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Research Article

EVALUATION AND SELECTION OF SUPPLIER SUPPLY CHAIN WITH INTEGRATED APPROACH AHP AND SIR UNDER INTUITIVE FUZZY CONDITIONS

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ABSTRACT
In recent decades, the supply of raw materials and selection of suppliers in the supply chain has been a challenge for most organizations. Since the performance of suppliers, major effect on the success or failure of the supply chain, supplier selection, known as a strategic task. In this study, we tried to use a combination of both AHP and fuzzy intuitive SIR in a condition to be used for selecting the supplier. Fuzzy intuitive considered a good way to overcome the lack of information. Also taking into account the parameters of non-membership, the membership function of the fuzzy-born child looks doubtful advantage. This can be a good reference for solving problems of selection and assessment.

***Keywords**: AHP, SIR, Intuitive Phase, Suppliers*

INTRODUCTION

Due to the improvement of network technologies and the increasing globalization of the economy, purchasing management plays an important role in the success of the business supply chain management plays. On the other hand, is based on new concepts like supply chain management and creating partnerships with suppliers and close relationships with suppliers is suppliers and customers, the organization known as the competitors are not but the members of a supply chain with the purpose of each, maximize profits and increase the productivity of the entire chain. One of the important challenges in the purchase, managers are faced with the difficult the evaluation and selection of suitable suppliers for their business. Many studies have been done on the choice of supplier in this study we have used multi-criteria decision-making methods such as analytic hierarchy process (AHP), analytic network process (ANP), mathematical programming and data envelopment analysis (DEA) and TOPSIS (TOPSIS) (Wu and Olson, 2008; Kheljani *et al.*, 2009; Lin *et al.*, 2011; Bhattacharya *et al.*, 2010; Moghadam *et al.*, 2008; Wang *et al.*, 2009; Amindoust *et al.*, 2012; Kannan *et al.*, 2013). Among these methods, AHP (Saaty, 1980) to deal with complex problems and simplicity of this method has gained popularity. However, because different criteria (such as quality, cost, service performance and risk factors (Deng *et al.*, 2014) are involved in supplier selection, estimation and measurement criteria should be considered a priority both. The models can be further integrated into the assessment. The method of multi-criteria decision making (MCDM) in four stages: problem definition, benchmarking, identifying suppliers, grading and selection (Boer *et al.*, 2001), the evaluation and selection of suppliers to do. Therefore, a method that can supplement the AHP method PROMETHEE (Brans *et al.*, 1986) is due to transposition ranking is based on the output approach, an effective method is presented to help MCDM. Superiority and inferiority PROMETHEE method was developed by some researchers superiority and inferiority method Superiority and Inferiority Ranking (SIR) (Xu, 2001) developed. However, the inability deals with the uncertainty inherent in the SIR model and criticized inaccuracies in the input data (Deng *et al.*, 2014). SIR phase intuitive way by Chai and *et al.*, (2012) presented the full basic intuition is fuzzy logic. The input data is the decisions of real information that is congruent with the real world. In addition, an intuitive method of fuzzy membership function of the non-member function named function there is uncertainty and function (Chai *et al.*, 2012), which leads to a fuzzy set by Zadeh (1965). Now experts for supplier selection are subjective and descriptive and the qualitative judgments and uncertainties include inaccuracies and incomplete information. Therefore, in this study, a hybrid model of AHP and Fuzzy intuitive SIR under the terms of the selection of supplier's offer. Finally, a case study will be presented with a complete example.

Intuitive Fuzzy Set

Since fuzzy sets by Zadeh (1965), the types of systems that have been created are inaccuracies. Due to pressure of time constraints, when a person is faced with uncertainty or hesitation problems arise. The term uncertainty is discussed. Fuzzy sets the interval (IVFS) defined by Zadeh a membership function in the closed interval [0, 1] is shown. In 1986 Atanasov an intuitive fuzzy set (IFS) by the membership, non-membership function and the uncertainty is known, presented (Atanassov, 1986). Chai and *et al.*, (2012) suggest that π A: π A = 1 - µA - vA an intuitive indicator of X in is a function of X in A covers doubt. Given these 3 parameters for measuring the interval between the IFS report suppose that A and B are two IFS at X = {x1... xn} are the intervals are calculated using the following relationship:

