Applying AHP in Evaluation the Distribution Science of Suppliers for Retails in Vietnam: Case of Saigon Co-op Mart

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Abstract

Purpose: Retailing is a very special sector because it demonstrates the effectiveness of combined products and services to create business values. In this study, the author wants to investigate particular areas in the distribution sciences of the purchasing process in Coopmart (Saigon Coop-Vietnam), which is about sauces and seasoning. **Research design, data and methodology:** The data were collected by experts of Saigon coop, which first went through the Delphi method to choose criteria and sub-criteria for the Analytic Hierarchical Process (AHP). **Results:** After a long process of calculation based on AHP, the final supplier is chosen according to experts' interview; Masan is the most potential candidate to be the main supplier of *sauces and seasoning* to Coop mart. Therefore, it is necessary to apply the typical methods such as quantitative analysis of this process - AHP. With the aim of increasing the computational content of the evaluation process suppliers, especially the comparison of suppliers in the same industry as AHP has shown. This enables analyses of all the providers to be more scientific. **Conclusions:** Thus, this paper would help the facility managers ensure objectives to the reasonable decision, which can be based on AHP to get more information, implement plans and get strategic collaboration with suppliers.

Keywords : AHP, Suppliers, Distribution Science, Decision Making, Sauces and Seasoning

JEL Classification Code: M3, M14, M37, M56

1. Introduction

Vietnam has a young population with the median age of 28.7; and 87% of them are under 54 years old. Over the next 10 years, about 17 million people whose age is between 10 and 19 now will enter the consumer market. These figures show that Vietnam is holding a "golden" retail index. Moreover, Vietnam is now developing and becoming one of the most dynamic emerging countries in the East Asia region. Higher living standards and rising income have enabled people to spend more for their lives. Although the economy has gone through a difficult period with recession, inflation and trade deficit, it is still one of the most potential markets for retailers with the compound annual growth rates. Among many retailing companies having the business operation in Vietnam at the moment, Saigon co-op (well known as Co-op mart) Supermarket stands out as one of the leaders.

Retailing is one of the factors of the supply chain management (SCM), which is demonstrated at the effectiveness of combined products and services to create business values. The greater part critical and only the SCM is the buying activity, and the multi-criteria dissection shows up to be correct results for those order about a significant number bought products in the firm (Lestari et al., 2020; Nguyen, 2020; Choi & Choi, 2018; Ryu et al., 2020; Hsing, 2019). As these exertions that acquire items with a sensible cost, straight quantity, suitable quality, ideal

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lead-time from those straight sources, may affect the firm's survival in the competition (Simchi-Levi and Kaminsky, 2003). Especially in *Fast Moving Consumer Goods* (FMCG), the importance of food supply chain management has been growing both at the industrial and scientific levels. The challenges faced in food supply chains are at the intersection of several disciplines and go beyond the traditional cost minimization concern (Ozawa, 2003; Nguyen, & Tran, 2019). Particularly, in the process food industry, the retailers have to deal with higher uncertainties both upstream and downstream of the supply chain. These uncertainties are related to an ever-increasing product variety, more demanding customers and a highly interconnected distribution network. This implies that companies operating in the process food industry need to manage the risk/cost trade-off without disregarding freshness, sustainability and corporate social responsibility issues (Maloni, & Brown, 2006). Making a right decision in supplier selection is very important for the retail enterprises. This Research will present the application of the Analytic Hierarchy Process (AHP) method in evaluation and selection of suppliers for Coopmart enterprise in Vietnam.

Established in 1989, Saigon Coopmart operates business in the form of "Hypermarket" or "Supercenter", a modern retail business which is managed under the company name at Saigon co-op. It is one of the major retailers in the world, 25 years working in the retails with over 16,000 employees, establish more than 360 stores in Vietnam includes 90 supermarkets (name as Co-op mart), 200 mini-store (name as Coopfood), 60 grocery store (name as Coop Smile), 2 wholesale affiliated supermarket (name as Coop Extra) and in progress opening convenience store name as CHEERS.

The word Coop mart reflects the popular Vietnamese meaning of the word 'supermarket'. Moreover, Co-op mart currently stocks over 40,000 items to meet every customer's needs. With more than 16,000 staffs, Coop mart offers a clean, comfortable shopping environment with a wide assortment of goods available at reasonable prices and provides an outstanding customer service in order to ensure the winning business strategy.

In this research, the author wants to investigate particular areas of purchasing process in Co-op mart. The purchasing product, which is the brands sauces and seasoning such as soy-bean sauces, is selected as the main focus during the research because it will benefit to Coop mart in practice. Moreover, this contributes to this work as the paper's research objectives is stated as the following objectives: First, the author determinate the process of purchasing product/service existing in Coop-Mart enterprise; Second, a short review of literature regarding selection of suppliers is presented, focusing at supplier evaluation criteria and methods to propose model for supplier evaluation for the current study; Third, AHP

method is explained and its main stages in selection of suppliers for the enterprises is described. Then the author applies AHP to select vendors.

From that point of view, the research questions are as follow:

[1]. What are the factors affecting the evaluation and selection of supplier in retails?

[2]. How Analytic Hierarchy Process (AHP) method support retail company to select the right supplier?

