An Application of the Analytical Hierarchy Process to Determine Benchmarking Criteria for Identifying Product Vendors.

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ABSTRACT

In this paper, we introduce a framework to guide decision makers in evaluating products for distribution and identifying the right supply vendors. This paper is motivated by a lack of adequate decision making mechanisms with broader scopes and ease of use for the decision makers. The framework, which adopts Analytic Hierarchy Process (AHP) methodology, represents four different factors of product distribution to vendors. A survey based on AHP methodology was conducted to obtain decision maker preferences. Instead of relying on dedicated AHP software, we prefer to clearly demonstrate the process of AHP calculations by using Microsoft Excel® in data analysis. The aims are to show the applicability of Microsoft Excel® in handling AHP decision making problems and to help decision makers in identifying products that yield better returns and likewise identify vendors that make better sales.

Results show that vendors sell more of product X3, X1, X4, X14 and X2 more than the remaining products and frequency of credit receivable has the highest priority, followed by level of sales patronage, location of stores and ease of transportation. The findings reflect future factors to consider in distributing to vendors in order to improve turnover of the organization.

(Keywords: AHP, AHP calculation, product priority, vendor, distribution)

INTRODUCTION

In today's business environment with the trending recession having a negative influence on business, sales managers want to try as much as possible to meet customer needs completely and in a timely manner in order to compete with their rivals. Buying or ordering a product, and assuming the responsibility of distributing such ordered products, is regarded as a decision-making problem in which practitioners have come to realize that prioritization can be applied not only to customer needs, but also to business planning, in order to address problems in marketing, profitability, and investment in facility and equipment (Helper and Mazur, 2007). The possible budget is then a constraint in the decision on product orders and quantities. In order to reach the state of readiness, making right decisions and choices regarding product orders and supply is essential. Thus, the problem is to evaluate vendors and define the various products needed in order to satisfy customer's desires (Felice and Petrillo, 2010).

Fan Milk Depot, Yola, engages in ordering and distributing products to clients across Adamawa State, Nigeria. Fifteen (15) products are ordered and distributed every two weeks:

- 60 cartons of 1 liter ice cream
- 30 cartons of cup ice cream
- 20 cartons of sachet ice cream
- 60 cartons of 0.5 liter ice cream
- 30 cartons of sachet Fan-vanille
- 30 cartons of paper Fan-vanille
- 20 cartons of sachet Choco,
- 20 cartons of paper Choco,
- 20 cartons of sachet Fan-Dango
- 50 cartons of paper Fan-Dango of 500ml
- 30 cartons of paper Fan-Dango of 200ml
- 10 cartons of sachet Super Yogurt
- 20 cartons of paper Super Yogurt
- 30 cartons of Fantastic Yogurt of 500ml
- 20 cartons of Fantastic Yogurt of 200ml

In order to maximize profits, the sales manager for the Depot observed that the sales of sachet Fan-vanilla, paper Fan-vanilla, sachet Coco, paper Coco, sachet Fan-Dango, paper Fan-Dango of 500ml, and paper Fan-Dango of 200ml have more profit contribution, but are characterized by low sales records. While sales of the ice cream categories have low profit contribution but have high sales records which consequently yields a higher profit contribution. Thus, the sales manger considers the cost of distribution to the various retail outlets by preferring to supply the Yola retail outlet rather than other distant retail outlets. While also taking into consideration the locations of the various retail outlets as a viable factor that helps him in the distribution analysis. Likewise the reliability of the retailers has always been a subject of consideration in supply as has the previous period of transactions.

The primary focus of this study lies in the application of AHP through step-by-step mathematical calculations to solve decision making problems in the specific areas of product ordering and distribution. Microsoft Excel® is selected to show details of AHP procedure as a powerful tool to solve multi criteria decision making problems.

