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A new approach for the evaluation and classification of human resources according to competences using the TOPSIS method and the measurement of fuzzy possibilities

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Abstract— **This article presents an approach to assess and classify human resources according to skills. This approach combines the method based on consensus between decision-makers and the TOPSIS multicriteria method. As decision-makers usually have conflicting preferences for a choice issue. The first step represents the determination of a global agreement between the decision makers and the second step represents the classification of the condidates according to the TOPSIS method.**

***Keywords*: Evaluation, Classification, Competences, Fuzzy possibility, TOPSIS**

I. INTRODUCTION

In order to cope with fierce competition, companies must focus on creating sustainable competitive advantages. Since performance depends more on the management of innovation and diversification, intangible resources are more likely to produce competitive advantages than tangible resources. In this context, human resources with cognitive and decision-making capabilities have become the "new" key component of performance (Bennour & Crestani, 2007). Today, the emergence of several characteristics of organizational personnel, involving personnel knowledge, experience, and collaboration information from social networks, helps to introduce the concept of competence and emphasizes its importance to achieving organizational goals. This focus has opened up the horizon for researchers to develop more adaptive and effective capacity management techniques, some of which are important for human resource selection and performance evaluation. to develop more adaptive and effective competence management techniques among which some have important implication on Human Resources selection and performance appraisal.

II. Consensus based group decision making

A. *Fuzzy consensus based on possibility measure*

In a soft consensus measure, the consensus process is defined as a dynamic and iterative stakeholders discussion process coordinated by a moderator who helps the stakeholders to make their opinions closer. In each step of this process, the moderator knows the actual level of consensus between the stakeholders by means of the consensus measure, which establishes the distance to the ideal state of consensus. Soft consensus measures are usually calculated by using only the opinions given by the stakeholders (Herrera et al., 1996; Kacprzyk & Fedrizzi, 1988; Zadrozny, 1997) or the choice degrees of alternatives obtained from those opinions (Bryson, 1996). In such case, a soft consensus measure is defined by measuring the coincidence or the distance between them calculated, e.g., by means of the Euclidean distance

Liu and Zhang (2014) developed a consensus model for GDM with incomplete interval fuzzy preference relations using TOPSIS method. They, first defined a new consistency measure for incomplete interval fuzzy preference relations. Second, to estimate the missing interval preference values, they proposed a goal programming
model guided by the consistency measure. Third, using the induced ordered weighted averaging operator (Yager & Filev,1999), an ideal interval fuzzy preference relation is constructed. Fourth, they defined a similarity degree between complete interval fuzzy preference relations and the ideal one. The similarity degree is related to the associated weights, and used to aggregate the DM’s preference relations such that more importance is given to ones with the higher similarity

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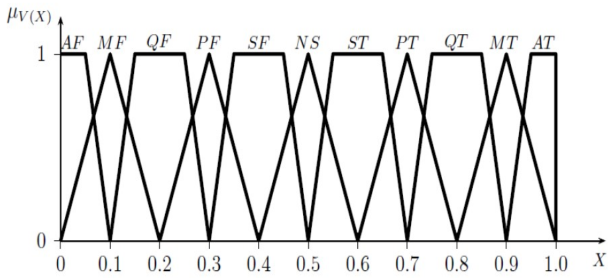
degree. Finally, a new algorithm is presented to solve the GDM problem with incomplete interval fuzzy preference relations, which is further applied to partnership selection in formation of virtual enterprises.

The trapezoidal membership functions for information processing are presented as follows.

Figure 6: Trapezoidal Membership Functions for Information Processing



The literature is very rich, specialized research To SCC, such as production and distribution coordination (Kim, Hong, & Lee, 2005), procurement and production coordination (Munson & Rosenblatt, 2001), production and inventory coordination (Grubbstrm & Wang, 2003) and distribution and Inventory coordination (Hengshan, 2002). According to Malone And Crowston (1994) "Coordination is the act of managing dependencies Joint efforts between entities and collaborative work between entities Towards a jointly determined goal". Several researchers (Arshinder and Deshmukh, 2008; Arshinder, Kanda, & Deshmukh, 2011; Cardenas-Barron, 2007; Piprani & Fu, 2005 etc.) realized the need to develop new supply methods Chain coordination problem. Some existing methods are shared Cost and price information (Yao & Chiou, 2004), others have Establish inventory management information system network

.