2. Literature Review

2.1. Purchasing Activities

Purchasing is defined as the activities of acquiring goods or services to accomplish the goals of an organization (Lysons et al., 2006). Besides, procurement is considered as the process of obtaining business supplies, especially for an organization. Purchasing is the strategic part of buying a good or a service, while procurement is considered as the fulfillment of orders to secure daily's operations. Therefore, procurement normally depends on purchasing

Purchasing is a critical process of any economic activity. The characteristics of the purchase department in any company is list out in the theory below (Craighead et al., 2007):

Consolidate process of productivity: procurement department manage the flow of material, components, equipment with no interrupted in continuous supplying and maintenance services.

The development of asset turnover: The investments in inventories and fixed asset have to be hang at bottom in relation to the according volume of sales. The effective purchasing department create the benefit of fixed assets and control a certain level of investments in inventories.

Expanding the benefit of supplier: The increasing of bargaining ability in negotiation with supplier is very important. It helps our company minimize the cost of materials and develop the ability solve the unpredictable problem.

Always keep in touch and sensible with suppliers.

Enhancement reasonable cost of materials supplies and equipment: This is very important in manufacturing operations. It helps business increases the performance of productivity and profitability of the operations.

The good strategy to integrate with other departments in our business:

With the manufacturing department: offers supplies for certain items, always observe the material specification, equipment, machine, process of materials...

The demand for increase capital such as investments of

materials and equipment are calculated by Finance department.

Human Resource demand for purpose of training the personnel of procurement activity, negotiation ability with supplier.

Base on the forecast sales that generate by the marketing department, the purchasing process can be adjusted the procurement of materials, impact of change of quality.

2.2. Characteristics of Purchasing

Purchasing may also involve the development, review of the product specifications, and receipt and processing of requisitions (Kim, & Youn, 2012; Su, 2013; Kim et al., 2014; Agustina, & Pramana, 2019). In addition, purchasing may include the advertisement for bid or bid evaluation, and the activities of awarding supply contracts as well as inspection of good received and stored (Leenders et al., 2002). In the study of Farmer and Jessop (2005), the major characteristics of purchasing are to: (1) maintain the quality and value of a company's products; (2) minimize cash tied-up in inventory; (3) maintain the flow of inputs to maintain the flow of outputs; and (4) strengthen the organization's competitive position.

The decision-makers rate those expected execution of the suppliers by assessment some factors under subjective judgment. The execution of the suppliers raking is multiplied by their respective critical weights to the yield (Kim, & Song, 2019; Kim et al., 2015). Finally, the merchant for those most elevated summated scores may be those predominant decision. Yet, those models need the hindrance from claiming supposition in ordinal scale concerning illustration a cardinal scale.

Chan et al. (2008) mentioned about five factors that influenced on the process of evaluating and selecting suppliers for business describe as below:

Cost: Product price, freight costs, tariffs and customs duties.

Service quality: Rejection rate of products, increase in delivery time, quality assessment, overcoming quality problem.

Delivery schedule: R&D, reacts to the changes, the ease of communication.

Vendors' profiles: Financial status, customer base, performance history, production facilities and capacity.

Risk factors: Geographical location, political stability, economic terrorism.

Afterward formed AHP-based decision-making approach will unravel the supplier choice issue. Possibility suppliers were assessed dependent upon 14 criteria. An affectability Investigation utilizing Expert Choice might have been performed should analyze those reaction for each alternative when those relative criticalness rating for each paradigm might have been transformed.

In another study conducted by Sevkli et al. (2007), they considered the analytic hierarchy process, known as AHP method, as a successful one in evaluating and selecting vendors for entrepreneurs. Six criteria which stated by Sevkli et al. (2007) includes: Performance evaluation; Human resources; Quality of the evaluation system; Production; Criteria business; Information technology. Similarly, Chavan (2009) pointed out six criteria to evaluate suitable vendors, which is admitted as one of the most modern method for the process of selecting supply chains for business and published worldwide in the report "Balance Score Card", following.

Financial Health: Revenue; Profit; Liquidity; ROI; Debt; Financial Transparency

Expertise: Capacity building network; Technical capability; Technical creation ability; Investment in R&D

Operational Performance: Delivery product on time; Lead-time; Responsiveness; Management and inventory control; Facility maintenance; Forecasting capacity

Business Process and Practices: Service quality in exchange value; Creating value in use; Operating business responsibly

Behavior and Cultural Factor: Racism; Business ethnic; Improvement; Updating information frequently; Honesty

Risks Factors: Political situation; Natural condition; Stable economy; Insurance; Commercial law

3. Methodology

The analytic hierarchy process (AHP) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. In this section, we will describe problem with the AHP which include its concept, functions, basic scales, practical applications, and illustrative examples. Finally, we analyze the advantages and limitations of AHP method.

Those matched correlation scales the middle of the correlation couple (aij) of two things (element i and element j) will be as takes after: (element i) 9 to 1 and 1 to 9 (element j)

The ratio scale for pair-wise correlations of two criteria rank from the minimum value 1 to 9 (0.111 in decimal from). Let aij stands for the correlations between element-i (right) and element-j (left). If element-i was greater (strong importance) 6 time than element-j for a given factor, then the comparison aij = 1/aij = 1/6 (0.167) or those equal esteem for the matched correlation between both elements.

