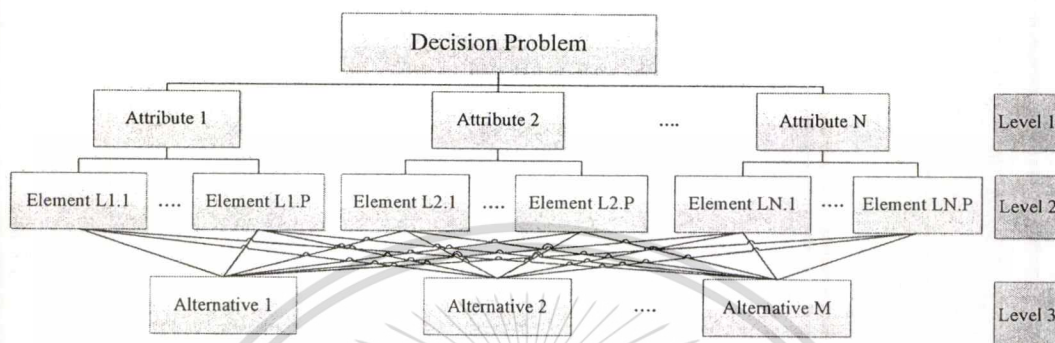


Figure 2.1 The hierarchical structure of a decision problem (Modified from Fogliatto and Susan, 2003)

Due to the main uniqueness of AHP method is the capability on weighting a great number of difference nature attributes (Triantaphyllou and Mann, 1995), such as comparing between product attributes and marketing attributes. Some studies applied the AHP for accessing the relative important by weighting score regardless finding the best alternative for the objective problem. They focused only on the weighting the relative important of attributes and elements. The study of Meißner and Decker (2008) conducted the AHP for determine the main attribute of coffee machine on consumer preferences. Another study of Kallas et al (2011) applied the AHP to access individual preference in rabbit meat comparing the CBC method for product development. Following this study, one may be interested to determine only the relative weight of attribute and element and the AHP method can be used without alternatives.

As mentioned above. The AHP uses a multi-level hierarchical structure of objective problem, attributes and elements by decomposing the decision problem into constituent sub-problem (Triantaphyllou and Mann, 1995). AHP estimated the relative importance weight for attributes and elements in order to explain individual behavior in choosing the preference product as objective problem (Kallas et al, 2011). Therefore, in order to measure the effect of attributes and elements on the preference,

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the pairwise comparison between criteria is conducted to obtain the weight of importance of the attributes and elements by determining the aggregate weights, In addition the ranking score of each elements, it can be obtain by calculating the global weight.

2.3.2 The methodology of AHP

The AHP allows determination the relative importance on the product attribute and element of the complex goods. The consumer preferences were evaluated following a hierarchical structure (Kallas et al., 2011). Six steps were recommended in using the AHP to solve a problem objective and determine the weight importance of attributes and ranking scores (adapted from Leung et al., (1998); Triantaphyllou and Mann, 1995; Kallas et al., 2011).

Step 1 : Defining the objective problem, attributes and element

This step is to define the objective problem, attributes and elements in hierarchical structure of decision problem.

Step 2 : Pairwise comparison

After creating the hierarchical structure of attribute and element, the comparison matrix of individual k are created by conducting the pairwise comparison of attribute N and element P .

Step 3: Estimating the individual important weight for attribute and element

The comparison matrices of each level (attributes and elements) are analyzed to estimate the importance weight of attributes N and elements P for individual k (W_{nk} , W_{pk})

Step 4: Consistency check for individual

One of the advantages of AHP method, the AHP allows the checking for consistency of pairwise comparison for each respondent.

Step 5: Determine the aggregate weight for attributes (W_{an}) and elements ($W_{La,p}$)

This step is to determine relative important of attributes and elements to represent the consensus or agreement for all respondents.

Step 6: Determine the global weight ($WG_{La,p}$) for elements

With the aim to measure and rank the weights for elements of each attribute. The global weights need to be calculated.

2.3.2.1 Defining the objective problem, attributes and elements

This step is to define the objective problem, attributes and elements in hierarchical structure of decision problem. In food product development study, the objective problem typically is the determining the most preferred product from a set of product criteria which is at the top of the multi-level of hierarchical structure. The objective problem is decomposed into predefine number of attribute N (level 1) and their corresponding element P (level 2). The demonstration of hierarchical structure of food product is represented in Figure 2.2 as below.

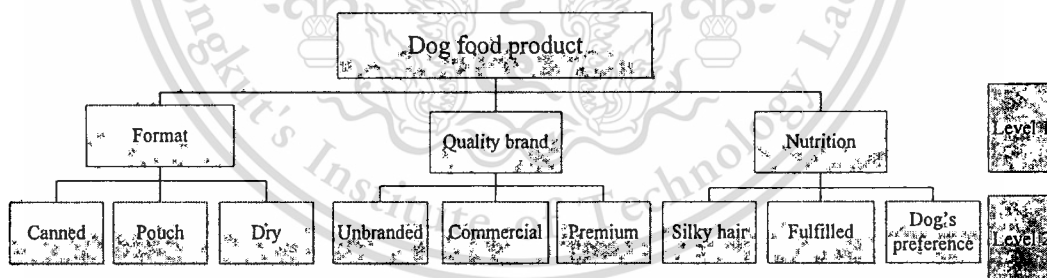


Figure 2.2 The hierarchical structure for food product

(Modified from Tengponsathorn and Phaosathienpan, 2012)

2.3.2.2 Pairwise comparison

After defining attribute and element for the structure of decision problem, the next step it is to conduct the pairwise comparison. The pairwise

comparison is important step to implement the AHP. The aim of pairwise comparison step is to measure the relative importance of attribute and element. From the structure decision problem in **Figure 2.2**, the objective problem in AHP is to quantify the important of an attribute over another in determining the preference of product. The values of the pairwise comparisons in the AHP are determined regarding to the scale introduced by Satty (Triantaphyllou and Mann, 1995). Saaty (1980) introduced a nine point scale for measuring the intensity of important for determining the preference by means of verbal judgments as shown in **Table 2.2**

The pairwise comparison step in AHP carries out the questionnaire to obtain the data from respondent where individuals are asked to rate the important of an attribute over another. The example of pairwise comparison is demonstrated in **Figure 2.3**. In addition, each respondent is asked to determine the total number of questions $N(N-1)/2$ and $P(P-1)/2$ for attribute (level 1) and element (level 2) respectively. According to the structure of decision problem in **Figure 2.2**, the number of attribute and element are equal to 4 and 3. Thus each respondent has to rate the pairwise comparison with the total number question equal to $[4(4-1)/2] + [3(3-1)/2 * 4] = 18$ questions.

Table 2.2 The 9 point scale of The AHP (Modified from Saaty, 2008)

| Intensity of importance | Definition of scale | Explanation |
|-------------------------|---|---|
| 1 | Equal importance | Two attributes are equally important to the objective |
| 3 | Moderate importance | The attribute is slightly important over another |
| 5 | Strong importance | The attribute is strongly important over another |
| 7 | Very strong importance | The attribute is very strong importance over another |
| 9 | Extreme importance | The attribute is extremely important over another |
| 2,4,6,8 | Intermediate values between the two adjacent scores | |

In your opinion, what is the most importance to you when buying dog food in market?

| | | | | |
|--|----------------------|--|----------------------|--|
| | More importance than | | Less importance than | |
|--|----------------------|--|----------------------|--|

Question 1

| | | | | | | | | | | | | | | | | | | |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---------|
| format | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | quality |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---------|

Question 2

| | | | | | | | | | | | | | | | | | | |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|
| format | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | nutrition |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|

Question 3

| | | | | | | | | | | | | | | | | | | |
|---------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|
| quality | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | nutrition |
|---------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|

Figure 2.3 The sample of AHP questions.

From the answer provided by individual, the values for pairwise comparison are the number of the set: $\{9, 8, 7, 6, 5, 4, 3, 2, 1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7, 1/8, 1/9\}$ from left to right side respectively (Triantaphyllou and Mann, 1995). A matrix with the following structure in Figure 2.4 is generated for each respondent known as a Saaty matrix (Kallas et al, 2011) or pairwise matrix (Triantaphyllou and Mann, 1995).

$$S_k = \begin{bmatrix} a_{11k} & a_{12k} & \dots & a_{1jk} \\ a_{21k} & a_{22k} & \dots & a_{2jk} \\ \dots & \dots & a_{ijk} & \dots \\ a_{i1k} & a_{i2k} & \dots & a_{NPk} \end{bmatrix}$$

Figure 2.4 Saaty matrix in AHP method

For individual k ($k = 1, \dots, K$), a_{ijk} represents the value obtained from the pairwise comparison between attribute i and attribute j within level 1 or element i and or element j (within level 2). The value i is the column number ($i = 1, \dots, N$) and the number j is the row number ($j = 1, \dots, P$). The fundamental properties of Saaty matrix are (a) if $a_{ijk} = x$ then $a_{jik} = 1/x$ (b) if the attribute or element i and j are equally important then $a_{ijk} = a_{jik} = 1$ (c) all the elements that along the diagonal line is equally important ($a_{iik} = 1 \forall i$) (Kallas et al., 2011)

For example, the objective problem is to determine the most preferred food product in. One of respondents answered the questions the Figure 2.3 that Q1: The quality is extremely moderate importance than format, Q2: The nutrition is slightly moderately important than format and Q3: The quality is moderate important

than nutrition attribute. The pairwise comparison values are equal to $1/9$, $1/2$ and 6 respectively. The Saatty's Matrix is given in **Figure 2.5**.