(a) Hamming distance:

$$d(A,B)=\frac{1}{2}\sum_{i=1}^{n}(|\mu_A(x_i)-\mu_B(x_i)|+|v_A(x_i)-v_B(x_i)|+|\pi_A(x_i)-\pi_B(x_i)|) \quad (1)$$

(b) Euclidean distance:

$$e(A,B)=\sqrt{\frac{1}{2}\sum_{i=1}^{n}(\mu_A(x_i)-\mu_B(x_i))^2+(v_A(x_i)-v_B(x_i))^2+(\pi_A(x_i)-\pi_B(x_i))^2} \quad (2)$$

An intuitive fuzzy logic (IFV) as a = (µa, va, π a) where µa ∈ [0, 1], is defined. Clearly maximum IFV as a = (µa, va, π a) defined that µa ∈ [0, 1], π a ∈ [0, 1] and µa + va + π a = 1. Clearly maximum IFV = (1, 0, 0) + a minimum IFV a- = (0, 1, 0). The operator IFWA and IFWG to use descriptive logic data are defined as follows. Value created by using the fuzzy value cross IFWG and IFWA is effective (Chai *et al.*, 2012).

Definition 1. Let $a_i=(\mu_{a_i},v_{a_i})$ $(i=1,\ldots,n)$ be a set of IFVs, and $IFWA:\Theta^n\to\Theta$ is defined as:

$$IFWA_\omega(a_1,a_2,\ldots,a_n)=\overset{n}{\underset{i=1}{\oplus}}(\omega_i a_i)=(1-\prod_{i=1}^{n}(1-\mu_{a_i})^{\omega_i},\prod_{i=1}^{n}(v_{a_i})^{\omega_i})$$

where $\omega=(\omega_1,\omega_2,\ldots\omega_n)^T$ is the weight vector of a_i $(i=1,\ldots,n)$ with $\omega_i\in[0,1]$ and $\sum_{i=1}^{n}\omega_i=1$.

Definition 2. Let $a_i=(\mu_{a_i},v_{a_i})$ $(i=1,\ldots,n)$ be a set of IFVs, and $IFWG:\Theta^n\to\Theta$ is defined as:

$$IFWG_\omega(a_1,a_2,\ldots,a_n)=\overset{n}{\underset{i=1}{\oplus}}(a_i^{\omega_i})=(\prod_{i=1}^{n}(\mu_{a_i})^{\omega_i},\ 1-\prod_{i=1}^{n}(1-v_{a_i})^{\omega_i})$$

Fuzzy Intuitive Hierarchical Process

Relative scale is a method used to help decision makers in evaluating various alternatives can be used. This decision enables complex issues to form a hierarchical structure turns (Benyoucef and Canbolat, 2007). Each hierarchy generally consists of at least three objectives, criteria and alternatives to achieve the goal. AHP, a logical and comprehensive framework for structuring a problem, providing and quantifying its elements to connect these elements with the general objectives and evaluating alternative solutions are created (Abdullah *et al.,* 2009). This four step algorithm for comparing two binary AHP and scale is in the evaluation of offers. Each step is based on AHP, little assistance is recommended without losing its originality. Steps 1 to 4 to ensure the applicability of the AHP in intuitive fuzzy sets have been created. Theoretical framework and the basis for these changes can be written by Abdullah *et al.*, (2009) received.

Step 1: Create a hierarchical structure

First, according to objective criteria are compared. A matrix nxn, where A is named, using primitive comparisons are made with elements aij represents the i-th criterion to criterion j th is, as shown in the following formula:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix}_{n\times n}$$

Aij values from the equation 1 = aij and aji = 1 / aij is obtained, where for all i's, aij> 0. So if you compare the number of element i is assigned to the element j, So i j value when compared to bilateral. Through the use of both the hierarchical structure / IFS run the positive and negative aspects. This change does not affect the normal and just AHP. A matrix nxn, known as A, using the comparison of two primitive elements aij is created and represents a measure of the value of i to j-th criterion is shown below:

$$\begin{pmatrix} (0 \quad 0) & (\mu_{12}^k \quad v_{12}^k) \cdots & (\mu_{1n}^k \quad v_{1n}^k) \\ (\mu_{21}^k \quad v_{21}^k) & (0 \quad 0) \quad \cdots & (\mu_{2n}^k \quad v_{2n}^k) \\ \vdots & \vdots & \vdots \quad \vdots \\ (\mu_{n1}^k \quad v_{n1}^k) & (\mu_{n2}^k \quad v_{n2}^k) \cdots & (0 \quad 0) \end{pmatrix}, \quad k = 1,2,\ldots,K \tag{3}$$

Step 2: Priorities weight to calculate hierarchy

This stage can be divided into two sub-phases.