After the correlation matrix is interpreted, AHP estimates by calculating a priority vector (also called an eigen vector) that means the relative positioning of preference (or importance) attached to the object or criteria being correlated. The most valued priority gives a scale of consistency. In the comparison matrix, if the determined doesn't satisfied with the transitive property and the largest eigen value is far exceeds the number of items being compared, there is not consistency. And if a matrix algebraic property of cardinal transitivity where the equality a(ij) = 1/a(ij) = a(ji)-1, and a(ij) = a(ik) a(kj) for any index i, j, k, there are consistency.

The Geometric mean is an elective measure of the weight and might have been framed toward taking those n-th root of the product matrix of row elements divided by the column sum of row geometric means. Those Geometric Mean is near with the weight.

Lambdamax (4.2385) is an eigenvalue scalar that comprehended those trademark mathematical statements of the information correlation matrix. Generally, those Lambdamax value ought to equivalent to the number of factors in the correlation (n=4) for sum of consistency.

Those consistency index (CI) measures the level of consistency through pair-wise correlations. The random index (RI) is the average CI value of randomly generated comparison matrices using Saaty's preference scale sort by the amount of item being acknowledged. If |CI| <0. 05, it demonstrates beneficial consistency for pair-wise correlations. Though |CI| >0. 05, the pair-wise correlation needs to be reconsidered.

$$CI = \frac{(\lambda \max - n)}{(n-1)} \qquad (1)$$

Consistency ratio (cr) indicates the amount of allowed inconsistency (0.10 or 10%). Higher numbers mean the comparisons are less consistent. Smaller numbers mean comparisons are more consistent. CRs above 0.1 means the pair-wise comparison should be revisited or revised.

$$CR = \frac{|CI|}{RI} \qquad (2)$$

RI index (Geoff, 2004) are shown:

RI index

n =	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI =	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

4. Research Design and Process

4.1. Traditional Method to Evaluate and to Select Right Supplier of Coopmart

The assessment suppliers of Coopmart are mostly qualitative, personal, and done without expertise, so greatest weaknesses are laden subjective elements and/or emotions which may cause bias. The criteria to be used include:

[1]. *Capacity of providers* includes factors such as: core competencies, financial, manufacturing technology, freight, providers assessing of how many cars and/or including any vehicles.

[2]. *Delivery time* consists of auxiliary criteria: the operation, the time of deliveries, and/or how to transfer.

[3]. *Experience* includes items such as a list of customers that have been or is about to be cooperated by the supplier. The growth of these customers is to credit the supplier. Finally, the long times of establishment also adds points to the supplier.

[4]. *Price*: Coopmart will see many providers to consider price competition to have the final decision-making choice.

[5]. *Time of payments*: Coopmart often requests to pay the supplier till the end of each month, and this demonstrate financial strength of the provider and their liquidity.

[6]. *Risk*: Coopmart will find out whether providers have met with problems or difficulties. Next is to consider the offer insured or not, if they have purchased, the cost will be higher but are offset to ensure safety, even if they do not buy insurance, the cost will be lower but they must provide sufficient reliability that they can prevent and control risk not expected to happen.

[7]. *Ability to transport* typically increases the number of times from e.g. 1 time per day to 2 or 3 times per day to ensure sufficient supplying to meet customer demands during Chinese New Year and other special occasions.

[8]. *Cultural practices* i.e. some cases as the drivers are specifically polite and honest. Suppliers are respectful to their customer of returns balances and/or lack the goods to report full replenishment time.

[9]. *As loyal suppliers*, the criteria are very highly.

[10]. The providers *sympathize* with difficulties of clients and are willing to share with clients. They are then really appreciated.

Coopmart monthly reviews of the statistics provided by the number of errors, the late deliveries and delayed time, and the number of defective products. Since then, they will handle compensation, evaluate credibility, and consider the added value e.g. if the supermarket delivers the products with negligible quantity at the free shipping but if the quantity of returned goods up from one to two cars or more, the shipping charges to return to the supplier. On the other hand, they also check if there are errors such as line breaks, lost goods of inferior quality. They also conduct disciplinary measures such as: ban runs (discontinue receiving), the owners requested compensation number of rows of shortfall amortization.

According to Faisal and Banwet (2009), the process of evaluating several vendors' bias is in a qualitative sense. The level of application tools and quantitative methods is low. Therefore, Coopmart has adopted many applications but not yet supported software evaluation, and comparison suppliers. The decision support system has not been promoting in use. Therefore, the analysis in decision-making process has not yet been deep. The major

management decisions are still based on personal experience. Thus, they need a professional method to select the right suppliers, not only based on their experience but also on the deep analysis, and AHP can meet their current demand and solve their problems (Kim, & Hun, 2017; Meiyani, & Putra, 2019; Kim, 2018; Lee et al., 2012; Nguyen, 2021; Nguyen et al., 2021).