In your opinion, what is the most importance to you when buying dog food in market?

| | More importance than | | | | | | | | | Less importance than | | | | | | | | | |
|------------|----------------------|---|---|---|---|---|---|---|---|----------------------|---|---|---|---|---|---|---|-----------|--|
| Question 1 | | | | | | | | | | | | | | | | | | | |
| format | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | quality | |
| Question 2 | | | | | | | | | | | | | | | | | | | |
| format | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | nutrition | |
| Question 3 | | | | | | | | | | | | | | | | | | | |
| quality | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | nutrition | |

| The most preferred dog food product | format | quality | nutrition |
|-------------------------------------|--------|---------|-----------|
| format | 1 | $1/9$ | $1/2$ |
| quality | 9 | 1 | 6 |
| nutrition | 2 | $1/6$ | 1 |

Figure 2.5 showing the example of pairwise comparison and a Saatty's matrix for individual k

2.3.2.3 Estimating the important weight of individual

The AHP allows for determining the individual weight (W_{ik}) from pairwise comparison by using main Eigenvector method and Geometric mean method. The weights assign by each attribute and element are obtain by using the Given the Saaty matrix the attributes or elements of each row are multiplied with each other and then the N -th or P -th root (where N and P are number of attribute and element). The calculation is expressed by **Equation 2.7** where N and P are number of attribute and element. Next step is to normalize the individual weight (W_{Nk} , W_{Pk}) by dividing them with the sum (Triantaphyllou and Mann, 1995).

$$W_{Nk,Pk} = \sqrt[N,P]{\prod_{i=1}^{N,P} a_{ijk}}$$

$$W_{ik} = \sqrt[N]{a_{i1k} \times a_{i2k} \times \dots \times a_{iNk}} \text{ or } \sqrt[P]{a_{i1k} \times a_{i2k} \times \dots \times a_{iPk}} \quad (2.7)$$

From the Saaty matrix in Table 2.6 and Equation 2.7, the corresponding priority vector is: $W_{\text{format},k} = \sqrt[3]{1 \times 1/9 \times 1/2} = 0.0786$, $W_{\text{quality},k} = \sqrt[3]{9 \times 1 \times 6} = 0.7786$, $W_{\text{nutrition},k} = \sqrt[3]{2 \times 1/6 \times 1} = 0.1428$ and The sum of weight is $= 0.0679+0.07703+0.1617 = 4.8547$. Next the number are normalized, hence the priority weight for format, quality and nutrition for respondent k is: $(0.3816/4.8547, 3.7798/4.8547, 0.6934/4.8547)$ or $(0.0786, 0.7786, 0.1428)$. The Saaty matrix with individual weight (W_{Nk}) for product attributes is shown in Table 2.3 as below

Table 2.3 The Saaty matrix with individual weight (W_{Nk}) of product attributes

| The most preferred dog food product | format | quality | nutrition | Individual weight |
|-------------------------------------|--------|---------|-----------|-------------------|
| format | 1 | 1/9 | 1/2 | 0.0786 |
| quality | 9 | 1 | 6 | 0.7786 |
| nutrition | 2 | 1/6 | 1 | 0.1428 |

2.3.2.4 Checking Consistency of individual

After determining the individual weight for attribute and element of individual (W_{Nk}, W_{Pk}), AHP allows to checking the consistency for each respondent to ensure that the preference rating by each respondent is consistent. Saaty (1980) stated that the value of pairwise comparison given by respondent considered as consistency if $a_{ik} = a_{ij} \times a_{jk}$. For example, the respondent rate A is more importance than B = 3 ($a_{AB} = 3$), B is more importance than C = 2 ($a_{BC} = 2$): The perfect consistency occur, if the respondent rate A is more importance than C = 6 ($a_{AC} = a_{AB} \times$

a_{BC}). However, perfect consistency rarely occurs in practice (Triantaphyllou and Mann, 1995). In order to check the consistency of respondent with in attribute and element level, Saaty (1980) defined the Consistency Ratio as $CR = CI/RI$ where the RI is random Index which introduced in Table 2.3 and CI is Consistency Index calculated in Equation 2.8 by using maximum eigenvalue (λ_{max}) in Equation 2.9 as follow.

$$CI = \frac{(\lambda_{max} - 1)}{N - 1} \quad \text{or} \quad \frac{(\lambda_{max} - 1)}{P - 1} \quad (2.8)$$

; Where N and P are number of attribute and element

$$\lambda_{max} = \sum_i \sum_j a_{ij} W_{jk} \quad (2.9)$$

Table 2.4 Random Index value for each number of attributes or elements

| n | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----|------|------|------|------|------|------|------|------|------|------|
| RI | 0.00 | 0.00 | 0.58 | 0.90 | 1.12 | 1.24 | 1.32 | 1.41 | 1.45 | 1.49 |

Saaty (1980) recommend that the pairwise comparison in a decision matrix are considered to be adequately consistent if the corresponding consistency ratio (CR) is less than 0.1 and higher value respondents are asked to revise their pairwise comparison (Kallas et.al, 2011) From example of the Saaty matrix in Table 2.3, the demonstration of calculation of maximum eigenvalue, CL and CR as follow

$$\begin{aligned} \lambda_{max} &= \sum_i^3 \sum_j^3 a_{ij} W_{jk} \\ &= \sum_i^3 (a_{i1} W_{1k}) + (a_{i2} W_{2k}) + (a_{i3} W_{3k}) \\ \lambda_{max} &= (a_{11} W_{1k}) + (a_{12} W_{2k}) + (a_{13} W_{3k}) \\ &\quad + (a_{21} W_{1k}) + (a_{22} W_{2k}) + (a_{23} W_{3k}) \\ &\quad + (a_{31} W_{1k}) + (a_{32} W_{2k}) + (a_{33} W_{3k}) \\ &= (1 \times 0.0786) + (1/9 \times 0.7786) + (1/2 \times 0.1428) \\ &\quad + (9 \times 0.0786) + (1 \times 0.7786) + (6 \times 0.1428) \end{aligned}$$

$$\begin{aligned}
 &+ (2 \times 0.0786) + (1/6 \times 0.7786) + (1 \times 0.1428) \\
 &= 3.0092 \\
 \text{CI} &= \frac{(\lambda_{\max} - 1)}{N - 1} = (3.0092 - 1) / (3 - 1) = 0.0046 \\
 \text{CR} &= \text{CL} / \text{RI} = (0.0046 / 0.58) = 0.0079
 \end{aligned}$$

The CR value from is less than 0.1 indicates that the rating from individual k is considered to be consistent where the most important attribute to preference is quality (77.86%), nutrition (14.28%) and format (7.86%). In order to compare the relative importance of attributes and elements, the agreement for the total respondent K need to be considered by the aggregate weight for attributes and elements.

2.3.2.5 Determine the aggregate weight for attributes (W_{an}) and elements ($W_{La,p}$)

Once the individual important weights (W_{Nk} , W_{Pk}) have determined, the relative important of attribute and element of all respondents need to be estimated to represent the group preference affected by the attributes and elements. The group preference need to be determined by using aggregate weight (W_i) obtained from geometric mean in Equation 2.10 as follow

$$W_i = \sqrt[k]{\prod_{i=1}^k W_{ik}} \quad (2.10)$$

Where k is the number of attribute N or element P . The aggregate weight is the value used for determine the agreement of the important weight among the respondent within attribute level (level 1) and element level (level 2). However, the aggregate weights are used to compare within the criteria level (attribute level and element level corresponding their attribute). In order to compare relative importance

among the element with difference nature of attributes, the global weight for each element need to determine.

2.3.2.6 Determine the global weight ($W_{G_{Ln,p}}$) for elements

Final step, in order to rank and compare the relative importance of each element we need to calculate a global weight ($W_{G_{Ln,p}}$) for each element. These global weights are obtain by multiply the aggregate weights of sub-criteria at level 2 (Figure 2.3) with their corresponding weights of attribute at level 1 (Figure 2.3) as the Equation 2.9 below

$$W_{G_{Ln,p}} = W_{An} \times W_{Ln,p} \quad (2.11)$$

2.4 Related research reviews

2.4.1 Related research reviews of dog food

The type of dog and price food have been played important role on consumer preference on dog food. Some studies conducted consumer questionnaire to study buying decision of dog food product by consumer. The study of Taweekul (2006) reported that the attribute that affected buying decision were price and product characteristic. Regarding to the types of dog food, dry dog food was the most important element for buying dog food since the convenience to use, easy to storage (Naksuwan, 2008; Euromonitor International, 2013). In addition, the nutrition also is one of importance attribute of dog food. The study of Janworachet (2003) conducted the consumer questionnaire to study the buying behavior for dog food in Chaing Mai district area. He found that the most important attribute for dog food product that affected to the buying were “complete nutrition”, “formulated as appropriate to breeds or the ages of dogs” and “provide the information about the product on packaging”. As the same as the study of Sornlam (2008) reported that for nutrition, fulfill nutrition and dog food that has specific functional were most important attribute of product.

2.4.2 Related research reviews of CBC and AHP

Many studies had an aim to study individual preferences by using CBC and AHP in consumer decisions on their preferences. Many results have been reported such as the study of individual preference on coffee brewers using CBC on various attributes (Meißner and Decker, 2009). The result from this study, the CBC results showed that most important attributes to the consumer preferences were “Price of a cup of coffee: 34%”, “Price of machine: 22%”, “Material: 20%”, “Brand: 9%”, “Design: 8%”, and “System: 7%” subsequently for choice-based approach. The study also indicated that CBC was a good alternative method for estimating values of individual attribute outperforming choice-based approach in market share predictions. Kallas et al. (2011) had compared preferences for attributes and elements of rabbit meat by using CBC and AHP method. Restaurateurs whom were respondent and include rabbit meat in their menu in Catalonia, Spain. The result from AHP method demonstrated some similarities and difference in the obtain values. The most preferred element for restaurateurs was the “entire” format of the rabbit meat (23.8%), followed by the “Catalonian” origin (19.0%), and the “Pieced” rabbit (16.8%). The lowest weight was assigned to the “Foreign” origin (4.0%) followed by the “unbranded” product (4.3%). The result of the CBC had showed difference between elements to the AHP, the most preferred element for respondents was the “Catalonia” origin (0.6983), followed by the “Entire” rabbit meat (0.2428), and “Pieced” rabbit (0.1094). The lowest relative importance element was “Foreign” origin (-0.6357) followed by “Boneless” rabbit (-0.3521). Kallas et al. (2011) mentioned that CBC estimates may tend to be overestimated when valuing complex goods. The reason for divergence was some over attention attribute in CBC was included together with complex array of other stimulus, leading respondent

CHAPTER 3

METHODOLOGY

With the aims of this research are to investigate the consumer preferences on dog food products by using Choice-Based Conjoint Analysis (CBC) and Analytical Hierarchy Process (AHP) and to compare the results from both methods. The empirical analysis is divided into 6 parts as follow