A. Calculate the Weight of Each Criterion Priorities

Using the pairwise comparison matrix A, weights and measures, where Wc criterion i in the n standard, 2 and 3 are calculated using the equation:

$$A = \begin{bmatrix} a_{11}/b_1 & a_{12}/b_2 & a_{13}/b_3 & \cdots & a_{1n}/b_n \\ a_{21}/b_1 & a_{22}/b_2 & a_{23}/b_3 & \cdots & a_{2n}/b_n \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ a_{n1}/b_1 & a_{n2}/b_2 & a_{n3}/b_3 & \cdots & a_{nn}/b_n \end{bmatrix}_{n\times n} \tag{4}$$

$$W_{ci} = \frac{\sum_{j=1}^{n} \left(\frac{a_{ij}}{b_j}\right)}{n} \tag{5}$$

$$b_j = \sum_{i=1}^{n} a_{ij}$$

In which

Above, for each j = 1... n is true.

Aij of the matrix A as compared to both i-th row of the column and b i is i-th column is the total comparisons to Dewey. B. With respect to each criterion, weighted priority hierarchy of criteria and alternatives to find the next step is to consider any alternative measure to compare the two. As a matter of deciding criterion is n, N matrix is judged for each alternative. The matrix contains the weights for each sub-criterion and alternatives are Wsc, and it can be expressed in a manner calculated to determine the weighting of criteria.

Step 3: With respect to any measure, calculate the weight for each alternative, when priorities We, Wsc and Wn obtained, the next step is to calculate the weight of each option according to each criterion. To combine the results and obtain the weight of each option is an option for local priorities and a priority criterion corresponds to the following sub-criteria will be multiplied.

$$P = \begin{bmatrix} W_{C11} \bullet W_{A11} \bullet W_{SC11} \\ W_{C21} \bullet W_{A21} \bullet W_{SC21} \\ \vdots \\ W_{Cij} \bullet W_{Aij} \bullet W_{SCij} \end{bmatrix} \quad (6)$$

Step 4: Calculate the combined length of priority (the total weight of the hierarchy) The result obtained in step 3 is added to all criteria the compound or national priority for selection to find the best options. If the measure n and m have the option of a matrix AAHP Size nxm caused.

$$A_j = \sum_{i=1}^{n} W_{Cij} W_{Aij} W_{SCij} \text{ for each } j=1,\ldots,n \quad (7)$$

AAHP, resulting of weight matrix is for alternatives WA and minor criteria.

The most frequently used combination operator the arithmetic mean is the arithmetic mean sometimes not clearly distinguish between the amounts of the assessment. This paper combines geometric mean as a function of evaluating the positive values (membership functions) and non-negative values (the non-membership) v is considered as follows:

$$M_G(\mu, v) = \sqrt{\mu(1 - v)} \quad (8)$$

SIR Intuitive Fuzzy

SIR matrix formed by the superiority and inferiority ranking options highlighted (Xu, 2001). Suppose that a decision maker to compare the actual performance $g_j(A_i)$ to compare m option available $A_i\ (i=1,\ldots,m)$ is a comparison with standards $g_j\ (j=1,\ldots,n)$. If fi generalized function to measure the function gj non-decreasing and can be specified by the decision maker, then to compare both Ai and Ak relation $P_i(A_i, A_k) = f_j(g_j(A_i) - g_j(A_k))$ represents the preferred option or a put option on Ak Ai j according to my criteria. But tea and colleagues (Chai *et al.,* 2012) to align the classical SIR model with the real world and take advantage of the uncertainty SIR method of fuzzy and subjective judgments which are briefly presented visual treat. The method of tea and colleagues (Chai *et al.,* 2012) The importance of the individual and the weights came through fuzzy relations we fix this, we need to calculate the phase is not high or even through an intuitive fuzzy AHP method is attainable. SIR intuitive fuzzy method includes the following steps:

Step 1 Calculate the weight of decision makers

At this stage our kth DM's $v_k = (\mu_k, v_k)$ $k = 1,...,l$ amount transferred to the personal decision that does not imply that ξ_j and can be calculated from equations 1 and 2.