METHODOLOGY

The Analytic Hierarchy Process (AHP) is a method used for dealing with problems which involve the consideration of multiple criteria simultaneously. It has been observed that AHP is unique in its ability to deal with intangible attributes and to monitor the consistency with which a decision maker makes his decisions (Douligeris and Pereira 1994).

AHP as a multi-criteria decision-making approach was introduced by Saaty (1980a and 1997). The AHP method has been studied by many researchers in the literature (Ho, 2008). According to Saaty (1980b), AHP can help decision makers choose the best alternative in complex decision problems with multiple criteria. Basically, AHP uses a mathematical approach based on metrics algebra. It has been used as a tool to identify the importance of criteria in decision making or problem solving to achieve a goal. AHP bringing the qualitative and quantitative approach in research and combines it into the context as a sole empirical question. AHP applies the qualitative approach to restructure problems into hierarchy which is more systematic. On the other hand, based on a quantitative approach, it uses more of the comparison method of pair-wise to obtain responses and reliability that are more consistent through questionnaire forms (Mohd Safian and Nawawi, 2011). AHP can increase interaction and engagement of the individuals in decision making processes.

The steps to be followed while implementing the AHP process are illustrated as:

***Step* 1**- Diagnose the problem, and determine the objectives.

Step 2- Set up a decision hierarchy by breaking down the problem into a hierarchy of interrelated decision elements. The overall goal is placed at the top, with the main attributes on a level below.

***Step* 3**- Collect input data by pairwise comparisons of decision elements. Every attribute on each level is compared with adjacent attributes in respect of their importance to the parent. For the pairwise comparison, a ranking scale is used for the criteria evaluation as proposed (Saaty, 1980a). The scale is a crisp scale ranging from 1 to 9.

***Step* 4**- Use the "eigenvalue" method to estimate the relative weights of decision elements. The options available to the decision maker are now scored with respect to the lowest level

***Step* 5**- Aggregate the relative weights of decision elements to arrive at a set of ratings for the decision alternatives. The scores reflecting the weight given to each attribute are adjusted and then summed to yield a final score for each option.

A consistency test is performed to examine the extent of consistency of each judgment matrix once the priorities are determined. Saaty recommended using consistency index (CI) and consistency ratio (CR) to check for the consistency associated with the comparison matrix. The final step in the consistency evaluation is to examine the ratio of the calculated consistency index and the random index (RI) derived from the number of matrix activities.

A CI, which measures the inconsistencies of pair wise comparisons, is given as:

$$CI = \frac{(\lambda_{max} - n)}{n - 1} \quad \textbf{(1)}$$

Where λ_{max} is the average to the sum of the ratio of weighted sum by its corresponding weight. The CR is the basis by which an analyst can conclude that the pairwise comparison matrix evaluations are sufficiently consistent. The CR is determined by taking ratio of the CI and the random index (RI) denoted as:

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

RI proposed by Saaty is obtained by checking the corresponding RI against the number of n in the pairwise comparison matrix as shown in Table 2.

If CI is sufficiently small, the decision-makers comparisons are probably consistent enough to give useful estimates of the weights for the objective function.

If $\frac{CI}{RI} \leq 0.10$, the degree of consistency is satisfactory, but if $\frac{CI}{RI} > 0.10$, inconsistency may exist, and the AHP may not yield meaningful results.

The evaluation procedure has to be repeated to improve consistency. The measurement of consistency can be used to evaluate the consistency of decision maker's opinion as well as the consistency of all the hierarchy.

ANALYSIS

The manager considers the following four factors (criteria), location of store (C1), frequency of credit receivable (C2), ease of transportation (C3), and sales patronage (C4) while distributing the products for sale. During interaction, the manager verbally expresses the importance of one criterion over the other, as represented in the matrix below with its corresponding numerical rating:

	C1	C2	C3	C4
C1	1	$\frac{1}{7}$	4	$\frac{1}{3}$
C2	7	1	6	3
C3	$\frac{1}{4}$	$\frac{1}{6}$	1	$\frac{1}{5}$
C4	3	$\frac{1}{3}$	5	1

Figure 1: Pairwise Comparison Matrix among Criteria.

