Application of new media retrieval system based on Neutrosophic in marketing

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Abstract

The new media is a crucial ply role in the market. The new media growth rapidly in the market so, select consumers and companies for competition. So, the new media is a complex task for companies and firms. The new media retrieval contains much content such as image retrieval, audio and video retrieval. The new media retrieval contains many criteria, and each criterion contains sub-criteria. So, use an MCDM method for dealing with this problem. The new media retrieval system is analyzing under a neutrosophic environment. The Decision-making trial and evaluation laboratory (DEMATEL) integrated with single-valued neutrosophic. DEMATEL method used to show importance and impact criteria of new media retrieval for helping companies in market competition. An example is provided for showing calculations.

Keywords: AHP; Neutrosophic; Retrieval System; New Media.

1. Introduction

New media is a complex task for companies and firms. Many researchers have interest in retrieval systems and methods in the last years. Researchers have many researchers in motions retrieval, audio retrieval, image retrieval and video retrial[1]–[4], [4]–[9]. But in these days, many researchers are not concerned with a retrieval system. So, it is beneficial for providing an application of new media in retrieval systems. So, it is a complex task for determining the new media retrieval.

There are many articles in the new media retrieval system. The new media retrieval system has many criteria and sub-criteria that were collected from the literature review. So, these criteria must be ranked and show

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importance between them to help companies determine criteria that affect a new media retrieval system. The multi-criteria decision-making method is used for dealing with various criteria and sub-criteria[10]–[15].

The DEMATEL method used in this paper shows the importance and impact of criteria in the new media retrieval system. The DEMATEL is an MCDM method. It is used to show the impact of criteria and sub-criteria—the DEMATEL method integrated into a neutrosophic environment to deal with incomplete information. We use Single Valued Neutrosophic Sets (SVNS) to deal with incomplete information. We use a neutrosophic over the fuzzy system. Fuzzy systems consider truth and falsity values in calculations and ignore the indeterminacy value. So, we use SVNSs to deal with this problem. SVNSs contains three values for truth, indeterminacy and falsity values. So the SVNSs is better than a fuzzy system[16]–[19].

The main contributions in this paper are that we used a neutrosophic environment for a new media retrieval system for the first time and integrated many of the criteria with the DEMATEL method to show the impact and importance of criteria.

The rest of this paper is organized as follow: section 2 present DEMATEL method, section 3 present an example and results—finally section 4 present conclusions of this work.

2. DEMATEL Method.

This section present a integrate DEMATEL with the neutrosophic sets. We use a single valued neutrosophic numbers in [20]. which contains form three values. DEMATEL method used in different areas. The following steps of DEMATEL method.

Step 1: collect criteria, sub criteria and experts.

Step 2: Build a pairwise comparison matrix between criteria then sub criteria by opinions of experts.

Step 3: Convert the SVNNs into on value

$$S(A) = \frac{2+a-b-c}{3} \quad (1)$$

Where A is a value of pairwise comparison matrix

Step 4: Combine the pairwise comparison matrix into one matrix by mean value

Step 5: Normalize the pairwise comparison matrxix

$$R = A * F \quad (2)$$

$$f = \frac{1}{\max \sum_{x=1}^{n} a_{xy}} \quad (3)$$

Where, n = number of criteria, x=1,2,3…n, y = 1,2,3,….m

Step 6: Obtaining the Total relation matrix by a Matlab software.

Step 7: Sum of rows and columns then rank criteria according largets value in subtract sum of columns form sum of rows.

