Identify the Factors Influencing Supplier Selection in Purchasing Raw-Material of Seafood Manufacturers by Using Analytic Hierarchy Process (AHP)

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Abstract

The purpose of this paper identified the influencing factors supplier selection the in purchasing raw-materials of seafood manufacturers by Analytic Hierarchy Process (AHP), as a Multi-Factors Decision Model (MCDM) for analyzing importance weight of supplier selection. The primary factors; product and quality, price, location and distribution channels, service and nineteen secondary factors are considered for selecting specific suppliers. A literature and document review were carried out by using academic database. For determining the importance weight of factor, in-depth interviews of three company managers, who have experience more than 5 years only in purchasing raw-materials for seafood products, were used as the case study. A questionnaire survey was collected to compare each factor for further analysis using AHP technique. The result presented primary factors for supplier selection of each group's overall importance weight by group relative importance. A quality (0.395), price (0.364), service (0.149), and location and distribution channels (0.092). are the factors influencing the decision to select supplier in Purchasing Raw-Material of Seafood Manufacturers.

Keywords: Analytic Hierarchy Process, Seafood, Manufacturers.

Introduction

Nowadays, processed seafood products are considered popular among Thai people of all ages and can be consumed on many occasions. Both in small family celebrations at home or often go to see it at a hotel party and various locations which

come from various flavors that can be used in many dishes, such as steaming, frying, boiling, grilling, or salad, as well as being easy to find and store. Especially, from Krungsri Research, the processed seafood products are not famous only in Thailand, they forecast that the value of Thai exports of processed seafood will rise by an average of 1-2% per year in the period 2019-2021, up from a 0.02% increase in 2018. And output by the chilled and frozen seafood sector is forecast to rise by 1-2% and 0.51% per year with regard to volume and value (Chaiwat Sowcharoensuk, 2019). This makes the industrial sector try to develop the products that come out with quality for the needs of consumers. Products that come out of quality can only be made from quality raw-materials. Therefore, choosing to purchase raw-materials to put into the production process is so important. And while the raw-material seller or those who wanting to sell raw-materials to the company, there are also many suppliers to choose for purchasing. So, the company should know those factors affecting the decision to select suppliers in the purchase of raw-materials to make the decision to select suppliers more precisely.

The consideration of factors to choose the right supplier can be a challenge. There are several methods of decision making to approach. This paper presents Multi-Factors Decision Making (MCDM) for choosing optimal probable options in decision making. One popular method of MCDM is called Analytic Hierarchy Process or AHP. It uses the deriving of objectives, factors and sub-factors into multi-level hierarchical structure and helps decision makers make the best decision. This is a structured technique for solving complex decisions that easy to understand. It is designed to reflect the way human think and apply logics to decompose decision problem into a hierarchy structure (Vargas, 1990). The MCDM is very famous technique (Laguna et al, 1999). There has been the development of computer programming to ease analytic decision making. Moreover, this can help in planning and developing organization strategy for the best efficiency to compete against others (Kantamon Sukkrajang & Tarathorn Kullpattaranirun, 2011).

Objectives

1. To determine and evaluate key factors influencing the selection supplier in purchasing raw-materials of seafood manufacturers by multi-factors decision making method

2. To create the hierarchy structure to select the right supplier in purchasing raw-materials

Concept and Theory

Analytic Hierarchy Process Theory

The Analytic Hierarchy Process (AHP) is a theory of measurement for dealing with quantifiable and intangible factors that has found many applications in decision theory, conflict resolution and in models of the brain. It is based on the principle that, to make decisions, experience and knowledge of expert is at least as valuable as the data they use (Vargas, 1990). AHP is thus a decision making approach based on the genuine ability of expert to make critical decisions that allow the active participation of decision makers in exploring all possible options in order to fully understand the underlying problems before reaching an agreement or arriving at a decision. Its fundamental purpose is to judge the given alternatives for a particular goal by developing priorities for these alternatives and for the selected factors (Saaty, 2001). A pairwise comparison technique is used to derive the priorities for the factors in terms of their importance in achieving the goal. Similarly, the priorities for the alternatives (i.e., the competing choices under consideration) are derived in pairwise comparisons in terms of their performance against each criterion. Generally, AHP is based on three principles: decomposition, comparative judgment, and synthesis of priorities on a standardized scale of nine levels present in Table 2.

The process of AHP

This is an Eigen value approach to the pair-wise comparisons. It also provides a methodology to calibrate the numeric scale for the measurement of quantitative as well as qualitative performances. The scale ranges from 1/9 for least valued than, to 1 for equal, and to 9 for absolutely more important than covering the entire spectrum of the comparison. Some key and basic steps involved in this methodology are (Saaty, 1980) :

1. Problem identification.

2. Building the objectives of the problem and outcome.

3. Identify the factors that influence the behavior.

4. Building the problem diagram in a hierarchy of different levels constituting goal, primary-factors, secondary-factors and alternatives.

5. Compare each element in the corresponding level and calibrate them on the numerical scale. This requires n(n - 1)/2 comparisons, where n is the number of elements with the considerations that diagonal elements are equal or 1and the other elements will simply be the reciprocals of the earlier comparisons.