We divide each value in a column by its corresponding column sum. This result in a normalized matrix, the values in each column sum to 1. The next step is to average the values in each row to give the preferences for each criterion, thus indicating how the relative weight of the criteria are prioritized.

	Priority
C1	0.1248
C2	0.5669
C3	0.0576
C4	0.2507

CRITERIA CONSISTENCY COMPUTATION

STEP 1: AHP provides a measure of the consistency for the pairwise comparisons by computing a consistency ratio (CR). We determined CR by multiplying each value in the first column of the pairwise comparison matrix by the priority of the first item, multiply each value in the second column of the pairwise comparison matrix by the priority of the second item, and continue this process for all columns of the pairwise comparison matrix. As a result, we sum the values across the rows to obtain a vector of values labeled "weighted sum."

	WEIGHTED SUM
C1	0.520
C2	2.538
C3	0.233
C4	1.102

STEP 2: Divide the elements of the weighted sum vector obtained in step 1 by the corresponding priority for each criterion to get a consistency vector.

STEP 3: $\lambda_{max} = 4.2726$ is obtained by taking the average of the consistency vector. The CI is computed where n is the number of criteria considered, using the following formula:

$$CI = \frac{(\lambda_{max} - n)}{n - 1} \qquad \textbf{(3)}$$

$$CI = 0.0909$$

The CR of 0.10 or less is considered acceptable. Since, $CR = 0.1010$. The consistency of the pairwise comparisons is considered reasonable, and acceptable.

Definition of Decision Variables

Let x_1= number of 1 liter ice cream units to be purchased

Let x_2= number of Sachet ice cream units to be purchased

Let x_3= number of cup ice cream units to be purchased

Let x_4= number of 0.5 liter ice cream units to be purchased

Let x_5= number of Sachet Fan-vanille units to be purchased

Let x_6= number of Paper Fan-vanille units to be purchased

Let x_7= number of Sachet Choco units to be purchased

Let x_8= number of Paper Choco units to be purchased

Let x_9= number of Sachet Fan-Dango units to be purchased

Let x_{10}= number of Paper 0.5 liter Fan-Dango units to be purchased

Let x_{11}= number of Paper 0.2 liter Fan-Dango units to be purchased

Let x_{12}= number of Sachet Super-Yogurt units to be purchased

Let x_{13}= number of Paper Super-Yogurt units to be purchased

Let x_{14}= number of 0.5 liter Fan-Yogurt units to be purchased

Let x_{15}= number of 0.2 liter Fan-Yogurt units to be purchased

Pairwise Comparison Rating for Decision Alternatives on Location of Store

The decision maker determines how well each alternative "scores" on the Location of Store criterion. The rating is developed from the decision maker's professional judgments (Figure 2).

Pairwise Comparison Rating for Decision Alternatives on Frequency of Credit Receivable

The decision maker determines how well each alternative "scores" on the Frequency of Credit Receivable criterion. The rating is developed from the decision maker's professional judgement. We developed the rows equal to the decision alternatives, while the column total for each criterion was computed (Figure 3).

Pairwise Comparison Rating for Decision Alternatives on Ease of Transportation

The decision maker determines how well each alternative "scores" on ease of transportation criterion. The rating is developed from the decision maker's professional judgement and as a result, we developed the number of rows equal to the decision alternatives, while the column total for each criterion was computed (Figure 4).

Pairwise Comparison Rating for Decision Alternatives on Sales Patronage

The decision maker determines how well each alternative "scores" on alternatives to sales patronage criterion. The rating is developed from the decision maker's professional judgement and as a result, we developed a number of rows equal to the decision alternatives, while the column total for each criterion was computed (Figure 5).