II. Approach to solving the problem

This section presents the steps of our Opportunity Measurement and Assessment of Human Resource Competency Levels The assessment phase consists of.
In this consensus, decision makers have the opportunity to define the desired set of. With U represents the possibility transfer terminal.

The evaluation stages of our hybrid fuzzy approach combining consensus based

Step 1. Select all quantifiers and retrieve fuzzy preferences from. decision makersi.

Step 2. For each skill resource, calculate Gjs, Pi and U using the
equations

Step 3.. For each skill resource, select Djs [0, U] and calculate Tj.

Step 4. Apply the α-coupe and the optimal index . a to obtain the clear preference

Step 5. Calculate the Hi compliance measure for each decision maker to aggregate all assessments using the following equations:

Step 6. For each competency resource and candidate, select the decision maker's preference with the lowest Hi value.

Based on the TOPSIS technique and the assessments of decision-makers, we classified the resources according to competencies according to the following steps:

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A. Implementation of the consensus-based approach based on the possibility measure and the TOPSIS method Evaluation des competences.

The assessment step is to determine a consensus among decision makers based on the measure of opportunity. We will follow the steps presented in the previous section.

Decision-makers initially select the set of all quantifiers. Each STt decision-maker is invited to select and communicate their preferences in relation to each competency resource (knowledge, know-how, know-how). The following table represents the set of quantifiers for each competency

TABLE I
FONT SIZES FOR PAPERS

(TK)	VH , H, P
(KE)	M,H,VH,P
(KP)	M,H,VH
(PK-H)	H,VH ,M
(EK-H)	M, H, VH
(R)	H, VH, P
(CC)	M, H, VH
(B)	H,VH , M

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Thus, the assessments of decision makers for each competency resource and for each Ci alternative are represented in the following tables: Table 21 represents the assessments of decision makers for each competency resource, for each Ci candidate and for Task 1.

		Expert (E1)	Expert (E2)	Expert (E3)
Candidate1(C1)	*(TK)*	H	VH	M
	(KE)	M	H	H
	(KP)	H	H	H
	(PK-H)	M	M	M
	(EK-H)	M	H	H
	(R)	M	VH	H
	(CC)	H	M	H
	(B)	H	VH	P
Candidate1 (C 2)	*(TK)*	H	H	M
	(KE)	L	H	M
	(KP)	L	H	M
	(PK-H)	M	H	M
	(EK-H)	M	M	M
	(R)	H	H	M
	(CC)	L	M	H
	(B)	M	M	VH
Candidate1 (C 3)	*(TK)*	M	M	H
	(KE)	M	M	M
	(KP)	L	M	L
	(PK-H)	H	H	M
	(EK-H)	L	L	H
	(R)	M	M	H
	(CC)	L	L	M
	(B)			

Step 2: Determining the probabilities for the different quantifiers

The following tables represent the calculation of the Probabilities for the different Gj quantifiers for each competency resource and for each task based on the quantifiers table

Determining the probabilities Pi for each candidate and for each task.

After determining the different probabilities for each competency resource and for each task, the best probability is selected using the following formula:

$$Pj = \text{Min } \{1 - Gi + \sum (Gi)^2\}$$

Step 3: Determination of Opportunity Transfer Constant D and Ti Opportunity for each Competency Resource, Candidate and Expert Task 1.

the possibility transfer constant Ti using the following formula: Ti = Gi + D With Gi is the probability for each skill resource and Di is the opportunity transfer point Di $\in$ [0, U] (for our case Di=U) After determining the different probabilities for each competency resource and for each task, it is necessary to determine

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Step 4 : Apply l'α-coupe and the optimal index to obtain the net preference using the following equations:

In our case, the defluzzification of each language variable is done using a α-slice. The α-slice defines a confidence i nterval of lower bound BL and upper bound BU (Igoulalene ,2015)

BL = (b − a) α + a et BU = (d − c)α + d. et (5.4)

I = γ BL + (1 − γ) BU (6.4)

∀γ □ [0, 1] (for our case ∝=0.8 et γ= 0.5)

Step 5: In this step we calculate the Hi compliance measure to aggregate assessments of all alternatives and to determine a collective preference

This measure takes the following form:

$$Hi = \frac{\sum_j^n \pi j}{s}, \text{ with } \pi j = \text{Max } \{ \text{Min } (\frac{Ij}{0,5}, \frac{1-Ij}{0,5}), 0 \}$$

Step 6: Select the candidate's preference with the small Hi value for each candidate and for each competency resource.