4.2. AHP Method

According to five main criteria, the experts were asked to list down sub-criteria of each main criterion (Figure 1). This process is called second round selection, which are listed in the following sections. This process will be taken placed right after we summarized the main criteria. Moreover, they are also asked to fulfill one more point before we go on the survey of AHP, i.e. the names of the sauce and seasoning brands supplying products to Coopmart in recent years. They may also become their potential partner in the future because of this research.
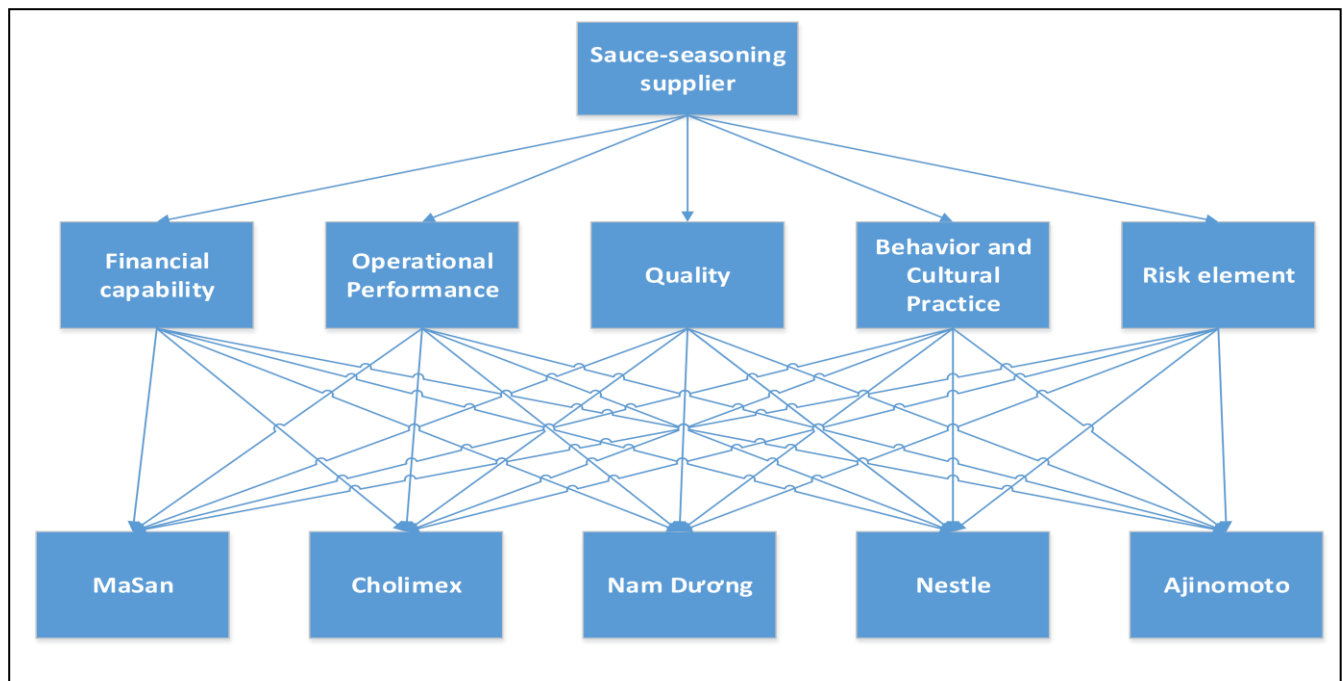

Figure 1: AHP method to select the best sauce & seasoning supplier

These five criteria include Financial Capacity, Operational Performance, Quality, Behavioral & Cultural Practice, and Risk Elements. They are very important elements for any company to consider a partner or supplier to fulfill.

Moreover, their sub-criteria are illustrated in Table 1 and Figure 2. They are also set-up by our experts during

this research. Also, by taking references from professional papers, this research concludes these factors into a very concise image.

After we have five main criteria, the experts were asked to list down sub-criteria of each main criterion. This process is called second round selection.