6. Perform calculations to find the maximum Eigen value for each factors/alternative.

Research Methodology

This process will identify the detail of factors influencing supplier selection in purchasing raw-material of seafood manufacturers base on AHP by following 3 steps.

1) Scope of The Study

1.1) Scope of population and sample

The populations were the 25 persons from management team of the company a case study. The samples in this study using 3 participants from purposive sampling method were management team, who are expert or who have experience more than 5 years only in purchasing raw-materials for seafood product from purchasing department a case study by using In-depth interview with principle of Analytic Hierarchy Process (AHP).

1.2) Scope of study's area

Choosing only 1 seafood manufacturer in Tambon Khao Rup Chang, Mueang Songkhla District, Songkhla, Thailand for this study.

2) Collecting Data

This research presents hierarchy structure to select supplier of seafood manufacturers. By studying contents, documentaries and literatures related choosing supplier; the relative factors are collected and evaluated for making the decision, as present in Table 1.

Table 1 A Group of Factors for selecting supplier of purchasing raw-materials in processed seafood products.

Primary Factors	Secondary Factor
Product and quality	Low price (Yücenur, Vayvay, & Demirel, 2011)
	Terms of payment (Mital, Del Giudice, & Papa, 2018)
	Wholesale and Retail (Bag, & Anand, 2015)
	Negotiable (Balci, Cetin, & Esmer, 2018)
	Promotion (Bandeira, Becker, & Waquil, 2011)

Primary Factors	Secondary Factor
Price	- Freshness and cleanliness (Kamble, & Raut, 2019) - Standard product (Magdalena, 2012) - Size and weight (Certa et al, 2018) - Product variety (Zarei, Fakhrzad, & Paghaleh, 2011)
Location and distribution channels	- Convenient transportation (Yang, 2019) - Distance (Jovanović, & Delibašić, 2014) - Safe and easy to find (Qiao, Dawei, & Xin, 2015) - Parking area (Chaiyaphan, & Ransikarbum, 2020)
Service	- Delivery (Ramlan et al, 2016) - Convenient and fast (Wang, 2020) - Completely pre-process service (Kim, & Choi, 2019) - Contact easily (Susanty et al, 2018) - Advising consumers (Fritz, 2009) - Staff (polite and good service) (Hwang, & Sneed, 2007)

Form table 1, It was shown the primary factors and secondary factors affecting the decision of supplier selection in seafood process product is classified into four factors that are placed at the second level of the structure as primary factors. The secondary factors are at the third level of the structure and alternative of supplier are at the fourth level shown in figure 2.

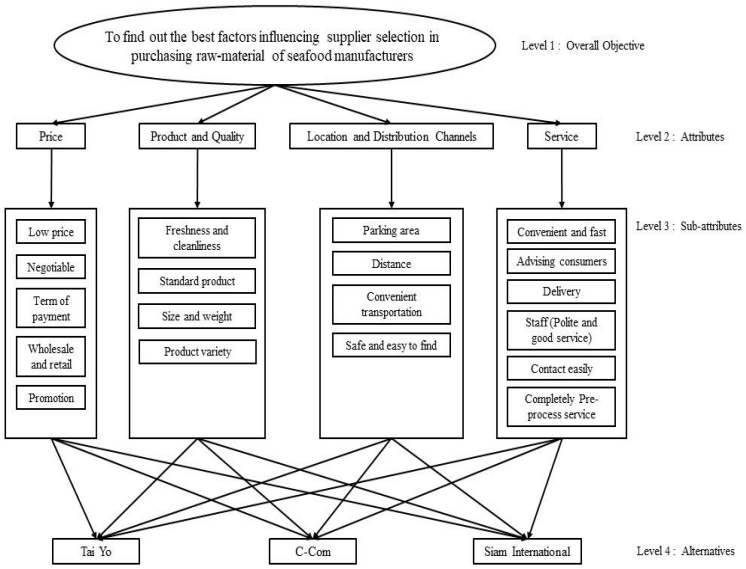

Figure 2 illustrates the hierarchy of factors affecting selecting supplier of purchasing raw-materials Seafood Manufacturers.

There are 3 experienced and expert respondents who are in management team or decision makers to get the In-depth interview as following principle of Analytic Hierarchy Process (AHP) with scoring the importance of various factors or choose preferable one by comparing them to each other two at a time or pair-wise comparison starting from top to bottom of hierarchy. The AHP measurement scale is derived into 9 levels as demonstrated in table 2.

Table 2 The Standard Evaluation of Pair-wise Comparisons (Saaty, 2008)

Intensity of Importance	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one factor over another
5	Strong important	Experience and judgment strongly favor one factor over another
7	Very strong importance	Experience and judgment very strong favor one factor over another. Its importance is demonstrated in practice
9	Absolute importance	The evidence favoring one factor over another is of the highest possible validity
2, 4, 6, 8	Intermediate values	When compromise is needed
1.1 – 1.9	If the factors are very close	When the importance of factors would not be too noticeable. 1.3 is moderately close, 1.9 is very much close

3) Hierarchy Analysis for Supplier Multi-Selection Factors

3.1) Structure The Hierarchy

3.1.1) Study documentaries, contents and research papers related to site selection, and collect the factors that influence decision making. Group the factors into primary and secondary factors to create questionnaire survey.