3. Example and results.

This section provides the outcomes of the proposed method. First, collect three experts to evaluate the criteria and sub-criteria. then collect criteria and sub-criteria from the literature review. The five main criteria and

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twenty-two sub-criteria were collected. C1: subsystem level contains four sub-criteria C1.1: use retrieval engine, C1.2: use retrieval facilities C1.3: use retrieval subsystem and C1.4: integration system. C2: Competition in the market: C2.1: Customer Media, C2.2: advertising, C2.3: interaction customer & suppliers, C2.4: Direct marketing, C2.5: quality of information, C2.6: service quality, C2.7: information technology and C2.8: Economics. C3: System level. C3.1: new media elements, C3.2: new media technology and C3.3: new media process. C4: Business level, C4.1buisness product and services, C4.2: tasks and process, C4.3 information types, C4.4: business objectives. C5: policy & supports, C5.1: training or sales, C5.2: public relation, C5.3: market policy, C5.4: finance & logistics. First, build a comparison matrix between five criteria in Table 1-3. Then combined matrix is in Table 4. Then normalize the pairwise comparison matrix into Table 5. Then normalize pairwise comparison in Table 6. Then obtain the total relation matrix in Table 7. The show importance of criteria in Table 8. Fig 1. Present the importance of criteria. The policy & support is of the highest importance, and the subsystem level is the lowest importance criteria.

Table 1: Pairwise comparison matrix for main criteria by first decision makers.

	C_1	C_2	C_3	C_4	C_5
C_1	0.5	0.8167	0.283	0.8167	0.9
C_2	1.22444	0.5	0.9	0.9	0.8167
C_3	3.533569	1.111111	0.5	0.283	0.9
C_4	1.22444	1.111111	3.533569	0.5	0.383
C_5	1.111111	1.22444	1.111111	2.610966	0.5

Table 2: Pairwise comparison matrix for main criteria by second decision makers.

	C_1	C_2	C_3	C_4	C_5
C_1	0.5	0.9	0.283	0.9	0.8167
C_2	1.111111	0.5	0.9	0.383	0.8167
C_3	3.533569	1.111111	0.5	0.8167	0.9
C_4	1.111111	2.610966	1.22444	0.5	0.283
C_5	1.22444	1.22444	1.111111	3.533569	0.5

Table 3: Pairwise comparison matrix for main criteria by third decision makers.

	C_1	C_2	C_3	C_4	C_5
C_1	0.5	0.283	0.8167	0.9	0.383
C_2	3.533569	0.5	0.383	0.283	0.383
C_3	1.22444	2.610966	0.5	0.8167	0.9
C_4	1.111111	3.533569	1.22444	0.5	0.8167
C_5	2.610966	2.610966	1.111111	1.22444	0.5

Table 4: Combined pairwise comparison matrix for main criteria.

	C_1	C_2	C_3	C_4	C_5
C_1	0.5	0.666567	0.4609	0.872233	0.6999
C_2	1.956373	0.5	0.727667	0.522	0.672133

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C_3	2.763859	1.611063	0.5	0.6388	0.9
C_4	1.148887	2.418549	1.99415	0.5	0.494233
C_5	1.648839	1.686615	1.111111	2.456325	0.5

Table 5: Normalized combined pairwise comparison matrix for main criteria.

	C_1	C_2	C_3	C_4	C_5
C_1	0.067541	0.090041	0.062259	0.117823	0.094544
C_2	0.264272	0.067541	0.098295	0.070513	0.090793
C_3	0.373349	0.217626	0.067541	0.086291	0.121574
C_4	0.155194	0.326703	0.269374	0.067541	0.066762
C_5	0.222729	0.227832	0.150092	0.331806	0.067541

Table 6: Total relation matrix for main criteria.

	C_1	C_2	C_3	C_4	C_5
C_1	0.382164	0.357063	0.255747	0.307248	0.230251
C_2	0.631966	0.379227	0.318361	0.306788	0.261845
C_3	0.890196	0.642604	0.378606	0.417637	0.362474
C_4	0.773281	0.785969	0.593316	0.402885	0.332735
C_5	0.903011	0.805396	0.571905	0.714776	0.368155

Table 7: Importance for main criteria.