Table 1: The Selection Criteria for the Suppliers to Coop-Mart

| Perspectives (Level 1)	Criteria (Level 2)	Descriptions (Beyer, Cohen Lys & Walther, 2010; Chan et al., 2008; Sevkli, 2008; Yang, 2006; Gorgievski, Ascalon& Stephan, 2011)
Financial Capability	Turnover	This is one of the important parameters in finance. When talking about the financial strength of a business, the reports often focus on turnover.
	Profit	This information is located at a deeper level than revenue. It shows the actual profit of the suppliers.
	ROI	ROI is one of the key indicators of financial analysis. It represents the fertility rate of business investment.
	Debt Concerns	If the supply of capital is in good rotation, it will help reduce financial risks and operate stably. And if they turn negative capitals, it will lead to a high risk of causing imbalance and debts. Then capital enterprises have difficulties in making money-flows in the system, which strongly affects the operation of each department - leading to unstable supply of goods to partners.
	Financial Explicit	This sub-criterion is qualitative factor representing meaningful financial stability, operational transparency, credibility, honesty, enterprise culture.
Operational Performance	Delivery Time	It guarantees stability for business customers to ensure implementation of customer requirements to be always stable.
	Sales Responsibility	It helps to ensure safety for the stability of Coop-Mart purchasing. It also shows that the quality of goods is stable.
	Standardized Op. Performance	This is to ensure quality output and stability for business activities also for the client's business. Besides, it provides peace of mind to customers for services and products provider.
Quality	Productivity Technology	It helps ensure the quality and the stability of the products and services provided to customers.
	ISO Standard	provides a framework and set of principles that ensure a common-sense approach to the management of your organization to consistently satisfy customers and other stakeholders
	Creating Good Benefits to Customers	This is basically in line with the tastes and needs of customers. In addition, this criterion also helps increase customers' attraction.
	Being Honest in Product Description	This is to ensure the accuracy and transparency of the product. There's also the place to create customers' confidence.
Behavioral & Cultural Practice	Business Trend – Future	It helps the orientation behavior and cultural factors vertically good direction. And this is also the factor for the development in the future.
	Honesty: Rules & Regulations	These criteria ensure reliability of supply. Moreover, it helps customers more information and minister to the faithful implementation of the collaborative process of suppliers.
	Reaction on problems	The respond of company when issues happen represent the behavioral and cultural of that company.
Risk Elements	Business Stability	It helps ensure risk mitigation provider. Thus, Coop-Mart is also more assured about the stability of the supply of goods.
	Prestige: Insurance & Safety	It makes the customer feel secure place. Nobody wants to do business with unreliable partners. Trust between the parties to ensure smooth cooperation and be durable.
	Problem solving	The process of working through details of a problem to reach a solution. Problem solving may include mathematical or systematic operations and can be a gauge of a company's critical ability.
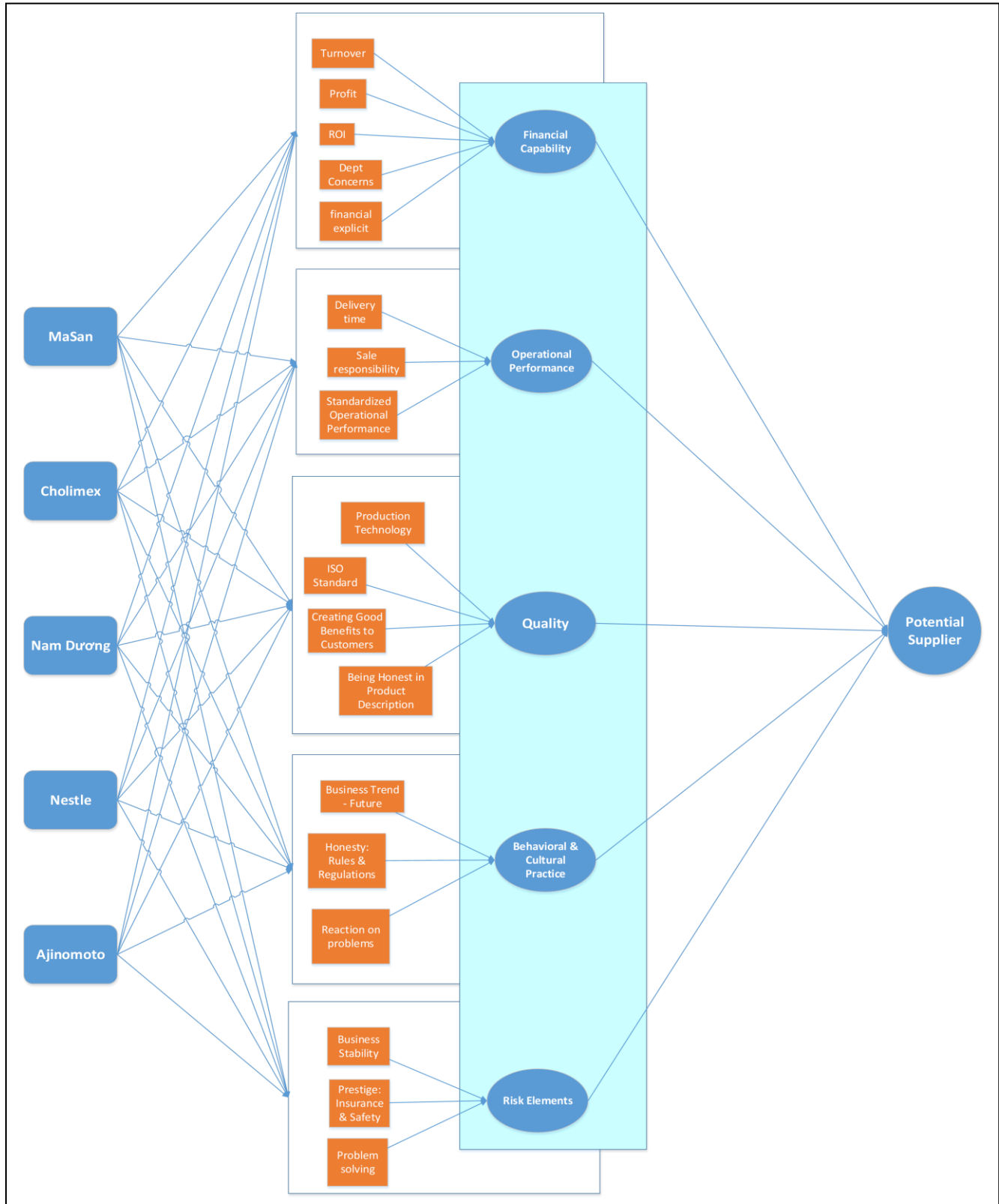
Figure 2: Research Model

The process hierarchy analysis is a new way to measure supplier sauces and seasoning industry of Coopmart. This is a new method to search for suppliers under its main ideas are comparing the performance of the supplier together. In this way, the results of the analysis hierarchy are a table which shows clearly the strong and weak suppliers. This important measure similar to the performance of the supplier and to analyze the factors behind this result and will be implemented in the next section.