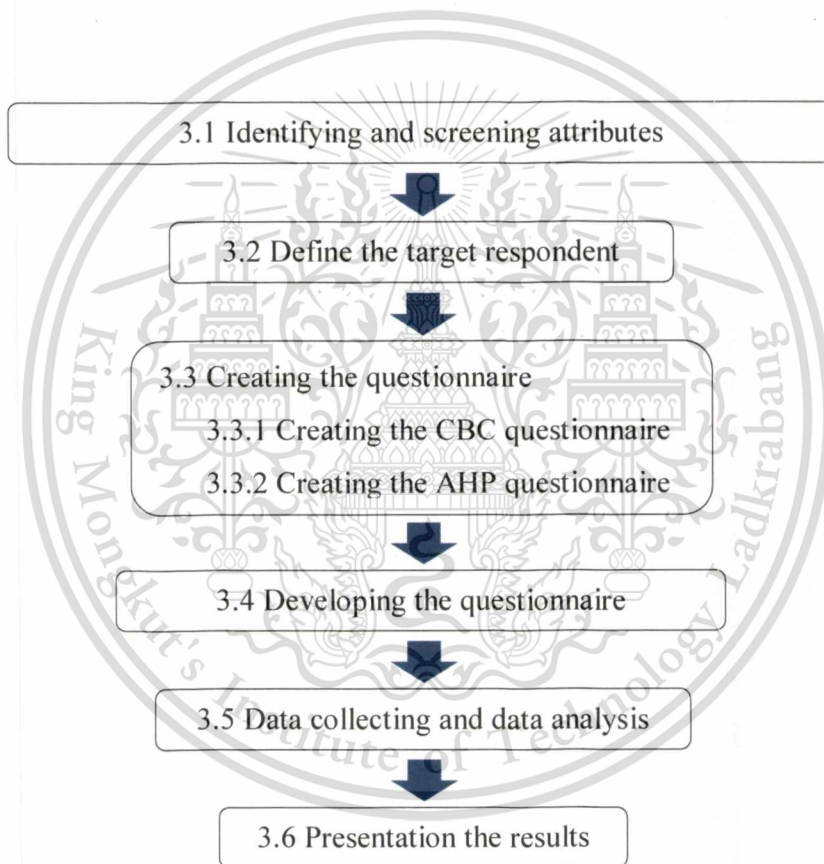


Figure 3.1 The empirical steps for this study

3.1 Identifying and screening attributes

In the empirical analysis of CBC and AHP method, the first step is to identify the main attributes of dog food that the consumers take into consideration. In

this study, the main attributes from literature reviews were identified (Chanworachet, 2003; Udomwansuktawi, 2005; Taweekul, 2006; Sornlam, 2008; Zicker et.al, 2008). Their study conducted the consumer-level questionnaire to study buying decision of consumer on dog food product. They found that the importance attributes for dog food product were format, appearance characteristic of product, nutrition, well-known brand, quality, price, marketing promotions and product distribution. These identified attributes were discussed in consumer group who usually buy pet food to feed their dogs. From interviewing the consumer group (n=30) about the relative importance to buy dog food product, the final set of attributes included: format, price, quality brand and nutrition. These attributes also were ensured to be realistic by checking the attributes and elements with the dog food product in market place. The final attributes and elements are shown in **Figure 3.2**.



Figure 3.2 The final set of the attributes and elements used in this study.

The important attributes for dog food in this study regards to four attributes (format, price, quality brand and nutrition) with three elements of different predefined dog food (For Thai consumer: canned, pouch, dry for format; with pricing 85 Bath, 135 Bath, 165 Bath per Kg; unbranded, commercial, premium for brand quality; fulfilled, silky hair and skin condition, dog's preference for nutrition). The information about the attribute and element are also explained in the glossary term of use in **Chapter 1**.

3.2 Define the target respondent

In this study, the target respondents were the dog owner who lived in Bangkok and suburban area. In order to obtain the consistent of target group, the consumer who attended pet exhibition venues was chosen. Thus, before doing the consumer survey, the request of permission needs to be prepared and send to exhibitors for consideration.

In order to obtain the consistency and accuracy of the target respondent in exhibition venues, the respondents were chosen according to their product consumed behavior (the dog's owner aged more than 15year old whose always purchase dog food available in market) and the chosen consumer was asked to provide their demographic data before doing the CBC and AHP questionnaires.

3.3 Creating the questionnaires for CBC and AHP

3.3.1 CBC questionnaire

For the application of the CBC and AHP, the questionnaires were created by using the final set of attributes and elements obtained from identifying and screening in **Figure 3.2** and the codes used for generating the questionnaire are shown in **Table 3.1**

For the application of the CBC, the experimental design was conducted to create the choice set for CBC questionnaire. In this study, the fraction factorial design was used to estimate the relative importance of attributes and elements. This experimental design allowed us to reduce the number of choice set from $3^4 \times 3^4$ to the 9 of choice sets. The step of creating choice set was explained by Aizaki and Nishimura (2008) the total choice sets can be created through five steps using R program shown in **Appendix A**.

For CBC questionnaire, respondents were clearly defined about product attributes and elements that they were going to consider in the choice set. Each

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respondent was asked to choose only one alternative in each choice set by using photos of sample products as the stimulus items. The **Table 3.2** showed an example of questions and a choice set for survey procedures

Table 3.1 The final attributes and elements used for the CBC and AHP questionnaires.



| Variables | Code for CBC | Code for AHP |
|-------------------------------|------------------|------------------|
| Attributes | | |
| Format | FOR | a ₁ |
| Price (Baht per 1 Kg) | PRI ^b | a ₂ |
| Quality brand | QUL | a ₃ |
| Nutrition | NUT | a ₄ |
| Elements | | |
| Canned dog food | CAN ^a | L _{1.1} |
| Pouch dog food | POU | L _{1.2} |
| Dry dog food | DRY | L _{1.3} |
| 85 Baht per 1 Kg | - | L _{2.1} |
| 135 Baht per 1 Kg | - | L _{2.2} |
| 165 Baht per 1 Kg | - | L _{2.3} |
| Unbranded quality | UNB ^a | L _{3.1} |
| Commercial quality | COM | L _{3.2} |
| Premium quality | PRE | L _{3.3} |
| Fulfilled nutrition | FUL ^a | L _{4.1} |
| Silky hair and skin condition | SIL | L _{4.2} |
| Dog preference | DOG | L _{4.3} |

^aBased element for CBC.

^bprice is quantitative variable for CBC and qualitative variable for AHP

Table 3.2 Example of a choice set of CBC in this study

If you were in the market to buy dog food these were your only option, which one would you choose?

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|---|---|---|
| |  |  | |
| | 1 kg | 1 kg | |
| Format | Dry | Pouch | Neither dog's pet food A nor B is preferred |
| Price | 135 baht | 165 baht | |
| Quality Brand | Unbranded | Commercial Brand | |
| Nutrition | Fulfilled nutrition | Dog preference | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |

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After all respondents had selected one of three alternative in 9 choice sets, the CL model was used to estimate of the utilities values or preference score of dog food. In order to compare the results with AHP results, we considered the attributes and elements of dog food (Table 3.1) as main variables that explain the utility function, regardless of interaction effect between attributes. Thus, the utility function in this study could be created in the CL model given by:

$$\begin{aligned} \text{Utility value} = & \text{ASC}^* + \beta_{\text{can}} (\text{CAN}) + \beta_{\text{pou}} (\text{POU}) + \beta_{\text{dry}} (\text{DRY}) + \beta_{\text{unb}} (\text{UNB}) \\ & + \beta_{\text{com}} (\text{COM}) + \beta_{\text{pre}} (\text{PRE}) + \beta_{\text{ful}} (\text{FUL}) + \beta_{\text{sil}} (\text{SIL}) + \beta_{\text{dog}} (\text{DOG}) \\ & + \beta_{\text{pri}} (\text{PRI})^* \end{aligned}$$

- *Noted that : “ASC” was an alternative specific constant for dog’s pet food
- : “PRI” was a quantitative variable comprised of 85, 135 and 165 baht per kg.
- : β_i s were coefficient values of elements (β_i s = $\beta_{\text{can}}, \beta_{\text{pou}}, \beta_{\text{dry}}, \beta_{\text{unb}}, \beta_{\text{com}}, \beta_{\text{pre}}, \beta_{\text{ful}}, \beta_{\text{sil}}, \beta_{\text{pri}}$)

Where all variables have been previously defined in Table 3.1

3.3.2 AHP questionnaire

For the application of the CBC, the same attribute and elements were used as same as CBC questionnaire. The respondents were asked to pairwise comparison each level of hierarchical structure in Figure 3.2. The 18 questions were conducted to by using 9 point scale shown as follow.

In your opinion, what is the most importance to you when buying dog food in market?

| | | | | | | | | | | | | | | | | | | |
|------------|----------------------------|---|----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|
| | More importance than | | Less importance than | | | | | | | | | | | | | | | |
| Question 1 | <u>Dog food attributes</u> | | | | | | | | | | | | | | | | | |
| format | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | quality |
| Question 2 | | | | | | | | | | | | | | | | | | |
| format | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | nutrition |
| Question 3 | | | | | | | | | | | | | | | | | | |
| quality | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | nutrition |
| Question 4 | <u>Format of dog food</u> | | | | | | | | | | | | | | | | | |
| canned | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | dry |
| Question 5 | | | | | | | | | | | | | | | | | | |
| canned | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | pouch |

Figure 3.3 Example of pairwise comparison questions of AHP in this study

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3.4 Developing the questionnaire

The CBC and AHP were developed by conducting the pilot study. The created questionnaires were applied in previous study (Phaosathienpan and Tengpongsathon, 2012 and (Tengpongsathon and Phaosathienpan, 2012)) with the numbers of target consumer ($n = 30$). The questionnaires for CBC and AHP were developed where no additional problem were identify before conducting the questionnaire to the target consumer.

3.5 Data collection and data analysis

The developed questionnaires (demographic data, CBC and AHP) were used at the pet exhibition venue located in Bangkok, Thailand. After gathering the questionnaire of all respondents ($n = 184$), the demographic data, CBC and AHP data were converted into data file in excel program as one of statistical programs conducted to analyze the data. The relative importance of attributes and elements was determined. For CBC, the relative importance of elements within each attribute was determined by coefficient value in condition logistic model analyzed by R statistical program (R Development Core Team, 2010) with additional Survival package (Therneau and Thomas, 2011). For AHP, the relative importance of attribute and element was determined by priority weight with main eigenvector and geometric mean in excel program followed by calculation in Chapter 2.

3.6 Presentation the results

The demographic data were reported as the table of frequency and percentage. For CBC, the relative importance of attributes and elements was shown in the table of coefficient values and utility equation. For AHP, the weight importance of attributes and elements was demonstrated by aggregate weight and global weight in hierarchical

structure. The coefficient value of CBC and important weight of AHP were assumed that equivalent to the preference score. The results from both methods were compared and reported in a table of relative importance of attribute and level. At final, ideal concept of dog food was identified



CHAPTER 4

RESULTS AND DISCUSSION

4.1 Demographic data of respondents

The respondents were dog owners who attended the pet food expo 2012 exhibition at Queen Sirikit venue during 17-20 May 2012. The respondents were chosen to do the CBC and AHP questionnaire by regarding their pet food buying behaviors (the dog's owner aged more than 15 years old who usually treats their dogs by pet food products). Before doing the AHP and CBC questionnaire, all respondents (n = 189) were also asked to provide their demographic data. The summary of demographic was shown in Table 4.1.

From Table 4.1 it was found that a total of 189 consumers replied to the questionnaire. For gender, a ratio of male and female respondents was 33.3% and 65.1% respectively. Most of the consumers were aged between 26-35 (47.1%), 15-25 (33.3%), and 36-45 (13.2%) years old. According to the age, the minor groups of consumer were aged between 46-55 (3.7%) and more than 56 (0.5%) years old respectively. In term of educational level, over 70.9% of them got bachelor degree and 12.7% got master degree which corresponded to the age of all respondents. Regarding to income, 33.3% of consumer earned around 15,001-25,000 bath per month, while 29.6% earned less than 15,000 bath per month and 19.6% had an income over 35,000 bath per month. For the marital status, 75.1% of respondents were single, 21.2% were marriage and 2.6% were divorced, widowed or separated.