	Importance
C_1	-2.04815
C_2	-1.07207
C_3	0.573582
C_4	0.738851
C_5	1.807784

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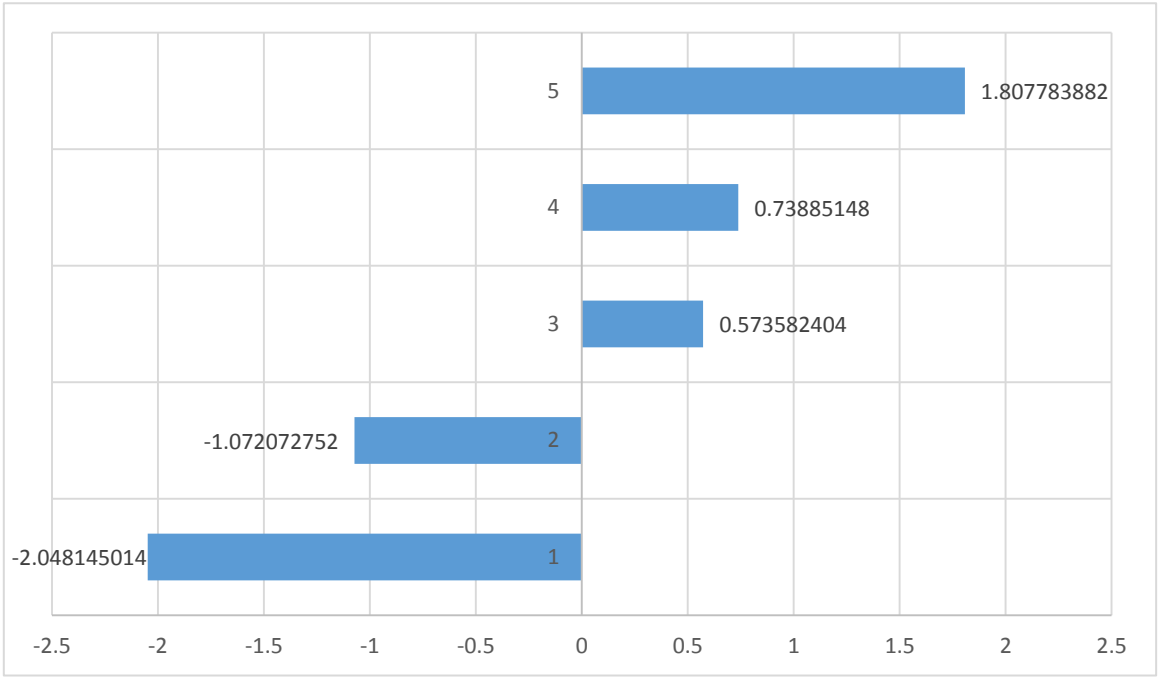

Figure 1: Importance of five criteria.

Then compute importance for sub-criteria C1. Then build a comparison matrix between five criteria in Table 9-11. Then combined matrix is in Table 12. Then normalize the pairwise comparison matrix into Table 13. Then obtain the total relation matrix in Table 14. The show importance of criteria in Table 15. Fig 2 Present the importance of criteria. The integration system is of the highest importance, and retrieval engine l is the lowest importance sub-criteria C1.

Table 9: Pairwise comparison matrix for main criteria by first decision makers.

	$C_{1.1}$	$C_{1.2}$	$C_{1.3}$	$C_{1.4}$
$C_{1.1}$	0.5	0.9	0.8167	0.283
$C_{1.2}$	1.111111	0.5	0.383	0.383
$C_{1.3}$	1.22444	2.610966	0.5	0.283
$C_{1.4}$	3.533569	2.610966	3.533569	0.5

Table 10: Pairwise comparison matrix for main criteria by second decision makers.

	$C_{1.1}$	$C_{1.2}$	$C_{1.3}$	$C_{1.4}$
$C_{1.1}$	0.5	0.8167	0.283	0.8167
$C_{1.2}$	1.22444	0.5	0.9	0.9
$C_{1.3}$	3.533569	1.111111	0.5	0.283
$C_{1.4}$	1.22444	1.111111	3.533569	0.5

Table 11: Pairwise comparison matrix for main criteria by third decision makers.