CONSISTENCY VECTOR

A consistency vector for each decision alternatives against the criteria is obtained by dividing each decision alternatives weighted sum by its corresponding priority value (Figure 6).

Figure 2: Pairwise Comparison Matrix among Decision Alternatives using Location of Store.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X1	1	3	1/6	1	7	7	7	7	7	5	5	5	5	3	3
X2	1/3	1	1/5	1/3	3	3	3	3	3	3	3	3	3	3	3
X3	6	5	1	5	7	5	5	5	5	3	3	5	5	3	3
X4	1	3	1/5	1	7	7	7	7	7	5	5	7	5	3	3
X5	1/7	1/3	1/7	1/7	1	½	1	3	1	1/2	1/2	1/3	1/2	1/2	½
X6	1/7	1/3	1/5	1/7	2	1	3	1	3	3	1/3	3	1	1/3	½
X7	1/7	1/3	1/5	1/7	1	1/3	1	3	1/2	1/2	1/2	1	1/2	1/3	1/3
X8	1/7	1/3	1/5	1/7	1/3	1	1/3	1	1/4	1/2	1/2	3	1	1/4	¼
X9	1/7	1/3	1/5	1/7	1	1/3	2	4	1	1/2	1/2	1	1/2	1/2	½
X10	*1/3*	1/3	1/3	1/5	2	1/3	2	2	2	1	3	5	5	1	3
X11	1/5	1/3	1/3	1/5	2	3	2	2	2	1/3	1	5	3	1/2	1
X12	1/5	1/3	1/5	1/7	3	1/3	1	1/3	1	1/5	1/5	1	1	1/2	½
X13	1/5	1/3	1/5	1/5	2	1	2	1	2	1/5	1/3	1	1	3	3
X14	1/3	1/3	1/3	1/3	2	3	3	4	2	1	2	2	1/3	1	3
X15	1/3	1/3	1/3	1/3	2	2	3	4	2	1/3	1	2	1/3	1/3	1

Figure 3: Pairwise Comparison Matrix among Decision Variables using Frequency of Credit Receivable.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X1	1	5	1/3	3	9	9	9	9	9	7	7	7	5	5	5
X2	1/5	1	1/5	1/3	3	3	3	3	3	1/4	3	3	3	1/4	1/3
X3	3	5	1	5	7	5	7	5	5	5	5	5	5	3	3
X4	1/3	3	1/5	1	7	7	7	7	5	3	3	7	5	3	3
X5	1/9	1/3	1/7	1/7	1	½	1	1/2	1	1/3	½	1	1/2	1/5	1/3
X6	1/9	1/3	1/5	1/7	2	1	3	1	3	1/4	2	3	1	1/4	1
X7	1/9	1/3	1/7	1/7	1	1/3	1	1/2	1	1/3	½	1	1/2	1/3	1/3
X8	1/9	1/3	1/5	1/7	2	1	2	1	5	1/3	1	3	1	1/3	1/3
X9	1/9	1/3	1/5	1/5	1	1/3	1	1/5	1	1/2	½	1	1/2	1/3	1/3
X10	1/7	4	1/5	1/3	3	4	3	3	2	1	3	5	5	1/4	3
X11	1/7	1/3	1/5	1/3	2	½	2	1	2	1/3	1	5	3	1/4	1
X12	1/7	1/3	1/5	1/7	1	1/3	1	1/3	1	1/5	1/5	1	1/2	1/3	1/3
X13	1/5	1/3	1/5	1/5	2	1	2	1	2	1/5	1/3	2	1	1/2	½
X14	1/5	4	1/3	1/3	5	4	3	3	3	4	4	3	2	1	3
X15	1/5	3	1/3	1/3	3	1	3	3	3	3	1	3	2	1/3	1