This section presents the process according to the method of calculation process of AHP. Start with a hierarchical diagram level five main criteria governing the evaluation of suppliers' sauces and seasoning industry. This matrix shows the relationship between the main criteria according to the scale of the AHP. Accordingly, it can determine the correlation between the levels of importance of the variables.

5. Case Application and Results

5.1. Setting Stage

Comparable data are collected by the method of survey

experts through interviewing and directing the relevant agencies. Homogeneity index (incon) 0.05 of AHP is satisfactory. The main criteria are comparable bond correlation pairs separate to produce detailed data calculations (Figure 3). For each pair-wise-comparison, experts were ask to choose which criterion/sub-criterion/alternative they are prefer than other and score them at specific level.

Delphi method: 1st round in one week, then move to 2nd round in one more week.

AHP questionnaire: within a month.

The process of data collection is carried out according to the method of experts:

Step 1: based on assessment model has been developed, author use pilot interviews to experts to verify the appropriateness of the 5 main criteria KPI in level one and 18 in level two, together with confirming the identification actual business reality.

Step 2: based on the results of step 1 to adjust the model and building surveys/questionnaires (attached in appendix).

Step 3: surveys combined with direct interviews to each expert. At the request should have over 20 experts but by the actual situation should be reduced to 10 experts.

Step 4: collect other data through reports and documents related.

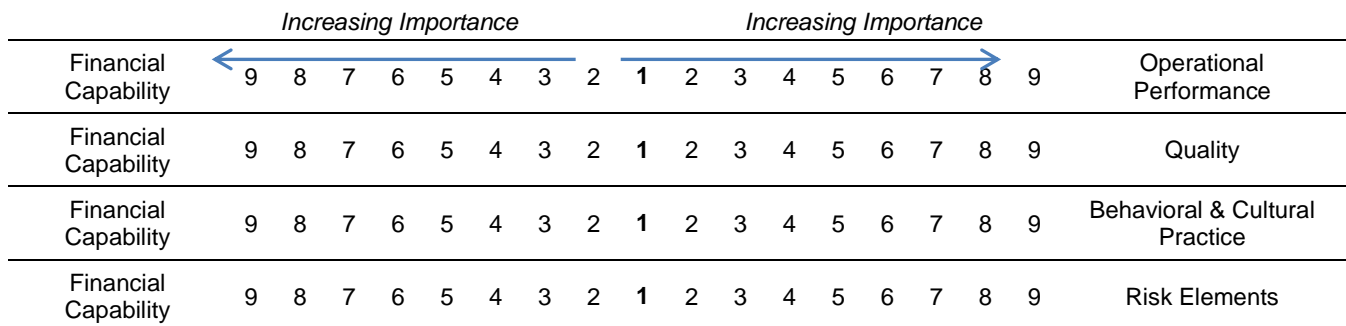1 = Equal; 3 = Moderate; 5 = Strong; 7 = Very Strong; and 9 = Extreme

	Increasing Importance									*Increasing Importance*								
Financial Capability	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Operational Performance
Financial Capability	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Quality
Financial Capability	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Behavioral & Cultural Practice
Financial Capability	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Risk Elements

Figure 3: Main Criteria Respect to Goal

Table 2: Pair-wise Comparison Matrix by Expert #. 1

Pair-wise comparison matrix by Expert #. 1					
Criteria	**Financial Capability**	**Operational Performance**	**Quality**	**Behavioral & Cultural Practice**	**Risk Elements**
Financial Capability	1	2	1/5	6	1/2
Operational Performance	1/2	1	1/6	6	1
Quality	5	6	1	5	1
Behavioral & Cultural Practice	1/6	1/6	1/5	1	1/4
Risk Elements	2	1	1	4	1
Total	8.6667	10.1667	2.5667	22.0000	3.7500

After finishing all the interview from expert, we need to input data into AHP measurement scale. Because the data in AHP is in matrix form so we need to convert the interview score to matrix (Table 2). Each cell is done by score divided to the cell total value of the matrix. For example, we have 0.309 = 1/3.238.

Then, the Weight (column priority) is the average of each row, which is total divided to the number of criteria:

Weight of Financial Capability = 0.275
= (0.309+0.228+0.380+0.255+0.205)/5.

Beside calculate the Weight of each criterion, we also need to test the consistency of the matrix and calculation by find the value of lambda max and CI with CR factors. We come up with SUM (column Priority weighting) and SUM/weight (column Priority weighting / Priority).

$$\lambda \max = \sum \frac{\text{SUM/Weight}}{n} = \frac{26.886}{5} = 5.377 \quad (3)$$

$$CI = \frac{(\lambda \max - n)}{(n-1)} = \frac{(5.377-5)}{(5-1)} = 0.094 \quad (4)$$

Table 3: Random Consistency Index (**RI**)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

There are 5 criteria so RI=1.12.

$$CR = \frac{|CI|}{RI} = \frac{0.094}{1.12} = 0.084 \quad (5)$$

CR=0.084 = 8.4% <10%, that means consistent.

The data is input like what've done and the weight of sub-criteria are also calculated by the same way of main criteria. For example, calculate the weight of sub-criteria in Financial Capability, with CR=0.078 = 7.8% <10%, that means consistent.

We do the same process for the remaining sub-criteria.