	$C_{1.1}$	$C_{1.2}$	$C_{1.3}$	$C_{1.4}$
$C_{1.1}$	0.5	0.383	0.283	0.9

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$C_{1.2}$	2.610966	0.5	0.283	0.8167
$C_{1.3}$	3.533569	3.533569	0.5	0.383
$C_{1.4}$	1.111111	1.22444	2.610966	0.5

Table 12: Combined pairwise comparison matrix for main criteria.

	$C_{1.1}$	$C_{1.2}$	$C_{1.3}$	$C_{1.4}$
$C_{1.1}$	0.5	0.727667	0.6388	0.522
$C_{1.2}$	1.611063	0.5	0.522	0.494233
$C_{1.3}$	1.99415	2.418549	0.5	0.349667
$C_{1.4}$	1.548227	1.278469	2.048178	0.333333

Table 13: Normalized combined pairwise comparison matrix for main criteria.

	$C_{1.1}$	$C_{1.2}$	$C_{1.3}$	$C_{1.4}$
$C_{1.1}$	0.095014	0.138278	0.12139	0.099195
$C_{1.2}$	0.306148	0.095014	0.099195	0.093918
$C_{1.3}$	0.378946	0.459594	0.095014	0.066447
$C_{1.4}$	0.294207	0.242946	0.389213	0.063343

Table 14: Total relation matrix for main criteria.

	$C_{1.1}$	$C_{1.2}$	$C_{1.3}$	$C_{1.4}$
$C_{1.1}$	0.481859	0.464293	0.347786	0.22816
$C_{1.2}$	0.733354	0.471228	0.367693	0.251269
$C_{1.3}$	1.073834	1.011147	0.498079	0.321384
$C_{1.4}$	1.101885	0.947602	0.827114	0.338011

Table 15: Importance for sub criteria C1.

	Importance
$C_{1.1}$	-1.86883
$C_{1.2}$	-1.07073
$C_{1.3}$	0.863772
$C_{1.4}$	2.075788

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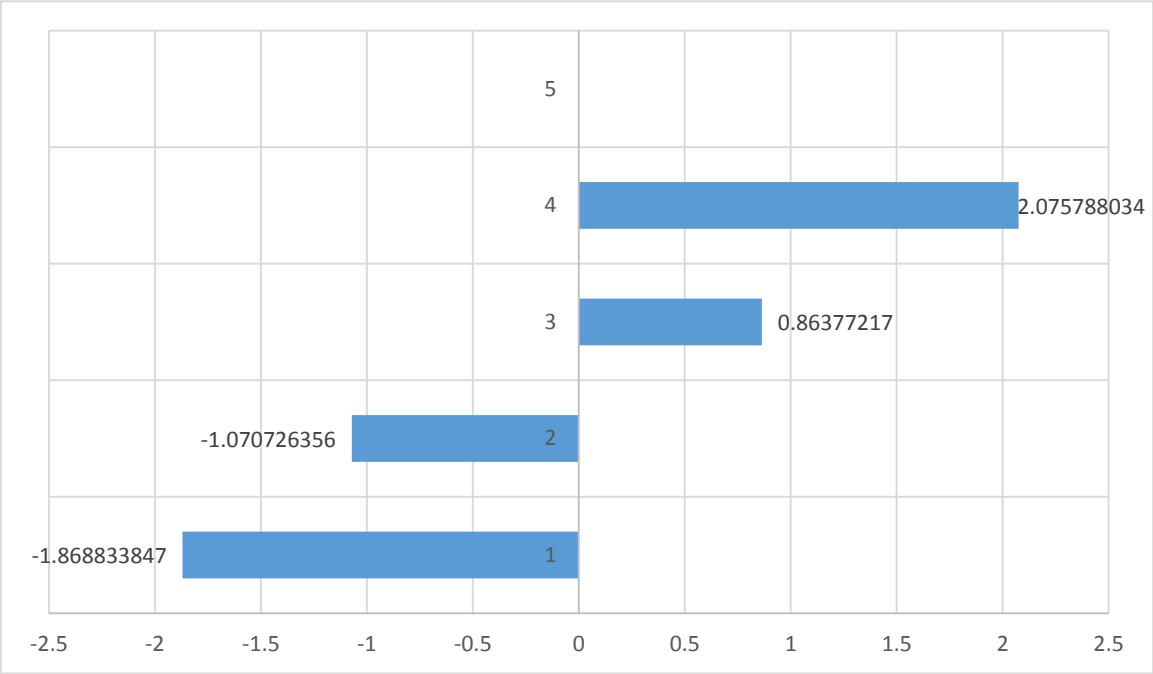