Figure 4: Pairwise Comparison Matrix among Decision Variables Using Ease of Transportation Criteria.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X1	1	5	1/3	3	5	5	5	5	5	5	5	5	5	5	5
X2	1/5	1	1/2	½	3	3	3	3	3	3	3	3	3	3	3
X3	3	2	1	5	5	5	5	5	5	3	3	5	5	3	3
X4	1/3	2	1/5	1	7	7	7	7	7	5	5	7	7	5	5
X5	1/5	1/3	1/5	1/7	1	1/3	2	3	2	1/3	1/3	2	2	1/3	1/3
X6	1/5	1/3	1/5	1/7	3	1	3	3	1/2	1/3	1/3	2	3	1/3	1/3
X7	1/5	1/3	1/5	1/7	½	1/3	1	2	1/3	1/2	1/2	2	2	1/3	1/3
X8	1/5	1/3	1/5	1/7	1/3	1/3	1/2	1	1/2	1/2	1/2	3	½	1/2	½
X9	1/5	1/3	1/5	1/7	½	2	3	2	1	1/2	1/2	2	3	1/2	½
X10	1/5	1/3	1/3	1/5	3	3	2	2	2	1	1/2	5	5	1/4	3
X11	1/5	1/3	1/3	1/5	3	3	2	1/3	2	2	1	5	3	1/4	1/3
X12	1/5	1/3	1/5	1/7	½	1/2	1/2	2	1/2	1/5	1/5	1	1	1/2	½
X13	1/5	1/3	1/5	1/7	½	1/3	1/2	3	1/3	1/5	1/3	1	1	½	¼
X14	1/5	1/3	1/3	1/5	3	3	3	2	2	4	4	2	3	1	3
X15	1/5	1/3	1/3	1/5	3	3	3	2	2	1/3	3	2	4	1/3	1

Figure 5: Pairwise Comparison Matrix among Decision Variables using Sales Patronage Criteria.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X1	1	7	¼	3	7	7	9	7	7	5	5	7	7	5	7
X2	1/7	1	1/5	1/3	5	5	5	5	5	3	3	5	3	3	3
X3	4	5	1	7	9	9	9	7	7	7	7	7	7	5	5
X4	1/3	3	1/7	1	5	5	5	5	5	5	5	5	5	5	5
X5	1/7	1/5	1/9	1/5	1	3	3	3	1/3	½	½	3	1/2	1/5	1/5
X6	1/7	1/5	1/9	1/5	1/3	1	3	3	3	½	½	3	3	1/3	1/3
X7	1/9	1/5	1/9	1/5	1/3	1/3	1	2	1/2	1/3	1/3	1/2	1/2	1/5	1/5
X8	1/7	1/5	1/7	1/5	1/3	1/3	1/2	1	3	1/3	1/3	3	1/4	1/5	1/5
X9	1/7	1/5	1/7	1/5	3	1/3	2	1/3	1	½	½	2	1/2	1/2	½
X10	1/5	1/3	1/7	1/5	2	2	2	2	2	1	3	5	5	¼	½
X11	1/5	1/3	1/7	1/5	2	2	3	3	2	1/3	1	5	3	1/4	1/3
X12	1/7	1/5	1/7	1/5	1/3	1/3	2	1/3	1/2	1/5	1/5	1	2	1/5	1/5
X13	1/7	1/3	1/7	1/5	2	1/3	2	4	2	1/5	1/3	1/2	1	1/3	3
X14	1/5	1/3	1/5	1/5	5	3	5	5	2	4	4	5	3	1	3
X15	1/7	1/3	1/5	1/5	5	3	5	5	2	2	3	5	1/3	1/3	1

Figure 6: Priority Values.