3.1.2) Having the factors, the hierarchy is structured. Weight of each factor is calculated. The person answering the questionnaire survey is management team or decision makers.

3.2) Factors Analysis

This research uses sample group to calculate the weight of every factors. The weight will be averaged and subjected into matrix for pair-wise comparison. This will establish priorities among factors in hierarchy. The management team or decision makers who are professional will select supplier for purchasing raw-material of seafood manufacturer. According to the interview following hierarchy process, Analyze data as hierarchy process 5 steps to find out weight of each factor

(1) Create questionnaire survey from hierarchy model for comparing each pair of factor(primary and secondary factors)

(2) The group of decision makers will complete the questionnaire (Step 1: pair-wise comparison of primary factors) and compare each pairs of factor, and then calculate the weight of the pairs of primary factors

(3) The group of decision makers will complete the questionnaire (Step 2: pair-wise comparison of secondary factors) and compare the data in pairs in each factors, and to calculate the weight of the pairs of secondary factors.

(4) Having the weights of primary and secondary factors, the average weight of secondary factors is calculated by Average weight of secondary factor = weight of primary factor × weight of secondary factor that below primary factor.

(5) When finishing calculation, the factors influencing the decision to select location will be obtained.

Result and Discussion

1) The analysis of data by using weight of the samples for each factor and averaged those weights. The obtained average weight will put into the matrix and compare in pairs, the result shows that

1.1) The weight of importance of primary factors for choosing supplier for purchasing raw-material of seafood manufacturers, by descending order, are product and quality (0.395), price (0.364), service (0.149), and location and distribution channels (0.092) as demonstrated in table 3. Studying the foreign literatures related to supplier selection of other groups found that the factor affecting the decision tends to be in the same direction. The entrepreneur often weighs the most important factors of product and quality (Agarwal & Vijayvargy ,2011; Ni-Di & Ming-Xian ,2010).

Table 3 The Weight Evaluation Result of Primary Factor

Primary Factors	Averaged Weight
Product and quality	0.395
Price	0.364
Service	0.149
Location and distribution channels	0.092

2) The weight of importance of secondary factors for choosing supplier for purchasing raw-material of seafood manufacturers, by descending order, are as following and demonstrated in table 4

Table 4 The Weight Evaluation Result of Secondary Factor

Secondary Factors	Averaged Weight
Price	
- Low price	0.2938
- Terms of payment	0.2251
- Wholesale and Retail	0.1891
- Negotiable	0.1661
- Promotion	0.1259
Product and quality	
- Freshness and cleanliness	0.340
- Standard product	0.359
- Size and weight	0.169
- Product variety	0.132

Secondary Factors	Averaged Weight
Location and distribution channels	
-Convenient transportation	0.346
- Distance	0.331
- Safe and easy to find	0.206
- Parking area	0.116
Service	
- Delivery	0.2469
- Convenient and fast	0.2249
- Completely pre-process service	0.1892
- Contact easily	0.1603
- Advising consumers	0.1000
- Staff (polite and good service)	0.0787

2.1) Price includes in term of low price (0.2938), terms of payment (0.2251), wholesale and retail (0.1891), negotiable (0.1661), and promotion (0.1259)

2.2) Product and quality include freshness and cleanliness (0.340), standard product (0.359), size and weight (0.169), and product variety (0.132)

2.3) Location and distribution channels are convenient transportation (0.346), distance (0.331), safe and easy to find (0.206), and parking area (0.116)

2.4) Service involves delivery (0.2469), convenient and fast (0.2249), completely pre-process service (0.1892), contact easily (0.1603), advising consumers (0.1000), and staff (polite and good service) (0.0787)

This study was based on the Analytics Hierarchical Process (AHP) methods for defining the weight of the factors Influencing supplier selection in purchasing raw-material of seafood processing industry and no similar studies was carried out involving seafood suppliers in Thailand. By in-depth interviewing with 3 purchase managers of a seafood processing firm. It was found that the results show that the primary factor was product and quality factor is the highest weight of important. According to Kamble & Raut (2019) have been investigated the factors affecting the purchase of raw materials in the potato processing industry. The quality of the raw materials was found to be the most importance in the purchasing decision process. As well as the study of Magdalena

(2012) was found that the quality factor have importance to selected the food supplier in Indonesia. However, there are still different findings than previous research findings by Chaiyaphan & Ransikarbum (2020) studied the factors that affect food safety in the fresh market the most important factor was not the quality of the raw materials. But it's the location and the building structure of fresh markets.

Exploitation of Research Results

This research will be useful for entrepreneurs to make decisions together with market research. Especially in the process of checking the quality of the raw materials. Entrepreneurs should have a modern raw material quality checking system, such as a computer vision system and contaminated systems to reduce human errors and increase reliability for entrepreneurs in the future.

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