Step 2 Calculate the collective decision-making information

At this stage we will calculate the collective decision $\bar{d}_{ij} = (\bar{\mu}_{ij}, \bar{v}_{ij})$ the mass of vague intuition comes oriented. IFWG operator must collect measurements used to measure the impact of poor mental and IFWA should be used to collect values there is a subjective judgment of decision makers in this process are:

$$\bar{d}_{ij} = IFWA_{\xi_k}(d_{ij}^{(1)}, d_{ij}^{(2)}, ..., d_{ij}^{(l)}) = \xi_1 d_{ij}^{(1)} \oplus \xi_2 d_{ij}^{(2)} \oplus ... \oplus \xi_l d_{ij}^{(l)}$$

$$= (1 - \prod_{k=1}^{j}(1-\mu_{ij}^{(k)})^{\xi_k}, \prod_{k=1}^{j}(v_{ij}^{(k)})^{\xi_k}) = (\bar{\mu}_{ij}, \bar{v}_{ij})$$

The third stage specify the function $g_j(Y_i)$.

At this stage, we value your $\bar{d}_{ij} = (\bar{\mu}_{ij}, \bar{v}_{ij})$ collective decision to move our real executive role. The first step $g_i(Y_i)$. in this process is suppose $D_j(\bar{d}_{ij}, d^+)$ $(D_j(\bar{d}_{ij}, d^-))$ as collective decision between value and IFV positive ideal IFV is real and negative. This distance can be calculated by measuring the phase-oriented seleh vague intuition. Function $g_j(Y_i)$ can be calculated from the relative accuracy of the IFV positive coefficient IFV $\Psi(\bar{d}_{ij}, d^+)$ is obtained Ideal

$$\Psi(\bar{d}_{ij}, d^+) = D_j(\bar{d}_{ij}, d^-) / (D_j(\bar{d}_{ij}, d^+) + D_j(\bar{d}_{ij}, d^-))$$

Since the true value $\Psi(\bar{d}_{ij}, d^+)$ of the vector $[0,1]$ are the real value of this coefficient can be considered as an executive function $g_j(Y_i)$, if $\bar{d}_{ij} \to d^+$. and $g_j(Y_i) \to 1$. The fourth phase of the matrix using the IF-SIR function is obtained. At first, given the $P_j(Y_i, Y_t)$ severity of the primacy supplier of Y_i on supplier Y_t standard is announced to be achieved

$$P_j(Y_i, Y_t) = \varphi_j(g_j(Y_i) - g_j(Y_t)), \quad j = 1,2,...,m, \quad i,t = 1,2,...,n, \quad i \neq t,$$

Where $\varphi_j(\bullet)$ plays the role of non-additive threshold and values in the vector $[0,1]$. in the range defined by the decision makers with reference to the reference threshold.

Secondly, for providing Y_i, we with the index IF-SIR taking into account the following criteria to show jth .

Priority Index is given

$$S_j(Y_i) = \sum_{i=1}^{n} P_j(Y_i, Y_t) = \sum_{i=1}^{n} \phi_j(g(Y_i) - g(Y_t))$$

Khatrī index is displayed as follows:

$$I_j(Y_i) = \sum_{i=1}^{n} P_j(Y_t, Y_i) = \sum_{i=1}^{n} \phi_j(g(Y_t) - g(Y_i))$$

So our supplier Y_i, matrix IF-SIR with regard to the j-th criterion obtains.
Priority matrix

$$[S_j(Y_i)]_{n\times m} = \begin{bmatrix} S_1(Y_1) & \dots & S_j(Y_1) & \dots & S_m(Y_1) \\ \dots & \dots & \dots & \dots & \dots \\ S_1(Y_i) & \dots & S_j(Y_i) & \dots & S_m(Y_i) \\ \dots & \dots & \dots & \dots & \dots \\ S_1(Y_n) & \dots & S_j(Y_n) & \dots & S_m(Y_n) \end{bmatrix}$$

And matrix Khatrī:

$$[I_j(Y_i)]_{n\times m} = \begin{bmatrix} I_1(Y_1) & \dots & I_j(Y_1) & \dots & I_m(Y_1) \\ \dots & \dots & \dots & \dots & \dots \\ I_1(Y_i) & \dots & I_j(Y_i) & \dots & I_m(Y_i) \\ \dots & \dots & \dots & \dots & \dots \\ I_1(Y_n) & \dots & I_j(Y_n) & \dots & I_m(Y_n) \end{bmatrix}$$