For occupation, 38.6% of respondent were company employee, followed by 24.9% for business owner, 18.5% for student, 5.3% were government officer, 4.2% were other occupation, 3.2% were merchant, 2.1 % and 1.6% were work for hire housekeeper respectively. While asking the respondents about the reason for raising the dog, the dog's owner about 82.9% stated the reason for raising the dog as being friend, 14.15% for house guarding and 3.6% for commercial purpose.

Table 4.1 Demographic data of consumer

| Demographic data | Frequency | Percentage |
|--|------------------|-------------------|
| Gender (n = 189, missing data = 3) | | |
| Female | 123 | 65.1% |
| Male | 63 | 33.3% |
| Age (year) (n = 189, missing data = 4) | | |
| 26-35 year old | 89 | 47.1% |
| 15-25 year old | 63 | 33.3% |
| 36-45 year old | 25 | 13.2% |
| 46-55 year old | 7 | 3.7% |
| more than 56 year old | 1 | 0.5% |
| Income (n = 189, missing data = 5) | | |
| 15,001- 25,000 bath per month | 63 | 33.3% |
| less than 15,000 bath per month | 56 | 29.6% |
| more than 35,000 bath per month | 37 | 19.6% |
| 25,001- 35,000 bath per month | 28 | 14.8% |
| Marital status (n = 189, missing data = 2) | | |
| Single | 142 | 75.1% |
| marriage | 40 | 21.2% |
| divorced, widowed or separated | 5 | 2.6% |
| Educational level (n = 189, missing data = 1) | | |
| bachelor degree | 134 | 70.9% |
| master degree | 24 | 12.7% |
| diploma | 12 | 6.3% |
| secondary school (Matthayom 4-6) | 11 | 5.8% |
| secondary school (Matthayom 1-3) | 4 | 2.1% |
| primary school | 3 | 1.6% |
| philosophy degree | 0 | 0.0% |
| Occupation(n = 189, missing data = 3) | | |
| company employee | 73 | 38.6% |
| business owner | 47 | 24.9% |
| Student | 35 | 18.5% |
| government officer | 10 | 5.3% |
| other occupation | 8 | 4.2% |
| Merchant | 6 | 3.2% |
| work for hire | 4 | 2.1% |
| Housekeeper | 3 | 1.6% |
| the reason for raising the dogs (n = 189) * | | |
| as being friend | 180 | 82.19% |
| for house guarding | 31 | 14.15% |
| for commercial purpose | 8 | 3.6% |

* Multiple choices, the consumer can choose as much as they want.

When asking the reason for raising the dog, 82.19% of respondent were raising the as being friend, followed by 14.15% for house guarding. There was only 3.6% for commercial. This can be implied that our respondents were household owners who treat their dog as a member of family and keep the dog in household.

It should be noted that in this study, the characteristics of target group corresponded to the group of younger consumer whose aged between 15-35 years old (teenager as student and worker as company employee and business owner), educational level in bachelor and master degree and treat the dog as being friend. In this study was household dog owner who treat their dog for the reason of being friend. The demographic data had also showed that the younger consumers were trending to stay single/ or childless longer and having pets as an alternative to a partner and/or children (Agriculture and Agri-food Canada, 2010). The dog owner in Bangkok had shown the trend that following the trend in developed market around the world.

4.2 Choice-Based Conjoint Analysis results

The results shown in **Table 4.2** were statistical values of variables for giving the conditional logistic model. According to the likelihood ratio test ($p = 0.000$), we could reject the null hypothesis that presented “all coefficients were equally to zero” at 99.99% confidential level. Moreover, the McFadden’s R^2 was equal to 0.2698 implies that the goodness of fit of CL model was within the acceptable range (any pseudo R^2 greater than 0.2 considered as highly satisfactory) (Novotorova, 2007, Mcffadent, 1974).

In conditional logistic model, the product attributes can be nominal, ordinal or even quantitative scales of measurement (Meißner and Decker, 2009). The ASC variable in the conditional logistic model was an alternative specific constant for dog food model. Regarding to attribute level of dog food, the coefficient values indicated that the important attributes were “quality”, “nutrition”, “format” and “price”, subsequently. However, when considered within each element of attributes, the coefficient values of condition logistic regression suggested that the “premium

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quality” element of format attribute was the most effect to utility score (preference score), following by “silky hair and skin condition”, “dry dog food”, “fulfill nutrition”, “price”, “pouch dog food”, “canned dog food”, “commercial quality”, “dog’s preference” and “unbranded quality” respectively. As explained above (Table 4.2), the utility function in the CBC model from this study was given by equation below:

Table 4.2 Results of the Choice-Based Conjoint Analysis (n = 189, missing data = 5)
All attribute codes referred to the Table 3.1

| Elements | Coefficients | Standard error | p-value |
|--|--------------|-------------------------|-------------------------|
| ASC | 1.9771 | 0.1883 | 0.0000 *** ^a |
| CAN ^b | -0.4193 | 0.0000 | NA |
| POU | -0.0344 | 0.1160 | 0.7700 |
| DRY | 0.4537 | 0.1503 | 0.0025 ** |
| PRI | -0.0016 | 0.0010 | 0.1100 |
| UNB | -1.5764 | 0.1146 | 0.0000 *** |
| COM | -0.4842 | 0.1282 | 0.0002 *** |
| PRE ^b | 2.0606 | 0.0000 | NA |
| FUL | 0.2149 | 0.1349 | 0.1100 |
| SIL | 0.8843 | 0.0904 | 0.0000 *** |
| DOG ^b | -1.0992 | 0.0000 | NA |
| <i>Summary statistics</i> | | | |
| No. of observations | | 184 | |
| The number of estimated coefficient | | 11 | |
| Log-likelihood of intercept model (LL0) | | -1823.696 | |
| Log-likelihood of full model (LLb) | | -1331.630 | |
| rho-squared (RHO2) ^c | | 0.2698 | |
| Adjust rho-square (AdjRHO2) ^d | | 0.2638 | |
| Likelihood ratio test | | 984.1 on 8 df, p=0.0000 | |

^a Significant codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘.’ 1

^b Base level of attribute

^c The rho-squared (RHO2) also called Mcfadden’s R² or pseudo squared can be calculated by $RHO2 = 1 - (LLb / LL0)$

^d The rho-square value adjusted by the number of estimate coefficients defined as

$Adj\ RHO2 = 1 - [(LLb - K) / LL0]$

NA variances and p-values can be obtained by re-estimating the model by changing the based element of the attributes

$$\begin{aligned} \text{Utility Score} = & 1.9771 - 0.4193 (\text{CAN}) - 0.0344 (\text{POU}) + 0.4537 (\text{DRY}) \\ & - 0.0016 (\text{PRI}) - 1.5764 (\text{UNB}) - 0.4842 (\text{COM}) + 2.0606 (\text{PRE}) \\ & + 0.2149 (\text{FUL}) + 0.8843 (\text{SIL}) - 1.0992 (\text{DOG}) \end{aligned}$$

The utility score (preference score) was associated with some elements that were qualitative variables such as “dry dog food”, “premium quality”, “fulfilled nutrition”, and “silky hair and skin condition”, which were the positive coefficient values. Then, it was indicated that the higher coefficient values influenced on the increasing of utility score. In the other hand, the negative sign coefficient values of elements (“commercial quality”, “unbranded quality”, “dog’s preference”, “canned dog food”, and “pouch dog food”) could be concluded that the lower utility score associated with these elements. In addition, a coefficient value of “price” attribute indicated as the quantitative variable with negative sign. It meant that the utility score would be increased when a level of “price” was decreased. However, the coefficients values were closed to zero and p-value equal to 0.1100 ($p > 0.05$). Thus, it can be assumed that the “price” attribute had no majority effect to the utility score. Therefore it was concluded that a product profile, which contained elements of “dry dog food”, “premium quality”, “fulfill nutrition”, and “85 baht per 1 Kg.” gave the most preferences score of consumer.

To compare the relative importance of each element of dog’s pet food by CBC method, all elements were ranking by their coefficient value as shown in Table 4.3

Table 4.3 Showing relative importance of attributes and element from Choice-Based Conjoint Analysis

| Elements | CBC results | Relative importance |
|-------------------------------|--------------------|---------------------|
| | Coefficient values | |
| Premium quality | 2.0606 | 1 |
| Silky hair and skin condition | 0.8843 | 2 |
| Dry dog food | 0.4537 | 3 |
| Fulfill nutrition | 0.2149 | 4 |
| Price ^a | -0.0016 | 5 |
| Pouch dog food | -0.0344 | 6 |
| Canned dog food | -0.4193 | 7 |
| Commercial quality | -0.4842 | 8 |
| Dog’s preference | -1.0992 | 9 |
| Unbranded quality | -1.5764 | 10 |

^a price was qualitative variable as attribute in CBC study

4.3 Analytic Hierarchy Process results

The AHP allows the priority weight for individual preference (W_{ik}) by main Eigenvector method. The group preference need to be considered by using aggregate weight (W_i) obtained from geometric mean while the consistency of pairwise comparison can be calculated by using λ_{max} , number of criteria and random consistency index (RI). Final step, is to compared the relative importance weights for attributes and elements by using global weights ($W_{G_Ln,p}$) for each level.

The results of important weights (aggregated weight and global weight) were shown in the hierarchy structure (Figure 4.1) where the average mean of CR value for all respondents was equal to 0.2973 (computed discarding the 5.71% of highest score). Saaty (2008) recommended that CR should less than 0.1. However, the higher CR value also acceptable. It depends on the kind of decision problem, out coming priorities and the required accuracy. Some researchers (Business performance management, 2014) recommended that it is still reasonable despite the CR value is higher than 0.1 up to 0.3. Regarding to these criteria, it concluded that the CR value in our study was within acceptable range.