	Location of Store	Frequency of Credit Receivable	Ease of Transportation	Sales Patronage
X1	0.8273	0.9517	1.0703	0.9596
X2	0.8360	0.7848	0.9388	0.7768
X3	1.4234	1.4200	1.4157	1.3627
X4	0.8257	0.7964	0.7797	0.8328
X5	0.9665	1.1060	0.8804	0.8641
X6	0.8612	0.8187	0.8129	0.8008
X7	1.0590	1.1219	1.0135	1.2538
X8	1.0987	0.8144	1.1031	1.1358
X9	0.9486	1.2426	0.8588	1.0913
X10	0.8918	0.7502	0.8078	0.8016
X11	0.9037	0.8541	0.8651	0.8226
X12	1.0572	1.2861	1.1320	1.2929
X13	0.9079	1.0297	1.0952	0.9680
X14	0.9388	0.8836	0.8507	0.7715
X15	1.0062	0.9527	0.8396	0.7753

Table 1: Summary of Decision Alternatives Consistency Evaluation.

	Location of Store	**Frequency of Credit receivable**	**Ease of Transportation**	**Sales Patronage**
λ_{max}	0.9701	0.9875	0.9642	0.9673
CI	-1.0021	-1.0009	-1.0026	-1.0023
CR	-0.6303	-0.6295	-0.6305	-0.6304

A consistency ratio of 0.10 or less is considered acceptable. Because the pairwise comparisons for the Location of store criteria show CR = -0.6303, Frequency of Credit receivable criteria show = -0.6295, Ease of transportation criteria show CR = -0.6305, Sales patronage criteria show CR = -0.6304, we can conclude that the degree of consistency in the pairwise comparisons is acceptable. The relative priority or preferences for each decision alternatives on each criterion, is therefore-fore presented below (Figure 7).

Figure 7: Developing an Overall Ranking for the Decision Alternatives.

	Location of Store	Frequency of Credit Receivable	Ease of Transportation	Sales Patronage
X1	0.148	0.203	0.169	0.177
X2	0.081	0.051	0.084	0.085
X3	0.206	0.195	0.173	0.243
X4	0.152	0.125	0.157	0.118
X5	0.023	0.017	0.031	0.027
X6	0.041	0.036	0.036	0.032
X7	0.023	0.017	0.024	0.014
X8	0.022	0.034	0.022	0.020
X9	0.027	0.019	0.034	0.023
X10	0.063	0.075	0.057	0.045
X11	0.049	0.038	0.048	0.038
X12	0.024	0.017	0.021	0.017
X13	0.043	0.029	0.021	0.032
X14	0.057	0.086	0.070	0.073
X15	0.043	0.058	0.052	0.055

PRIORITY
0.1248
0.5669
0.0576
0.2507

An overall score for each decision alternatives is computed by multiplying the values in the criterion reference vector by the succeeding criteria priority vector matrix and summing the products, as follows:

$$X1\ score = 0.148(0.1248) + 0.203(0.5669) + 0.169(0.0576) + 0.177(0.2507) = 0.188$$

$$X2\ score = 0.081(0.1248) + 0.051(0.5669) + 0.084(0.0576) + 0.085(0.2507) = 0.065$$

$$X3\ score = 0.206(0.1248) + 0.195(0.5669) + 0.173(0.0576) + 0.243(0.2507) = 0.207$$

$$X4\ score = 0.152(0.1248) + 0.125(0.5669) + 0.157(0.0576) + 0.118(0.2507) = 0.128$$

$$X5\ score = 0.023(0.1248) + 0.017(0.5669) + 0.031(0.0576) + 0.027(0.2507) = 0.021$$

$$X6\ score = 0.041(0.1248) + 0.036(0.5669) + 0.036(0.0576) + 0.032(0.2507) = 0.036$$

$$X7\ score = 0.023(0.1248) + 0.017(0.5669) + 0.024(0.0576) + 0.014(0.2507) = 0.017$$

$$X8\ score = 0.022(0.1248) + 0.034(0.5669) + 0.022(0.0576) + 0.020(0.2507) = 0.028$$

$$X9\ score = 0.027(0.1248) + 0.019(0.5669) + 0.034(0.0576) + 0.023(0.2507) = 0.022$$