Fig 2: Importance of sub criteria c1.

Then compute importance for sub-criteria C2. Then build a comparison matrix between five criteria in Table 16-18. Then combined matrix is in Table 19. Then normalize the pairwise comparison matrix into Table 20. Then obtain the total relation matrix in Table 21. The show importance of criteria in Table 22. Fig 3 Present the importance of criteria. The economics is the highest essential, and interaction customer & supplier is the lowest importance sub-criteria C2.

Table 16: Pairwise comparison matrix for main criteria by first decision makers.

	$C_{2.1}$	$C_{2.2}$	$C_{2.3}$	$C_{2.4}$	$C_{2.5}$	$C_{2.6}$	$C_{2.7}$	$C_{2.8}$
$C_{2.1}$	0.5	0.9	0.8167	0.283	0.9	0.8167	0.9	0.383
$C_{2.2}$	1.111111	0.5	0.383	0.9	0.9	0.383	0.8167	0.283
$C_{2.3}$	1.22444	2.610966	0.5	0.383	0.8167	0.283	0.283	0.8167
$C_{2.4}$	3.533569	1.111111	2.610966	0.5	0.383	0.9	0.383	0.9
$C_{2.5}$	1.111111	1.111111	1.22444	2.610966	0.5	0.8167	0.9	0.383
$C_{2.6}$	1.22444	2.610966	3.533569	1.111111	1.22444	0.5	0.8167	0.8167
$C_{2.7}$	1.111111	1.22444	3.533569	2.610966	1.111111	1.22444	0.5	0.9
$C_{2.8}$	2.610966	3.533569	1.22444	1.111111	2.610966	1.22444	1.111111	0.5

Table 17: Pairwise comparison matrix for main criteria by second decision makers.

	$C_{2.1}$	$C_{2.2}$	$C_{2.3}$	$C_{2.4}$	$C_{2.5}$	$C_{2.6}$	$C_{2.7}$	$C_{2.8}$
$C_{2.1}$	0.5	0.8167	0.9	0.383	0.283	0.9	0.8167	0.9
$C_{2.2}$	1.22444	0.5	0.8167	0.9	0.383	0.283	0.9	0.9
$C_{2.3}$	1.111111	1.22444	0.5	0.9	0.283	0.383	0.383	0.383
$C_{2.4}$	2.610966	1.111111	1.111111	0.5	0.8167	0.8167	0.283	0.283
$C_{2.5}$	3.533569	2.610966	3.533569	1.22444	0.5	0.9	0.8167	0.283

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$C_{2.6}$	1.111111	3.533569	2.610966	1.22444	1.111111	0.5	0.9	0.5
$C_{2.7}$	1.22444	1.111111	2.610966	3.533569	1.22444	1.111111	0.5	0.8167
$C_{2.8}$	1.111111	1.111111	2.610966	3.533569	3.533569	2	1.22444	0.5

Table 18: Pairwise comparison matrix for main criteria by third decision makers.