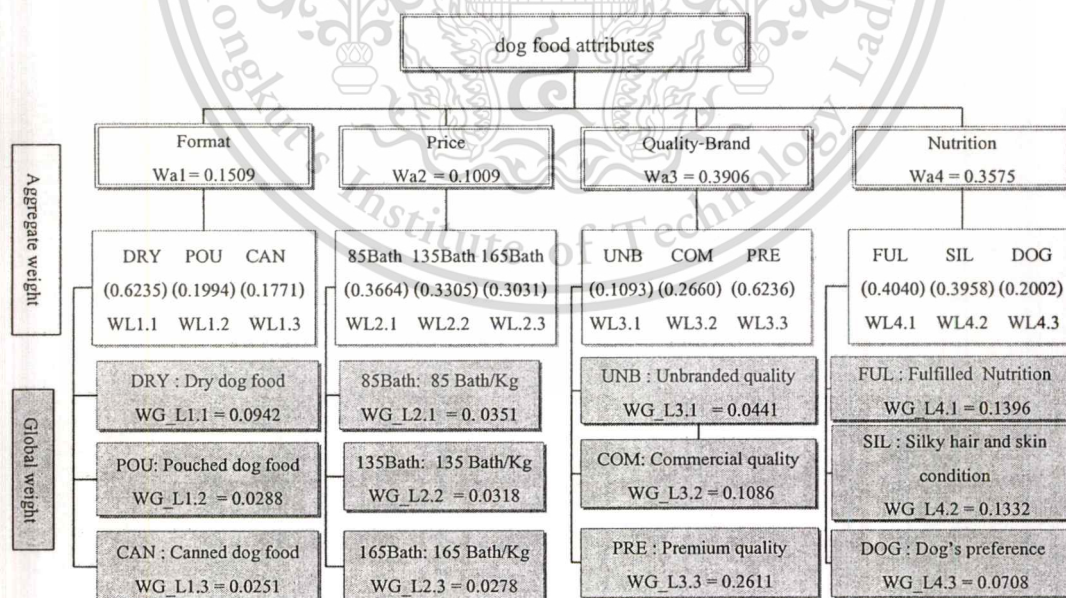


Figure 4.1 The hierarchy structure of attribute and element's weight (aggregate weights and global weights)

The weight of priority in each attribute (W_{an}) obtained by pairwise comparison. Then, when considering only level of attribute (Level 1), the sum of the weight of priority was equal to 1; ($0.3563 + 0.3534 + 0.1703 + 0.1200$ or 100%) and as similar as the sum of weight within the element level of the attribute (Level 2). At attribute level (Level 1), the value of aggregate weight (W_{an}) provided me to suggest that “nutrition” (39.06%) and “quality brand” (35.75%) attribute were more important than “format” (15.09%) and “price” (10.09%) attributes that determined preference score.

However, when considering the aggregate weight ($W_{L.n.p}$) within the element level of each attribute (Level 2), the most important element for “format” attribute was “dry pet food” followed by “can pet food” and “pouch pet food” for 62.35%, 19.94% and 17.71% respectively. The results showed that consumer’s preferred dry dog food more than canned and pouch dog food. For the “price” attribute which was considered to a categorical attribute, the level “85 Baht per 1 Kg” was the most preferred level comparing with “135 Baht per 1 Kg” and “165 Baht per 1 Kg” for 33.64%, 33.05% and 30.31% subsequently. For the “quality brand” attribute, the most important level was assign to “premium quality” followed by “commercial quality” and “unbranded quality” for 62.36%, 26.60% and 10.93% subsequently. Finally, within “nutrition” attribute, it showed that “silky hair and skin condition” and “fulfilled nutrition” element for 40.40% and 39.58% were more important than “dog’s preference” for 20.02%.

The results of AHP in this study, as similar as the previous study (Tengpongsathon and Phaosathienpan, 2012), indicated that the most preferred attribute was “quality” and “nutrition”. In additional, the previous results of AHP study suggested that the most prefer product profile was “dry dog food”, “complete nutrition”, “85 Baht per 1 Kg” and “premium quality”.

In order to compare the preference score of each element, the global weights had to be calculated by multiply the weight of attribute and their element level ($W_{G_L.n.p} = W_{an} \times W_{L.a.p}$). The total relative importance was shown in **Table 4.4** as follows:

Table 4.4 Results of relative importance of attributes and level obtained from AHP method.

| AHP results | | Relative importance |
|-------------------------------|----------------------------------|---------------------|
| Elements | Global weights ($W_{G_Ln,p}$) | |
| Premium quality | 0.2611 | 1 |
| Fulfill nutrition | 0.1396 | 2 |
| Silky hair and skin condition | 0.1332 | 3 |
| Commercial quality | 0.1086 | 4 |
| Dry dog food | 0.0942 | 5 |
| Dog's preference | 0.0708 | 6 |
| Unbranded quality | 0.0440 | 7 |
| 85 Bath per 1 Kg. | 0.0351 | 8 |
| 135 Bath per 1 Kg. | 0.0318 | 9 |
| Pouch dog food | 0.0288 | 10 |
| 165 Bath per 1 Kg. | 0.0278 | 11 |
| Canned dog food | 0.0251 | 12 |

The global weights ($W_{G_Ln,p}$) represented the preference score or the total relative importance of pet food elements. It implied that the most importance element for dog's pet food preference was "premium quality" (26.11%), followed by "fulfill nutrition" (13.96%), "silky hair and skin condition" (13.32%), "commercial brand" (10.86%), "dry dog food" (9.42%), "dog's preference" (7.08%). The lowest importance weight was assigned to "canned dog food" (2.51%), followed by "165 Bath per 1 Kg" (2.78%), "pouch dog food" (2.98%) and "135 Bath per 1 Kg" (3.18%) subsequently.

4.4 The Comparison results of CBC and AHP method

4.4.1 The CBC and AHP results

In order to evaluate the stated preferences for dog food, it needed to compare the coefficient values and the importance weight of CBC and AHP study. It should

be noted that, in this study the weights of preference were assumed equivalent to the global weights for AHP and also equivalent to the relative coefficients values in the utility function for CBC followed the study of Colombo et al. (2009) and Kallas et al. (2011). The compared results of both methods for each element were summarized in **Table 4.5**. The results showed some similarity regarding to the weight coefficient values of CBC and global weight of AHP. Both methods indicated that the important elements were “premium quality”, “fulfill nutrition” and “silky hair and skin condition”. It also should be noted that CBC estimation trended to be over estimation for “premium quality” element when comparing to AHP. Many studies of CBC (Kallas et. al., 2011, Ryan and Watson, 2009) reported the overestimated value could be observed when product concept comprised with several attributes. The respondents tended to be dominated by only some elements affected on their preferences. The results showed that “premium” element included in the product profile, leading the respondent to give increasing of preference and ignoring other elements constrain.

The preference score from both methods, the results of CBC allowed the weight for disutility or negative coefficient associated to utility score (or preference score), while AHP assumed positive coefficient associated to preferences for all attributes (Kallas et. al., 2011). It should be noted that for “price” attribute, it may not reasonable to compare the weight for each element between both methods since CBC consider “price” as quantitative variable while AHP considered “price” as categorical variable. While the CBC results suggested that there was no majority effect between “price” element and utility value, the AHP indicated slightly higher of appreciation when the price was decreased. It may unable to compare the preference score (or total relative weights) directly between CBC and AHP by using coefficient values and global weight, as some variables were measured in difference scale (In my thesis, the “price” attribute was considered as quantitative variable for CBC study and qualitative variable for AHP study).

The preference score from both methods, the results of CBC allowed the weight for disutility or negative coefficient associated to utility score (or preference score), while AHP assumed positive coefficient associated to preferences for all attributes (Kallas et. al., 2011). It should be noted that for “price” attribute, it may not reasonable to compare the weight for each element between both methods since CBC consider “price” as quantitative variable while AHP considered “price” as categorical

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variable. While the CBC results suggested that there was no majority effect between “price” element and utility value, the AHP indicated slightly higher of appreciation when the price was decreased. It may unable to compare the preference score (or total relative weights) directly between CBC and AHP by using coefficient values and global weight, as some variables were measured in difference scale (In my thesis, the “price” attribute was considered as quantitative variable for CBC study and qualitative variable for AHP study).

Table 4.5 The results of coefficients values and global weights for CBC and AHP study

| CBC results | | Relative importance | AHP results | |
|-------------------------------|--------------------|---------------------|-------------------------------|----------------|
| Elements | Coefficient values | | Elements | Global weights |
| Premium quality | 2.0606 | 1 | Premium quality | 0.2611 |
| Silky hair and skin condition | 0.8843 | 2 | Fulfill nutrition | 0.1396 |
| Dry dog food | 0.4537 | 3 | Silky hair and skin condition | 0.1332 |
| Fulfill nutrition | 0.2149 | 4 | Commercial quality | 0.1086 |
| Price ^a | -0.0016 | 5 | Dry dog food | 0.0942 |
| Pouch | -0.0344 | 6 | Dog's preference | 0.0708 |
| Canned dog food | -0.4193 | 7 | Unbranded quality | 0.0441 |
| Commercial quality | -0.4842 | 8 | 85 Bath per 1 kg. | 0.0351 |
| Dog's preference | -1.0992 | 9 | 135 Bath per 1 kg. | 0.0318 |
| Unbranded quality | -1.5764 | 10 | Pouch dog food | 0.0288 |
| | | 11 | 165 Bath per 1 kg. | 0.0278 |
| | | 12 | Canned dog food | 0.0251 |

^a price was quantitative variable in CBC study and qualitative variable in AHP study

However, it also may possible to compare the results between both methods when the all elements of each attribute are the same measurement and/or the attributes need to be adjusted before comparing between the both results. There was a study attempted to compare the results between CBC and AHP method. Kallas et.al

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(2011) had adjusted the “price” attribute as an implicit variable for CBC and excluded the “price” attribute for AHP method. Their results showed the similarity of the total relative weights between CBC and AHP method.

Then it may possible to compare the results of CBC and AHP only within attribute level by using the aggregate weight and coefficient weight when some general importance of elements within each attribute can be observed. The results were demonstrated in **Figure 4.2**

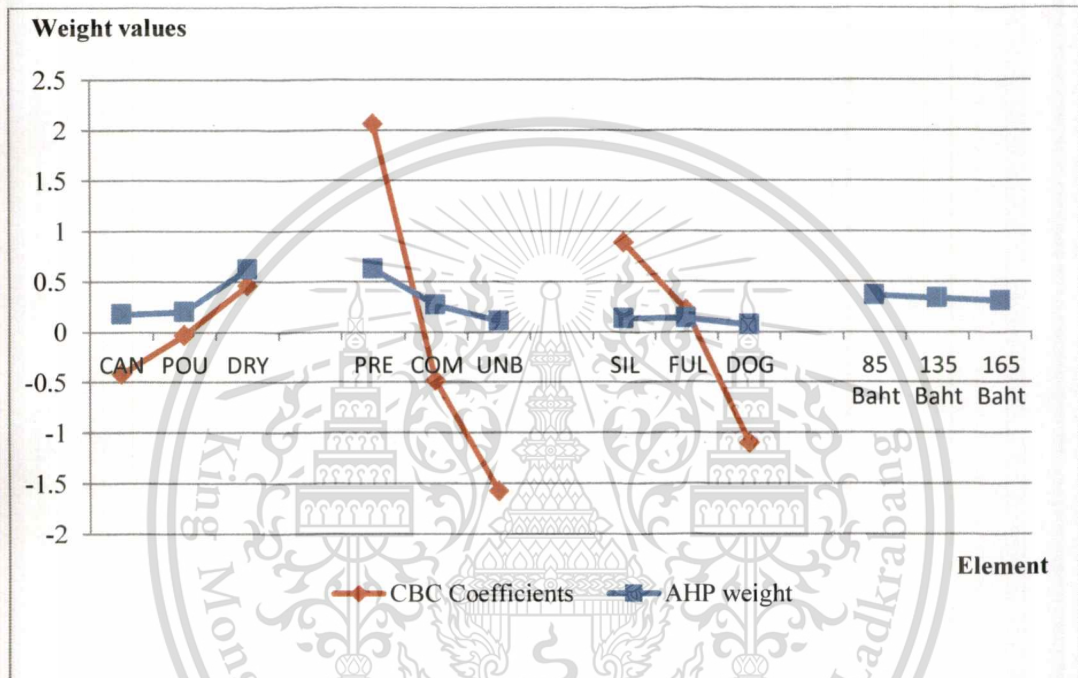


Figure 4.2 Showing coefficient weights (CBC) against aggregate weight (AHP)
(All element codes were from **Table 3.1**)

Remark: For CBC study, the “price” attribute is considered as qualitative variable and not shown in graph.