From the previous steps, we already have the weight of each main criterion and the weight of each sub-criterion belong to their main criteria. At this step, we need to calculate the global weight of sub-criteria over the whole picture to choose the supplier. For instant, to find the global weight of each sub-criterion in Financial Capability, we multiply the local weight of Financial Capability=0.275 to each weight of their sub-criteria.

We do the same process for the remaining criteria.

The data is input like what've done and the weight of each alternative is also calculated by the same way of main criteria and sub-criteria. For example, calculate the weight of each alternative in Financial Capability, with CR=0.082 = 8.2% <10%, that means consistent.

We do the same process for the remaining sub-criteria.

Same as what've done, we calculate the whole percentage of choice for each supplier under each sub-criterion. We multiply the global weight of each sub-criterion that've found to every weight of alternative under that sub-criteria. Then, the global weight of supplier under the Turnover in Financial Capacity is equal the global weight of Turnover multiply to the local weight of each alternative under Turnover.

We do the same process for the remaining sub-criteria .

5.2. Results and Analyses five Suppliers by each Criterion

After finishing all the 6 Steps in setting stage above, we found the results of data processing which are obtained after running the model evaluation. These data give us an overview of the comparative analysis and evaluation of suppliers between each criterion of the model.

The results of this research depend on the Consistency Ratio (CR) of every pair wise comparison and these ratios must be smaller or equal to 10%. If the CR is greater than 10%, the inconsistency is acceptable, but we need to revise the subjective judgment. Going through the top-down AHP scale, the top pair wise comparison matrix is between five main criteria respect to Goal that finding the potential supplier. The CR indices is 0.084 = 8.4% <10%, that means consistent. In evaluating five suppliers by each criterion, we also define the CR index of criteria and their belonging sub-criteria.

Follow all the steps in AHP calculated as described in the literature review. From the pair wise comparison matrices, providers in each sub-criterion of the financial capability criteria including turnover, profit, ROI, debt concerns, financial explicit are calculated secondary indicators average of each line.

The CR indices of each pair wise comparison among the sub-criteria respect to Financial Capability is 0.0788. And among suppliers respect to each sub-criterion are Turnover: CR=0.0822; Profit: CR=0.0643; ROI: CR=0.074; debt concerns: CR=0.067; and financial explicit: CR=0.0192. All of them are less than 10%, which means they are consistent in the pair wise comparison.

5.3. Best Choice of Suppliers

After respectively calculating, analysis and evaluating of

suppliers through each sub-criterion of five main criteria in *Balanced Scorecard* of AHP model, we have been solving the second floor of AHP hierarchy. It is the implementation of steps to the first floor properties of the ladder consisting of five main criteria evaluation model.

Table 4 shows the number of evaluations points each supplier according to the results of each model run sub-criteria are calculated as in the previous section form the matrix on the left. And 5×1 matrix on the right is the local index of the main criteria in each model.

Table 4: Final Ranking of Alternative

	Financial Capability	Operational Performance	Quality	Behavioral & Cultural Practice	Risk Elements	Sum	Ranking
Masan	0.107	0.060	0.084	0.025	0.023	0.299	**1**
Cholimex	0.051	0.029	0.076	0.009	0.018	0.182	**3**
Nam Duong	0.036	0.012	0.082	0.011	0.014	0.155	**4**
Nestle	0.050	0.037	0.077	0.023	0.027	0.213	**2**
Ajinomoto	0.031	0.019	0.065	0.016	0.019	0.151	**5**
Total	0.275	0.157	0.384	0.084	0.100	1.000	

This is the final calculation results which are obtained after running the data through the two floors of the criteria assessment model according to the method of AHP. The percentages of suppliers are shown in Table 3. Based on these values, we can rank as well as further analyze the selected alternatives. Plus we can evaluate each provider. Besides, to compare the degree of difference between the alternatives Saigonco-op can make a decision in choosing the best suppliers and the most suitable.
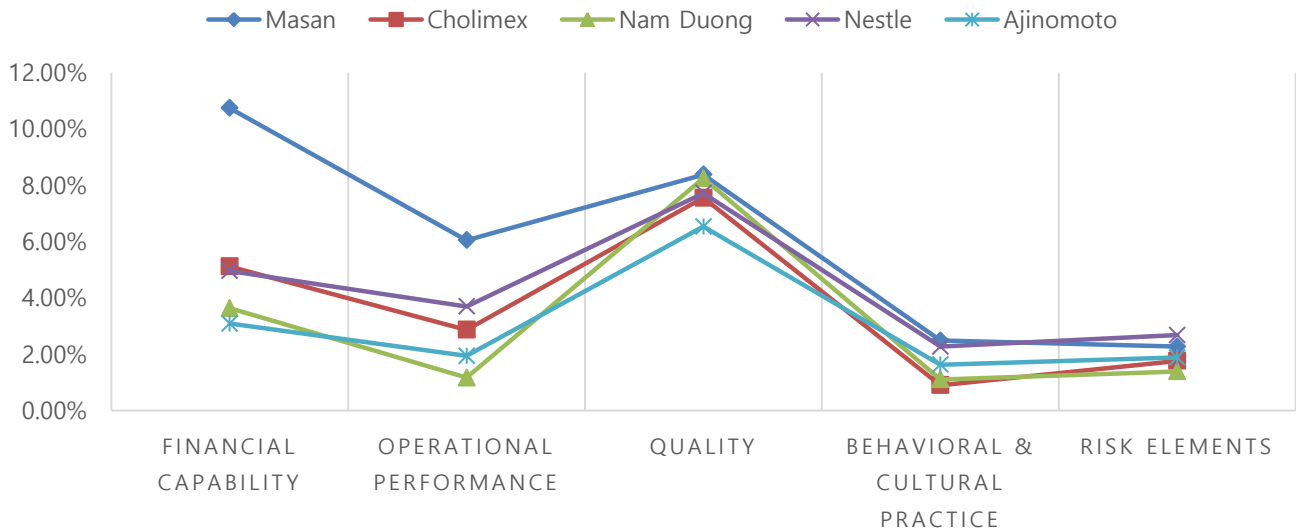
WEIGHTS OF SUPPLIERS