Step five: Given the matrix of $[I_j(Y_i)]_{n\times m}$ and $[S_j(Y_i)]_{n\times m}$ the IF-SIR can be calculated using the function-oriented collector witnesses. We IFWA for the superiority and inferiority consider here the operator can be used the subjective evaluation of the decision-makers and provide them with data. Priority flow can be obtained in this way:

$$\varphi^{>}(Y_i) = \sum_{j=1}^{m} \bar{\varpi}_j S_j(Y_i) = IFWA_{S_j(Y_i)}(\bar{\varpi}_1, \bar{\varpi}_2, \dots, \bar{\varpi}_m) = (1 - \prod_{j=1}^{m}(1-\bar{\mu}_j)^{S_j(Y_i)}, \prod_{j=1}^{m}\bar{v}_j^{\,S_j(Y_i)})$$
$$= (\mu^{>}(Y_i), v^{>}(Y_i))$$

Khatrī or UV flow is obtained as follows:

$$\varphi^{<}(Y_i) = \sum_{j=1}^{m} \bar{\varpi}_j I_j(Y_i) = IFWA_{I_j(Y_i)}(\bar{\varpi}_1, \bar{\varpi}_2, \dots, \bar{\varpi}_m) = (1 - \prod_{j=1}^{m}(1-\bar{\mu}_j)^{I_j(Y_i)}, \prod_{j=1}^{m}\bar{v}_j^{\,I_j(Y_i)})$$
$$= (\mu^{<}(Y_i), v^{<}(Y_i))$$

Sixth step: generate decision rules based on dominance relations. By comparing pairs - pairs can lead to a pair of supplier relationships to obtain, to obtain the IF-SIR, We are a supplier of $Y_i(\phi^{>}(Y_i), \phi^{<}(Y_i))$ compared with other suppliers $Y_t(\phi^{>}(Y_t), \phi^{<}(Y_t))$, where i, t = 1... n, t ≠ i .. all preference relations (OUTRANKING) defined as follows: are.

Comparing $\varphi^{>}(Y_i)$ and $\varphi^{>}(Y_t)$, we have $\varphi^{>}(Y_i) > \varphi^{>}(Y_t)$, $\varphi^{>}(Y_i) = \varphi^{>}(Y_t)$ or $\varphi^{>}(Y_i) < \varphi^{>}(Y_t)$.

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Step Seven: rankings. The supplier selection decisions are based on the scoring rules. This step by paired comparisons of scores for each of I and S are obtained:

$$Score(Y_i) = Sup(Y_i) - Inf(Y_i)$$

where

$$Sup(Y_i) = card(\{Y_t : \text{ at least one superior rule affirms } Y_i \succ Y_t\})$$

$$Inf(Y_i) = card(\{Y_t : \text{ at least one inferior rule affirms } Y_i \prec Y_t\})$$

In this algorithm, $\sup(Y)$ specifies the number of preferred suppliers similarly, $Inf(y)$ expresses the degree to which the supplier is less.

Steps to Conduct Research

To evaluate and select suppliers in this research, the following steps were taken:

1. After studying the situation in the center of the piece selected for study was the first questionnaire, which includes 28 criteria, was distributed among experts. After gathering expert opinion, 4 standards (Quality, cost, service performance and risk factors) were selected as the main criteria for evaluating suppliers.
2. After determining the main criteria, the experts were asked to compare the test criteria and their suppliers in relation to each criterion. After combining the results of paired comparisons, with the development of intuitive fuzzy scale range specified in Table 1 of the questionnaire using intuitive fuzzy AHP method, the weights were determined criteria.

Table 1: The scale and importance of intuitive fuzzy

Levels	"Importance" terms	"Performance" terms	IFVs
L1	Extremely Important (EI)	Extremely Positive (EP)	(1.00, 0.00)
L2	Absolutely Important (AI)	Absolutely Positive (AP)	(0.90, 0.10)
L3	Very Very Important (VVI)	Very Very Positive (VVP)	(0.80, 0.10)
L4	Very Important (VI)	Very Positive (VP)	(0.70, 0.20)
L5	Important (I)	Positive (P)	(0.60, 0.30)
L6	Medium (M)	Medium (M)	(0.50, 0.40)
L7	Less Important (LI)	Negative (N)	(0.40, 0.50)
L8	Not Important (NI)	Very Negative (VN)	(0.05, 0.80)
L9	Unconsidered (UC)	Extremely Negative (EN)	(0.00, 1.00)

The paired comparison matrix in Table 2 was formed. Based on the relationships described in the section on fuzzy AHP intuitive weights were calculated for each criterion is shown in Table 2.