Comparing the coefficient values and aggregate weights within element level, the results of CBC and AHP were quite similar on the aggregate level, the CBC and AHP estimated the relative importance of elements was the same within “format” and “quality” attributes. The most preferred element of dog food for “format” attribute was “dry pet food” and of the “quality” attribute was “premium quality”. However, there were some differences between CBC and AHP results such as for the “nutrition” attribute, AHP determined “fulfilled nutrition” (0.4040) as importance as “silky hair and skin condition” (0.3958), while CBC indicated that “silky hair and skin

condition" (0.8843) was more importance than "fulfilled nutrition" (-0.2149) and "dog's preference" (-1.0992). Moreover, the "price" attribute defined as quantitative variable for CBC but as the qualitative variable in AHP. The CBC estimated the coefficient value for "price" was nearly to zero (-0.0016). It was indicated that preference score or utility value was not affected by "price" attribute. In contrast to AHP, there was slightly decreasing in preference score when the price increased (0.3664, 0.3305, 0.3031 for 85, 135 and 165 Bath per 1 Kg respectively)

Although the comparison of results estimated by CBC and AHP method was not perfectly, the important characteristic of dog food product can be observed. The preference score of dog food product would be increased when the concept of product comprised with these elements of "premium quality", "fulfilled nutrition", "silky hair and skin conditioned" and "dry pet food", while these elements of "canned dog food", "pouch pet food", "commercial quality", "dog's preference" and "unbranded quality" would associate the lowering preference score of the product. There was no difference in preference score corresponding to "price" elements.

This is especially true in Bangkok, the capital Thailand, one of the largest targets of consumers who buy dog's pet food for reasons of convenience to use and wide product availability (Konthip, 2006, Euromonitor, 2013).

4.4.2 Advantage and disadvantage of CBC and AHP methods

For creating questionnaire, the number of attribute and element also play an importance role in the size of experimental design, the number of choice set can be substantial increased when increases the number of attribute and element generated by Fractional Factorial experimental design (2^{n-p} , 3^{n-p}). While AHP takes an advantage of the number of attribute and element with higher number of attribute compared to CBC. However, the summary of advantage and disadvantage of CBC and AHP were summarized in **Table 4.6**

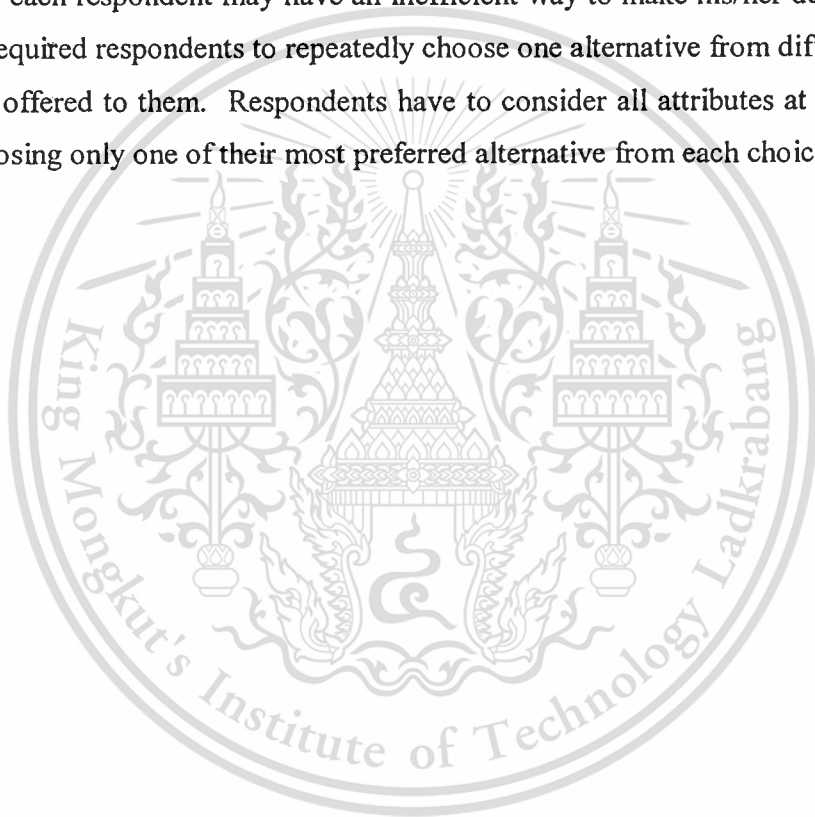
Table 4.6 The advantage and disadvantage of AHP and CBC

| CBC method | AHP method |
|--|---|
| <u>Application</u> | |
| - Selection of a 'set of attribute' represented by 'alternatives' within 'choice set' | - pairwise comparison |
| - More natural and realistic in answering since stimulates what respondent actually does at market place | - Less natural and realistic in answering but simple task |
| <u>Experimental design</u> | |
| - More complex when the number of attribute increased. The respondent has to consider all attribute at once time before choosing the most preferred alternative from each choice set | - Less constraint for the number of attribute. |
| - Fractional Factorial experimental design, the number of alternative determines from the number of alternative = 1^{k-p} when l = the number of level of each attribute, typically 2^{k-p} or 3^{k-p} k = the number of attribute p = the size of fraction of full factorial | - the number of choice set determines from $N(N-1)/2$, when N is the number of attribute and $P(P-1)/2$, when P is the number of element or level |
| Example when the number of attribute is equal to 4 ($N=4$) and the number of element for all attribute equal to 3 elements ($l = 3$). The number choice set is equal to 3^{4-p} | Example when the number of attribute is equal to 4 ($N=4$) and each attribute comprise of 3 elements or levels ($P = 3$) |
| The number of choice set can be 81 when $p = 1$, 27 when $p = 2$ or 9 when $p = 3$. It should be note that increase the number of p can reduce the accuracy of the results | The number choice set $= (N(N-1)/2) + (P(P-1)/2)$ $= (4(4-1)/2) + (3(3-1)/2) \times 4$ $= (12/2) + (6/2) \times 4$ $= 18$ choice sets |
| <u>Sample size requirement</u> | |
| - at least 30 respondents are need (Kallas, et.al., 2011) | - It could be applied for only one expert (Kallas, et.al., 2011) |
| <u>Estimation procedure</u> | |
| - Using R statistical program (R Development Core Team, 2010) to perform conditional logistic model. | - Using simple calculation by using Main Eigenvector and Geometric mean method. |
| - Consistency could be checked for all respondent by likelihood ratio test and McFadden's R^2 | - Consistency could be checked individually by Consistency Ratio (CL) |

In order to determine the consumer preference toward the food product, the CBC questionnaire seems to be more realistic and friendly to the respondents than AHP questionnaire when doing consumer survey with both kinds of questionnaires. Since the CBC simulates what the consumer does at the marketplace by asking the consumers to choose the most preferred product among the alternative product within the choice set. Then, the consumer also can choose the choice of "no product

preferred” in each choice set. The CBC determines what the consumer actually does when making their decision on buying dog product. The respondent has to consider all elements when doing CBC

In the other hand, AHP showed more theoretical method to consistence on making decision when comparing with CBC. However, CBC still have some disadvantages because each concept is described on elements of many attributes and considered in the study, each choice-set may contain several concepts. So CBC required each concept to be more realistic than AHP. In order to elicit individual preference, each respondent may have an inefficient way to make his/her decisions in CBC. It required respondents to repeatedly choose one alternative from different sets of profiles offered to them. Respondents have to consider all attributes at once time before choosing only one of their most preferred alternative from each choice set.



CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study focused on accessing preferences on consumer and comparing the results by using two different methods; CBC and AHP. Both methods have successfully demonstrated the potential to estimate the relative importance and ranking scores of attributes on dog food product. CBC simulates the consumer's buying behavior and estimates the preferences in term of utility values. Consumers were shown the sets of difference competitive products and asked if they would buy it. The task of choosing the preferred product is similar to what consumers actually do at the marketplace by making decision on the choice set of alternatives. In contrast, AHP determines the preferences by considering the importance weights and the consumers were asked to make decision directly on attributes and elements of product in pairwise comparison. In addition, the 9-point scale has been used to compare the most importance attribute or element that determines their preference for dog food product. In this study, the CBC and AHP questionnaire had been used to elicit information regarding four attributes (format, price, quality brand and nutrition) with three elements of dog food (canned, pouch, dry for format; with pricing 85, 135, 165 baht per 1 kilogram; unbranded quality, commercial quality, premium quality for quality brand; fulfilled nutrition, silky hair and skin condition, dog's preference for nutrition). The data were collected from dog owners (n = 189) who attended the pet food expo 2012 at Queen Sirikit Exhibition venue, during 17-20 May 2012.

Although it is not possible to perfectly compare the result from CBC and AHP some the important element can be observed. The result from CBC and AHP suggested that "premium quality" was the most importance elements on preference score. The comparison results between CBC and AHP showed the similarity on relative importance of element within "format" and "quality brand" attribute. The CBC had showed the overestimation results of dominated elements effect on preference score. The "premium quality" and "silky hair and skin condition" were

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dominated element on the preference score when evaluating the preference on complex good.

5.2 Recommendation

5.2.1 The results in this study showed that “premium quality”, “silky hair and skin condition”, “fulfilled nutrition” and “dry dog food” were main attributes of dog food. The improvement of exist product or creating the innovative product of dog food should focus on functional properties, the physical properties such as size, shape and hardness that followed the humanization and premiumisation trend.

5.2.2 The AHP allows for determining the important weight of attribute and element at individual level. The further study should focus on the identifying clusters of most preferred product concept regarding consumer preference to attributes and elements weights.