Figure 4: Weight of Suppliers

Figure 4 summarizes the final decision of selecting right partners after applying AHP method. We can see the changes of percentage of suppliers by criteria. Overall, except the *Risk Element*, Masan is always reaching the top of ranking through five main criteria. All of 5 suppliers get nearly the same score in *Behavioral & Cultural* practice and *Risk Elements*, around 1 to 2% of the measurement scale. In Quality, Ajinomoto is left behind with 6% while the others are staying around 8%. The two remaining criteria are *Financial Capability* and *Operational Performance*. These

ranking is the spectacular breaking of Masan when they leave Nestle behind at second place with the range between them approximately double. Specifically, in *Financial Capability* Masan reach on top at 10.7% while Nestle is 5%. The same as *Operational Performance*, Masan is 6% larger than Nestle at second with 3.7%.

All things considered, Figure 5 shows the whole picture of the result of this research that applying AHP in evaluation and selection of 5 sauces and seasonings suppliers for Saigonco-op. Because Masan is always reach on top in four out of five main criteria in AHP scale, so they obviously gain the first place in the ranking of potential supplier. The final score of Masan is 30% double larger than the last place of this ranking. The second place belong to Nestle gain about 21% of total score. Cholimex and Nam Duong are sharing the third and fourth with 18% and 16% respectively. Finally, Ajinomoto is close to Nam Dương with 15%.
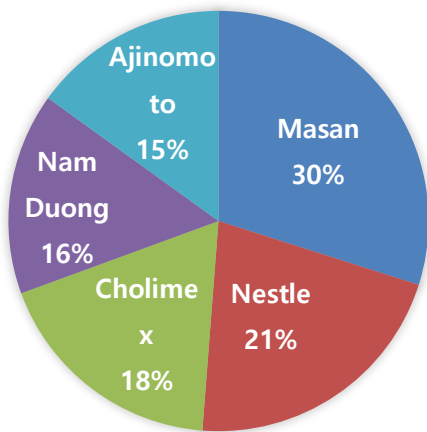
PERCENTAGE OF POTENTIAL SUPPLIER

Figure 5: Percentage of Potential Supplier

6. Discussions and Conclusions

6.1. Discussion and Managerial Implications

After applying AHP methodology to analysis and evaluating sauce and seasoning suppliers for Co-opmart, we observe that are a greater amount prohibitive of the present methodology for enterprises rather qualitative, lack of objectivity, mainly depending on experience and sense of decision makers.

The results from the model are evaluated using the method of AHP quantification. AHP could analyze the tiniest contrasts between supplier through the numbers, charts and graphs. The outcome of detailed calculations to each level of the ladder system provide multi-faceted perspective. Solid capability to synthesize the components of the hierarchy and logic algorithms are not too complicated, but also help managers examine each aspect and see the overview of all issues to be considered.

There are always three important lines existed in an organization: The first line is communication throughout the system, the second is financial flows, also known simply as cash flow, and finally is the material flow. Purchasing is one of the important tasks of the business because it is responsible for the physical input line of the organization. Increasing awareness of purchasing should be advanced position and its role in the enterprise is increasing. Information security requirements for these departments are increasingly stringent.

The process of evaluation and selection of suppliers has held long bias in a qualitative sense, dependent on experience and emotions of those who have related responsibilities. Therefore, it is necessary to apply the typical methods such as quantitative analysis of this process - AHP presented in this study. With the aim of increasing the computational content of the evaluation process suppliers, especially the comparison of suppliers in the same industry as AHP has shown. This enables the analysis of all the providers to be more scientific. Thus, this paper would help the facility managers ensure objectivity to the reasonable decision.

6.2. Conclusions

After an analyzed process of calculation based on AHP, we have chosen the final supplier according expert's interview. The results have been stated in chapter 4 that Masan is the most potential candidate to be the main supplier of sauces and seasoning for Coopmart. The next priority should be Nestle, Cholimex, Nam Duong and Ajinomoto respectively.

By this paper, author would contribute to the purchasing process of the supermarket, in general, and the special case of Coopmart is a very modern model to apply, then to choose the right partner, not only for sauces and seasoning industry but it can be applied for a lot of categories of the supermarkets.

Masan is the leader in Vietnamese sauces and seasoning market share recently. The result of paper makes sense not only in currently but also for the further. The run out Nestle, the international brand can replace the 1st if they use potential financial strength to run wide promotion. And, the 3rd place – Cholimex can be chosen if they can catch up

"back to traditional" trend in customer behavior.

The decision maker, purchasing Department, can based on AHP to get more information, implement plans and get strategic collaboration with suppliers.

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