Table 2: Paired comparison matrix intuitive fuzzy criteria weights

	Quality	**Cost**	**Performance Services**	**Risk factor**	**weight**
Quality	(0,0)	(0.70,0.20)	(0.70,0.10)	(0.30,0.20)	(0.9892, 0.0022)
Cost	(0.60,0.10)	(0,0)	(0.20,0.70)	(0.20,0.30)	(0.9309, 0.0284)
Performance Services	(0.30,0.40)	(0.70,0.20)	(0,0)	(0.10,0.70)	(0.9560 , 0.0133)
Risk factor	(0.20,0.70)	(0.40,0.30)	(0.10,0.60)	(0,0)	(0.8900, 0.0532)

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According to Table 2, Equation 6 can be any amount of weight, measure and prioritize them According to which we have:

Table 3: Prioritization criteria

Weight	priority	Rank
(0.9892, 0.0022)	.9934	1
(0.9309, 0.0284)	.9823	2
(0.9560 , 0.0133)	.9712	3
(0.8900, 0.0532)	.9153	4

3. To select suitable suppliers, superiority and inferiority phase heuristic method was used. The method is based on section 4 of the questionnaire was the decision Tuesday and on the basis of the experts' opinions were collected in the following tables.

Table 4: Evaluation Specialists

Weighting of criteria				Weight	Expert
w4	**w3**	**w2**	**w1**		
(0.60, 0.30)	(0.80, 0.10)	(0.70, 0.20)	(0.90, 0.10)	(1.00, 0.00)	1
(0.70, 0.20)	(0.70, 0.20)	(0.60, 0.30)	(0.80, 0.10)	(0.80, 0.10)	2
(0.60, 0.30)	(0.60, 0.30)	(0.70, 0.20)	(0.70, 0.20)	(0.70, 0.20)	3

Based on 1 and 2 and the first stage of the fourth section of each of the experts can assess which is equal to: (1.0000, 0.8314, and 0.7405).

4. Matrix decision based on fuzzy aggregation of expert opinions based on the second stage intuitive sir obtained

(0.9677, 0.0090) (0.9254, 0.0323) (0.9777, 0.0048) (0.9548, 0.0159)
(0.9120, 0.0399) (0.9043, 0.0446) (0.9289, 0.0301) (0.8859, 0.0574)
(0.9920, 0.0027) (0.9777, 0.0048) (0.9785, 0.0045) (0.9785, 0.0045) $\bar{d}_{ij}$ =
(0.9397, 0.0239) (0.8574, 0.0766) (0.9699, 0.0080) (0.9289, 0.0301)
(0.8816, 0.0603) (0.7982, 0.1184) (0.9441, 0.0215) (0.8603, 0.0746)

5. The function was presided decision matrix below.

0.9684 0.9284 0.9781 | 0.9561
0.9160 0.9090 0.9317 | 0.8920
$g\,Y=$ | 0.9920 0.9781 0.9789 0.9789
0.9418 0.8662 0.9706 | 0.9317
0.8881 0.8137 0.9460 | 0.86 8

6. Final ranking after performing the necessary calculations were taken from Section 4.

Table 5: Flow IFSIR

Suppliers	$\phi^{\succ}(Y)$	$S^{\succ}(Y)$	$\phi^{\prec}(Y)$	$S^{\prec}(Y)$
Y1	□ 0.3134, 0.6017□	□0.2883	(**0.1178**,**0.8442**)	-0.7264
Y2	(0.1138,0.8506)	-0.7368	(0.3164,0.5971)	-0.2807
Y3	(0.3942,0.5079)	-0.1137	(0.0000,1.0000)	-1
Y4	(0.1636,0.7852)	-0.6216	(0.2758,0.6469)	-0.3711
Y5	(0.0308,0.9577)	-0.9269	(0.3750,0.5304)	-0.1554

Options can be ranked according to Table 5.