$$X10\ score = 0.063(0.1248) + 0.075(0.5669) + 0.057(0.0576) + 0.045(0.2507) = 0.065$$

$$X11\ score = 0.049(0.1248) + 0.038(0.5669) + 0.048(0.0576) + 0.038(0.2507) = 0.040$$

$$X12\ score = 0.024(0.1248) + 0.017(0.5669) + 0.021(0.0576) + 0.017(0.2507) = 0.018$$

$$X13\ score = 0.043(0.1248) + 0.029(0.5669) + 0.021(0.0576) + 0.032(0.2507) = 0.031$$

$$X14\ score = 0.057(0.1248) + 0.086(0.5669) + 0.070(0.0576) + 0.073(0.2507) = 0.078$$

$$X15\ score = 0.043(0.1248) + 0.058(0.5669) + 0.052(0.0576) + 0.055(0.2507) = 0.055$$

Thus ranking these priorities, we have the AHP ranking of the decision alternatives indicating the following:

	Priority
X3	0.207
X1	0.188
X4	0.128
X14	0.078
X2	0.065
X10	0.065
X15	0.055
X11	0.040
X6	0.036
X13	0.031
X8	0.028
X9	0.022
X5	0.021
X12	0.018
X7	0.017

DISCUSSION

It can be observed from the results of this study that, the Frequency of Credit Receivable (C2), with a rating of 0.5669, is more important to decision makers in running their businesses than other factors which have been considered. Likewise, Sales Patronage (C4), was ranked second with a rating of 0.2507; Location of Store (C1), was ranked third with a rating of 0.1248; and Ease of Transportation (C3), was ranked fourth with a rating of 0.0576 as critical factors that a distributor could use to identify vendors of its products.

Using these decision makers' priorities attached to the decision alternatives, through the help of AHP techniques, the products that the decision maker/distributor should make available for vendors are ranked according to order of priority.

- Consequently, cup of ice cream (x_3), with a weight of 0.207, was ranked first indicating more of the product should be purchased for distribution.

- 1 liter ice cream (x_1) product was ranked second with a weight of 0.188;
- 0.5 liter ice cream (x_4) was ranked third with a weight of 0.128;
- Fan-yogurt of 500ml (x_{14}) was ranked fourth, with a weight of 0.078;
- Sachet ice cream (x_2) was ranked fifth with a weight of 0.065;
- Paper Fan-Dango of 500ml (x_{10}) was ranked sixth with a weight of 0.065;
- Fan-yogurt of 200ml (x_{15}) was ranked seventh with a weight of 0.055;
- Paper Fan-Dango of 200ml (x_{11}) was ranked eighth with a weight of 0.040;
- Paper Fan-vanille (x_6) was ranked ninth with a weight of 0.036;
- Paper Super-Yogurt (x_{13}) was ranked tenth with a weight of 0.031;
- Paper Choco (x_8) was ranked eleventh with a weight of 0.028;
- Sachet Fan-Dango (x_9) was ranked twelfth with a weight of 0.022;
- Sachet Fan- vanille (x_5) was ranked thirteenth with a weight of 0.021;
- Sachet Super-Yogurt (x_{12}) was ranked fourteenth with a weight of 0.018;
- and Sachet Choco (x_7) was ranked fifteenth with a weight of 0.017.

CONCLUSION

In order to strengthen the competitive advantage of the decision maker, as a result of the analysis conducted, the distributor can now better understand how to go about his daily routine of supply by identifying worthy vendors and determining the quantity of each products that should be re-stocked based on product demand in the market.

The AHP as a versatile decision aid has been presented as a technique which can handle problems involving both multiple objectives and uncertainty. The AHP model can therefore be said to faithfully represent a decision maker's preferences given the numerical representations of these judgments and the mathematical processes which are applied to them. It should, however, be noted that the purpose of any decision aid is to provide insights and understanding, rather than to prescribe a "correct" solution.

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