This step involves selecting for each competency resource the preference of the decision maker that corresponds to the lowest Hi value.

The following tables represent Hi compliance values and decision makers' preferences for each task.

The following table summarizes the Hi compliance values and preferences of the three decision makers for Task 1.

B. Ranking of Candidates

Based on the preferences of the decision-makers presented in the tables above (Step 6) we obtain the fuzzy matrix of collective preferences and then the ordinary matrix of collective preferences.

Step 1: Calculate the distance between the different levels and the ideal and anti-ideal solutions.

After determining the acquired and required aggregate levels as well as the ideal and anti-ideal solutions. It is interesting to calculate the Euclidean distances between the different levels and the ideal and anti-ideal solutions using the following formulas:

-Euclidean distance between different levels and ideal solutions

$$d_{ij}^{+} = (\sum_{r=1}^{8} wrj(x_{rj} - xrj^{+})^2)^{1/2}$$

-Euclidean distance between different levels and anti-ideal solution

$$d_{ij}^{-} = (\sum_{r=1}^{8} wrj(x_{rj} - xrj^{-})^2)^{1/2}$$

With :

x_{rj}: The aggregate level acquired that corresponds to the skill resource r and task j.

xrj^{+} : The ideal level corresponding to the skill resource r and task j.

xrj^{-} : The anti- ideal level corresponding to the skill resource r and task j.

wrj : The importance weight of the resource r for task j. (For our case the weight of the skill resources are equal ,wrj=1/8)

Step 2: Decision Making and Interpretation

Applying the TOPSIS method and the results found in the preceding table, it is interesting to calculate the coefficient of proximity according to the following expression:

$$CC_{ij} = \frac{d_{ij}^{-}}{d_{ij}^{+} + d_{ij}^{-}} \forall$$

i={ 1,2,..n} and j={1,2 ….m}

The ranking of the candidates for each task is determined in descending order of the different values of the coefficient CC_{ij}.

The following table represents the ranking of candidates for each module.

CC_{ij}	*C1*	*C2*	*C3*	*Ranking*
T1 (M1)	0.81	0.6	0.19	C1≻C2≻C3
T2 (M2)	0.75	0.41	0.45	C1≻C3≻C2
T3 (M3)	0.17	0.83	0.4	C2≻C3≻C1
T4 (M4)	0.17	0.5	0.69	C3 ≻ C2 ≻ C1

Based on these results, the majority of candidates classified by Approach 2 based on the consensus of different decision makers

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and the TOPSIS method are characterized by higher proximity coefficients for different tasks compared to candidates classified by the first approach based on method 2- tuples and the TOPSIS method

Tasks T1 and T2 must be taken in charge by candidate C1, he recorded levels for knowledge, know-how and know-how that were close to those required for task T1, so for task T2 , it has recorded high levels for knowledge and know-how.

As far as task T3 is concerned, it must be taken over by candidate C2, it has recorded important levels for knowledge. Thus the C2 candidate recorded high levels as those of the C1 candidate for some resources however these ressources étaient les moins importantes pour traduire un coefficient de proximité plus élevé.

For the C3 candidate, this candidate can only be assigned to the T4 task, he recorded higher levels than the C1 and C2 candidates and which were close to those required.

Conclusion

The work presented in this article has enabled us to make contributions to several organizational processes, including the process of evaluating and classifying human resources according to skills. Indeed, we have proposed a decision support method for the management of this process based on a consensus based on the possibility measure in a fuzzy environment and the TOPSIS multicriteria method. Comparing the results by other methods, we found that the consensus based on the possibility measure retained the assessments of the majority of decision makers, leading to better results compared to other methods. Indeed, the coefficients of the proximities obtained by this evaluation method are higher.

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