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Creating of choice set for CBC using R statistical program

This section is a introduction of creating choice set for CBC questionnaire and data analysis by using R statistical program version 2.13.2 (R Developer Core Team, 2010), which is a free software environment for statistical computing and graphic. R program complies and runs on a wide variety of UNIX platforms, Windows and Mac OS.

Choice-based conjoint analysis belongs to the family of stated preference methods also called as “choice experiments”. We explain the process of creating choice sets using the AlgDesign package (Wheeler, 2011) which is additional package for R statistical program. and the process of statistically analyzing responses using the survival package (Therneau, 2011) as guided by Aizaki and Nishimura (2008). R and its packages that are used in this study can be downloaded from the official web site of R (The R Project for Statistical Computing; <http://www.r-project.org/>)

Creating choice sets using the AlgDesing package

Following the hypothetical example of consumer of dog food, which was studied on this research, the attribute and element were shown in Table 3.1 and used in creating choice set for CBC. The step of creating choice set was guided by Aizaki and Nishimure (2008) the total choice sets can be created through five steps as follow.

Step 1: Creating a full factorial design by the `gen.factorial()` function included in the AlgDesign package (Wheeler, 2011a).

Step 2: Creating a fractional factorial design by the `optFederov()` function included in the AlgDesign package (Wheeler, 2011b).

Step 3: Making a copies of fraction factorial design array in alternatives.

Step 4: Create a choice set with the M number of alternatives

Step 5: Translating the design codes in the choice sets into codes with a unique and corresponding level, and then adding the non-of-these option to each choice set optionally.

STEP 1: Creating a full factorial design.

A full factorial design regards to four attribute with 3 elements of dog food comprises with eighty one combinations of the level of each attributes ($3 \times 3 \times 3 \times 3 = 81$). The AlgDesign was run by using command `library()`, the full factorial design was generated and assigned to an object `ffd` using the function `gen.factorial()` as follows.

```
>library(AlgDesign)
>ffd<-
gen.factorial(c(3,3,3,3),varNames=c("FOR","PRI","GRA",
"NUT"),factors="all")
>ffd [1:10,]
      FOR    PRI    GRA    NUT
1      1      1      1      1
2      2      1      1      1
3      3      1      1      1
4      1      2      1      1
5      2      2      1      1
6      3      2      1      1
7      1      3      1      1
8      2      3      1      1
9      3      3      1      1
10     1      1      2      1
```

The function `gen.factorial()` has three arguments: `c()`, `varNames`, and `factors`. The argument `c()` in the function is used for setting the attributes and levels (or elements) included in a full factorial design. The argument `varNames` is used for assigning the name of the attribute. In this study, we used dog food as case study for CBC regarding to product characteristics. The names of the product attribute are “FOR” (format), “PRI” (price), “QUA” (quality) and “NUT” (nutritional) which each attribute were divided into 3 elements : canned dog food, pouch dog food, dry dog food for format; with pricing 85, 135, 165 Baht per 1 Kg; unbranded quality, commercial quality, premium quality for quality brand; fulfilled nutrition, silky hair and skin condition, dog’s preference for nutrition. The last argument is `factors="all"` indicates that all attributes are factors.

At the second of command line, the full factorial design as mentioned above was assigned to the object `ffd` which comprised of eighty one ($3^4 = 81$) combinations.

Total result of full factorial can be shown by using command “`ffd`”, to show some part of result by using `[1:10]` means showing the combination row only 1 to 10.

Step 2: Creating a fractional factorial design by the `optFederov()` function included in the `AlgDesign` package (Wheeler, 2011b) .

The function `optFederov()` generates the fractional factorial design from the full factorial design from **step 1**, which is assigned to object `des`. The Fractional factorial design can be created randomly by using function `set.seed()` as follow.

```
> library(AlgDesign)
> ffd<-gen.factorial(c(3,3,3,3),varNames=c("FOR", "PRI",
"GRA", "NUT"), factors="all")
> ffd [1:10,]
  FOR PRI GRA NUT
1    1  1  1  1
2    2  1  1  1
3    3  1  1  1
4    1  2  1  1
5    2  2  1  1
6    3  2  1  1
7    1  3  1  1
8    2  3  1  1
9    3  3  1  1
10   1  1  2  1
> set.seed(54321)
des<-optFederov(~.,ffd,9); des
$D
[1] 0.2311204
$A
[1] 6.333333
$Ge
[1] 1
$Dea
[1] 1
$design
  FOR PRI GRA NUT
3    3  1  1  1
13   1  2  2  1
26   2  3  3  1
34   1  3  1  2
38   2  1  2  2
51   3  2  3  2
59   2  2  1  3
72   3  3  2  3
73   1  1  3  3

$rows
[1] 3 13 26 34 38 51 59 72 73
```

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The function *optFederov()* has three arguments: “~”, *ffd*, and “9”. The function starts with the argument “~.” implies that the command using variable name from data and all variable from data are to be used linearly (Wheeler, 2011a). The argument “*ffd*” is the name of object containing the full factorial design from **Step 1**. The argument 9 indicates the number of choice set in the fraction factorial design.

The object “*des*” contain some object (elements) as a result of the function *optFederov()*. The fractional factorial design included in object “*des*” is required. The notation \$ is used to access an element of the object *des* and fractional factorial design is assigned to an object “*alt1*” as follow.

```
> alt1<- des$design
> alt1
  FOR PRI GRA NUT
3    3   1   1   1
13   1   2   2   1
26   2   3   3   1
34   1   3   1   2
38   2   1   2   2
51   3   2   3   2
59   2   2   1   3
72   3   3   2   3
73   1   1   3   3
```

Step 3: Making a copies of fraction factorial design array in alternatives

The fractional factorial design is created in **step 2** are using for making alternative in choice set of CBC questionnaire. Before creating the choice set comprised with alternatives and “none-of-these option” in questionnaire, the copies of fractional factorial design must be created.

Since two alternatives for each question in the CBC ($M=2$), a copy of the fractional factorial design must be made, in this study. The copy is created in an object *alt2* using the operator “<-“ in the following command line. The copy of fraction factorial design array from object *alt1* is shown from first row to tenth row by the second command line as follow.

```

> alt2 <-alt1 ; alt2
  FOR PRI GRA NUT
3     3   1   1   1
13    1   2   2   1
26    2   3   3   1
34    1   3   1   2
38    2   1   2   2
51    3   2   3   2
59    2   2   1   3
72    3   3   2   3
73    1   1   3   3

```

Step 4: Create a choice set with the M number of alternatives

In order to create a choice set with the number of two alternatives, randomly select the alternatives from the sets of the fractional factorial design without replacement. First, a new uniform random number is added to the object alt1 and alt2 as follows.

```

> alt1 <-transform(alt1, r1=runif(9))
> alt2 <-transform(alt2, r2=runif(9))

```

The result of adding random number in object alt1 and alt2 were showed by using command as below.

```

> alt1
  FOR PRI GRA NUT      r1
3     3   1   1   1 0.69833016
13    1   2   2   1 0.22399155
26    2   3   3   1 0.51712285
34    1   3   1   2 0.90483454
38    2   1   2   2 0.41088065
51    3   2   3   2 0.18471478
59    2   2   1   3 0.60188281
72    3   3   2   3 0.35824596
73    1   1   3   3 0.08372198
> alt2
  FOR PRI GRA NUT      r2
3     3   1   1   1 0.3513522
13    1   2   2   1 0.1087347
26    2   3   3   1 0.4897943
34    1   3   1   2 0.3593932
38    2   1   2   2 0.2253029
51    3   2   3   2 0.2440067
59    2   2   1   3 0.1189549
72    3   3   2   3 0.2772546
73    1   1   3   3 0.9210973

```

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Next, each fractional factorial design is sorted on the basis of its corresponding uniform random variable. Following command is executed on the object `alt1` by using the function `order()`. As well as creating fraction factorial design in **step 2**, the notation `$` is used to access an element of the object `alt1` and `alt2` as follows.

```
> alt1_sort <-alt1[order(alt1$r1),]
> alt2_sort <-alt2[order(alt2$r2),]
```

The result of adding random number in object “`alt1_sort`” and “`alt2_sort`” were showed by using typing the name of object as follows.

```
> alt1_sort
```

| | FOR | PRI | GRA | NUT | r1 |
|----|-----|-----|-----|-----|------------|
| 73 | 1 | 1 | 3 | 3 | 0.08372198 |
| 51 | 3 | 2 | 3 | 2 | 0.18471478 |
| 13 | 1 | 2 | 2 | 1 | 0.22399155 |
| 72 | 3 | 3 | 2 | 3 | 0.35824596 |
| 38 | 2 | 1 | 2 | 2 | 0.41088065 |
| 26 | 2 | 3 | 3 | 1 | 0.51712285 |
| 59 | 2 | 2 | 1 | 3 | 0.60188281 |
| 3 | 3 | 1 | 1 | 1 | 0.69833016 |
| 34 | 1 | 3 | 1 | 2 | 0.90483454 |

```
> alt2_sort
```

| | FOR | PRI | GRA | NUT | r2 |
|----|-----|-----|-----|-----|-----------|
| 13 | 1 | 2 | 2 | 1 | 0.1087347 |
| 59 | 2 | 2 | 1 | 3 | 0.1189549 |
| 38 | 2 | 1 | 2 | 2 | 0.2253029 |
| 51 | 3 | 2 | 3 | 2 | 0.2440067 |
| 72 | 3 | 3 | 2 | 3 | 0.2772546 |
| 3 | 3 | 1 | 1 | 1 | 0.3513522 |
| 34 | 1 | 3 | 1 | 2 | 0.3593932 |
| 26 | 2 | 3 | 3 | 1 | 0.4897943 |
| 73 | 1 | 1 | 3 | 3 | 0.9210973 |

Each line of the sorted fractional factorial designs (object “`alt1_sort`” and “`alt2_sort`”) corresponds to each question of the choice-base conjoint analysis.