Table 6: Ratings Options

	number of superiority of S	number of subordination I	Score
Y1	3	1	2
Y2	1	3	2-
Y3	4	0	4
Y4	2	2	0
Y5	0	4	-4

According to Table 6, the supplier and the supplier of Fifth Third will be the best choice as a supplier was the worst.

CONCLUSION

As stated in previous discussions, human reasoning and judgment, a very large role in determining the performance of suppliers. Therefore, as a decision-making, human resources and engage with complex systems, a fuzzy-intuitive phenomenon, to describe these systems will predominate. Both AHP and SIR method for evaluating suppliers has advantages over other approaches but each of them also have shortcomings. AHP can risk and uncertainty in evaluating the performance of suppliers to efficiently take into account. When decision makers are faced with a problem of uncertain and complex and uncertain proportions as their comparative judgments "about twice more important" and "Between two to four times less important than" tell. Therefore the research of the intuitive approach of fuzzy AHP method and the method we use SIR. The results also show that quality and cost are the most important factors in selecting suppliers. Therefore, it is recommended parts suppliers focus their system more focused on these two criteria to cause improvement of their choice by the stakeholders.

REFERENCES

Abdullah L, Taib I and Salleh R (2009). Public Perceptions of Cancer Risk using Analytic Hierarchy Process. *Applied Science* **9** 2319-2324.

Amindoust A, Ahmed S, Saghafinia A and Bahreininejad A (2012). Sustainable supplier selection: A ranking model based on fuzzy inference system. *Applied Soft Computing* **12**(6) 1668-1677.

Atanassov KT (1986). Intuitionistic fuzzy sets. *Fuzzy Sets and Systems* **20**(1) 87–96.

Benyoucef M and Canbolat M (2007). Fuzzy AHP-based supplier selection in e-procurement. *International Journal of Services and Operations Management* **3**(2) 172-192.

Bhattacharya A, Geraghty J and Young P (2010). Supplier selection paradigm: an integrated hierarchical QFD methodology under multiple-criteria environment. *Applied Soft Computing* **10** 1013–1027.

Brans JP, Ph. Vincke and Mareschal B (1986). How to select and how to rank projects: The PROMETHEE method. *European Journal of Operational Research* **24** 228−238.

Chai J, Liu JN and Xu Z (2012). A new rule-based SIR approach to supplier selection under intuitionistic fuzzy environments. *International Journal of Uncertainty, Fuzziness and Knowledge-based Systems* **20**(03) 451-471.

De Boer L, Labro E and Morlacchi P (2001). A review of methods supporting supplier selection. *European Journal of Purchasing and Supply Management* **7** 75−89.

Deng X, Hu Y, Deng Y and Mahadevan S (2014). Supplier selection using AHP methodology extended by D numbers. *Expert Systems with Applications* **41**(1) 156-167.

Kannan D, Khodaverdi R, Olfat L, Jafarian A and Diabat A (2013). Integrated fuzzy multi criteria decision making method and multi-objective programming approach for supplier selection and order allocation in a green supply chain. *Journal of Cleaner Production* **47** 355-367.

Kheljani JG, Ghodsypour SH and O'Brien C (2009). Optimizing whole supply chain benefit versus buyer's benefit through supplier selection. *International Journal of Production Economics* **121** 482–493.

Lin CT, Chen CB and Ting YC (2011). An ERP model for supplier selection in electronics industry. *Expert Systems with Applications* **38** 1760–1765.
Moghadam MRS, Afsar A and Sohrabi B (2008), Inventory lot-sizing with supplier selection using hybrid intelligent algorithm. *Applied Soft Computing* **8** 1523–1529.
Saaty TL (1980). *The Analytic Hierarchy Process: Planning, Priority Setting, Resources Allocation* (New York: McGraw-Hill Inc.).
Wang JW, Cheng CH and Kun-Cheng H (2009). Fuzzy hierarchical TOPSIS for supplier selection. *Applied Soft Computing* **9** 377–386.
Wu DS and Olson DL (2008). Supply chain risk, simulation, and vendor selection. *International Journal of Production Economics* **114** 646–655.
Xu XZ (2001). The SIR method: A superiority and inferiority ranking method for multiple criteria decision making. *European Journal of Operational Research* **131** 587−602.
Zadeh LA (1965). Fuzzy sets. *Information and Control* **8**(3) 338–353.