Table A1. the code for choice set generated by AlgDesign.



| FOR | PRI | GRA | NUT | r1 | | FOR | PRI | GRA | NUT | r2 | | |
|-----|-----|-----|-----|----|--------|------------|-----|-----|-----|----|---|--------|
| 73 | 1 | 1 | 3 | 3 | 0.0837 | Question 1 | 13 | 1 | 2 | 2 | 1 | 0.1087 |
| 51 | 3 | 2 | 3 | 2 | 0.1847 | Question 2 | 59 | 2 | 2 | 1 | 3 | 0.1189 |
| 13 | 1 | 2 | 2 | 1 | 0.2239 | Question 3 | 38 | 2 | 1 | 2 | 2 | 0.2253 |
| 72 | 3 | 3 | 2 | 3 | 0.3582 | Question 4 | 51 | 3 | 2 | 3 | 2 | 0.2440 |
| 38 | 2 | 1 | 2 | 2 | 0.4108 | Question 5 | 72 | 3 | 3 | 2 | 3 | 0.2772 |
| 26 | 2 | 3 | 3 | 1 | 0.5171 | Question 6 | 3 | 3 | 1 | 1 | 1 | 0.3513 |
| 59 | 2 | 2 | 1 | 3 | 0.6018 | Question 7 | 34 | 1 | 3 | 1 | 2 | 0.3593 |
| 3 | 3 | 1 | 1 | 1 | 0.6983 | Question 8 | 26 | 2 | 3 | 3 | 1 | 0.4897 |
| 34 | 1 | 3 | 1 | 2 | 0.9048 | Question 9 | 73 | 1 | 1 | 3 | 3 | 0.9210 |

Step 5 translating the design codes

Each design code in the choice set represents the elements in each attribute. In this step we translate all design code into element name for using in the CBC questionnaire. The respondent would be asked to choose the preferred between two alternatives and the none-of-these option. FOR takes a value of “1” if product is “canned” formation or “2” if product is “pouch” formation or “3” if product was “dry” formation. PRI denotes the price of product (85, 135 or 165 Baht per 1 Kg for value 1, 2 or 3 subsequently). QUA takes a value of 1, 2 and 3 if the brand-quality is Unbranded quality, Commercial quality and Premium quality respectively. As well as NUT takes a value of 1,2 and 3 if the nutrition of dog food is “Fulfilled nutrition”, “Silky hair and skin condition” and “dog’s preference” respectively.

For an example, In question 1 (**Table A1**) consisted of the element code in alternative A product profile was “FOR = 1, PRI = 2, QUA = 2 and NUT= 2” respectively and alternative B product profile was “FOR = 3, PRI =3, QUA =2 and NUT = 1” respectively. The sample of choice set in question would be presented in Table A2 as follow.

Table A2. The example of choice set generated by AlgDesign package.

| Attributes | Alternative “A” | Alternative “B” | Alternative “C” |
|----------------------|--|---|---|
| Format |  1 kg canned |  1 kg dry | Neither dog’s pet food A nor B is preferred |
| Price | 135 baht | 165 baht | |
| Quality Brand | Commercial Quality | Commercial Quality | |
| Nutrition | Silky hair and Skin condition | Fulfilled nutrition | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |

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APPENDIX B

THE QUESTIONNAIRS USED IN THIS RESEARCH



Instruction: This questionnaire aims to study the preference of dog food product in Bangkok and suburban area. This questionnaire is divided into 3 sessions. Please fill the form truly and completely.

Session 1: The demographic data


1. Gender 1. Male 2. Female
2. Age 1. Between 15 – 25 year 2. Between 26 – 35 year
 3. Between 36 – 45 year 4. Between 46 – 55 year
 5. \geq 56 year
3. Income 1. \leq 15,000 Baht/month
 2. 15,001 – 25,000 Baht/month
 3. 25,001 – 35,000 Baht/month
 4. \geq 35,000 Baht/month
4. Marital status 1. single 2. marriage
 3. divorced, widowed or separated
5. Educational level 1. primary school 2. Matthayom
1-3 3. Matthayom 4-6 4. diploma
 5. bachelor degree 6. master
degree 7. philosophy degree
6. Occupation 1. company employee 2. government officer
 3. student 4. work for hire
 5. housekeeper 6. business owner
 7. merchant 8. other _____
7. the reason for raising the dogs (You can answer more than 1 choice)
 1. as being friend 2. for house guarding
 3. for commercial purpose

Session 2. If you were in the market to buy dog food these were your only option, which one would you choose?



Question 1

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|--|--|---|
| Format |  1 kg |  1 kg | Neither dog's pet food A nor B is preferred |
| Price | Canned 85 baht | Canned 135 baht | |
| Quality Brand | Premium Quality | Commercial Quality | |
| Nutrition | Dog preference | Fulfilled nutrition | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |

Question 2

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|---|---|---|
| Format |  1 kg |  1 kg | Neither dog's pet food A nor B is preferred |
| Price | Dry 135 baht | Pouch 135 baht | |
| Quality Brand | Premium Quality | Commercial Quality | |
| Nutrition | Silky hair and Skin condition | Dog preference | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |



Question 3

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|--|--|---|
| Format |  1 kg |  1 kg | Neither dog's pet food A nor B is preferred |
| Price | Canned 135 baht | Pouch 85 baht | |
| Quality Brand | Commercial Quality | Premium Quality | |
| Nutrition | Fulfilled nutrition | Silky hair and Skin condition | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |

Question 4

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|--|--|---|
| Format |  1 kg |  1 kg | |
| Price | Dry 165 baht | Dry 135 baht | Neither dog's pet food A nor B is preferred |
| Quality Brand | Commercial Quality | Premium Quality | |
| Nutrition | Dog Preference | Silky hair and Skin condition | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |



Question 5

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|--|--|---|
| Format |  1 kg |  1 kg | |
| Price | Pouch 85 baht | Dry 165 baht | Neither dog's pet food A nor B is preferred |
| Quality Brand | Commercial Quality | Commercial Quality | |
| Nutrition | Silky hair and Skin condition | Dog preference | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |



Question 6

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|--|--|---|
| Format |  1 kg |  1 kg | |
| Price | Pouch 165 baht | Dry 85 baht | Neither dog's pet food A nor B is preferred |
| Quality Brand | Premium Quality | Commercial Quality | |
| Nutrition | Fulfilled nutrition | Fulfilled nutrition | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |



Question 7

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|--|--|---|
| Format |  1 kg |  1 kg | Neither dog's pet food A nor B is preferred |
| Price | Pouch 135 baht | Canned 165 baht | |
| Quality Brand | Commercial Quality | Commercial Quality | |
| Nutrition | Dog Preference | Silky hair and Skin condition | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |

Question 8

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|--|--|---|
| Format |  1 kg |  1 kg | Neither dog's pet food A nor B is preferred |
| Price | Dry 85 baht | Pouch 165 baht | |
| Quality Brand | Commercial Quality | Premium Quality | |
| Nutrition | Fulfilled nutrition | Fulfilled nutrition | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |

Question 9

| Attributes | Alternative "A" | Alternative "B" | Alternative "C" |
|----------------------|--|--|---|
| Format |  1 kg |  1 kg | Neither dog's pet food A nor B is preferred |
| Price | Canned 165 baht | Canned 85 baht | |
| Quality Brand | Commercial Quality | Premium Quality | |
| Nutrition | Fulfilled nutrition | Dog preference | |
| | <input type="checkbox"/> A | <input type="checkbox"/> B | <input type="checkbox"/> C |

Session 3. In your opinion, what is the most importance to you when buying dog food in market? Please circle only choice in each question.

Example

Criteria A is more importance than Criteria B = 6

| | More importance than | | | | | | | | | Less importance than | | | | | | | | | |
|------------|----------------------|---|---|---|---|---|---|---|---|----------------------|---|---|---|---|---|---|---|---|--|
| Question 1 | | | | | | | | | | | | | | | | | | | |
| A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | B | |

3.1 Dog food characteristics

| | More importance than | | | | | | | | | Less importance than | | | | | | | | | |
|------------|----------------------|---|---|---|---|---|---|---|---|----------------------|---|---|---|---|---|---|---|-----------|--|
| Question 1 | | | | | | | | | | | | | | | | | | | |
| format | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | price | |
| Question 2 | | | | | | | | | | | | | | | | | | | |
| format | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | quality | |
| Question 3 | | | | | | | | | | | | | | | | | | | |
| format | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | nutrition | |
| Question 4 | | | | | | | | | | | | | | | | | | | |
| price | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | quality | |
| Question 5 | | | | | | | | | | | | | | | | | | | |
| price | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | nutrition | |
| Question 6 | | | | | | | | | | | | | | | | | | | |
| quality | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | nutrition | |

3.1 Formats of dog food

| | More importance than | | | | | | | | | Less importance than | | | | | | | | | |
|------------|----------------------|---|---|---|---|---|---|---|---|----------------------|---|---|---|---|---|---|---|-------|--|
| Question 7 | | | | | | | | | | | | | | | | | | | |
| canned | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | pouch | |
| Question 8 | | | | | | | | | | | | | | | | | | | |
| canned | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | dry | |
| Question 9 | | | | | | | | | | | | | | | | | | | |
| Dry | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | pouch | |

3.2 Prices of dog food

| | | | | | | | | | | | | | | | | | | | | |
|--|----------------------|--|--|--|--|--|--|--|--|--|----------------------|--|--|--|--|--|--|--|--|--|
| | More importance than | | | | | | | | | | Less importance than | | | | | | | | | |
|--|----------------------|--|--|--|--|--|--|--|--|--|----------------------|--|--|--|--|--|--|--|--|--|

Question 10

| | | | | | | | | | | | | | | | | | | |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------|
| 85Baht/kg | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 135Baht/kg |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------|

Question 11

| | | | | | | | | | | | | | | | | | | |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------|
| 85Baht/kg | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 165Baht/kg |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------|

Question 12

| | | | | | | | | | | | | | | | | | | |
|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------|
| 135Baht/kg | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 165Baht/kg |
|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------|

3.3 Brand-Quality of dog food

| | | | | | | | | | | | | | | | | | | | | |
|--|----------------------|--|--|--|--|--|--|--|--|--|----------------------|--|--|--|--|--|--|--|--|--|
| | More importance than | | | | | | | | | | Less importance than | | | | | | | | | |
|--|----------------------|--|--|--|--|--|--|--|--|--|----------------------|--|--|--|--|--|--|--|--|--|

Question 13

| | | | | | | | | | | | | | | | | | | |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------|
| unbranded | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | commercial |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------|

Question 14

| | | | | | | | | | | | | | | | | | | |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---------|
| unbranded | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | premium |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---------|

Question 15

| | | | | | | | | | | | | | | | | | | |
|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---------|
| commercial | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | premium |
|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---------|

3.4 Brand-Quality of dog food

| | | | | | | | | | | | | | | | | | | | | |
|--|----------------------|--|--|--|--|--|--|--|--|--|----------------------|--|--|--|--|--|--|--|--|--|
| | More importance than | | | | | | | | | | Less importance than | | | | | | | | | |
|--|----------------------|--|--|--|--|--|--|--|--|--|----------------------|--|--|--|--|--|--|--|--|--|

Question 16

| | | | | | | | | | | | | | | | | | | |
|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------------------|
| Fulfilled nutrition | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Silky hair and skin condition |
|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------------------|

Question 17

| | | | | | | | | | | | | | | | | | | |
|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------------|
| Fulfilled nutrition | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Dog preference |
|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------------|

Question 18

| | | | | | | | | | | | | | | | | | | |
|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------------------|
| Dog preference | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Silky hair and skin condition |
|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------------------|

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