	$C_{2.1}$	$C_{2.2}$	$C_{2.3}$	$C_{2.4}$	$C_{2.5}$	$C_{2.6}$	$C_{2.7}$	$C_{2.8}$
$C_{2.1}$	0.5	0.8167	0.8167	0.9	0.8167	0.383	0.283	0.383
$C_{2.2}$	1.22444	0.5	0.9	0.383	0.283	0.9	0.9	0.9
$C_{2.3}$	1.22444	1.111111	0.5	0.283	0.9	0.283	0.283	0.8167
$C_{2.4}$	1.111111	2.610966	3.533569	0.5	0.283	0.8167	0.8167	0.283
$C_{2.5}$	1.22444	3.533569	1.111111	3.533569	0.5	0.383	0.383	0.9
$C_{2.6}$	2.610966	1.111111	3.533569	1.22444	2.610966	0.5	0.283	0.283
$C_{2.7}$	3.533569	1.111111	3.533569	1.22444	2.610966	3.533569	0.5	0.383
$C_{2.8}$	2.610966	1.111111	1.22444	3.533569	1.111111	3.533569	2.610966	0.5

Table 19: Combined pairwise comparison matrix for main criteria.

	$C_{2.1}$	$C_{2.2}$	$C_{2.3}$	$C_{2.4}$	$C_{2.5}$	$C_{2.6}$	$C_{2.7}$	$C_{2.8}$
$C_{2.1}$	0.5	0.844467	0.844467	0.522	0.666567	0.6999	0.666567	0.555333
$C_{2.2}$	1.186664	0.5	0.6999	0.727667	0.522	0.522	0.872233	0.694333
$C_{2.3}$	1.186664	1.648839	0.5	0.522	0.666567	0.316333	0.316333	0.672133
$C_{2.4}$	2.418549	1.611063	2.418549	0.5	0.494233	0.844467	0.494233	0.488667
$C_{2.5}$	1.956373	2.418549	1.956373	2.456325	0.5	0.6999	0.6999	0.522
$C_{2.6}$	1.648839	2.418549	3.226035	1.186664	1.648839	0.5	0.666567	0.533233
$C_{2.7}$	1.956373	1.148887	3.226035	2.456325	1.648839	1.956373	0.5	0.6999
$C_{2.8}$	2.111014	1.918597	1.686615	2.726083	2.418549	2.25267	1.648839	0.5

Table 20: Normalized combined pairwise comparison matrix for main criteria.

	$C_{2.1}$	$C_{2.2}$	$C_{2.3}$	$C_{2.4}$	$C_{2.5}$	$C_{2.6}$	$C_{2.7}$	$C_{2.8}$
$C_{2.1}$	0.03276	0.05533	0.05533	0.034202	0.043674	0.045858	0.043674	0.036386
$C_{2.2}$	0.077751	0.03276	0.045858	0.047677	0.034202	0.034202	0.057149	0.045493
$C_{2.3}$	0.077751	0.108033	0.03276	0.034202	0.043674	0.020726	0.020726	0.044039
$C_{2.4}$	0.158465	0.105558	0.158465	0.03276	0.032382	0.05533	0.032382	0.032018
$C_{2.5}$	0.128183	0.158465	0.128183	0.16094	0.03276	0.045858	0.045858	0.034202
$C_{2.6}$	0.108033	0.158465	0.211372	0.077751	0.108033	0.03276	0.043674	0.034938
$C_{2.7}$	0.128183	0.075276	0.211372	0.16094	0.108033	0.128183	0.03276	0.045858
$C_{2.8}$	0.138315	0.125708	0.110508	0.178615	0.158465	0.147596	0.108033	0.03276

Table 21: Total relation matrix for main criteria.

	$C_{2.1}$	$C_{2.2}$	$C_{2.3}$	$C_{2.4}$	$C_{2.5}$	$C_{2.6}$	$C_{2.7}$	$C_{2.8}$
$C_{2.1}$	0.116946	0.137426	0.14565	0.101158	0.09602	0.092616	0.08151	0.069066
$C_{2.2}$	0.167602	0.119989	0.144106	0.119664	0.091567	0.087115	0.098107	0.080541

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$C_{2.3}$	0.160977	0.186835	0.118405	0.100462	0.095069	0.068548	0.061936	0.077864
$C_{2.4}$	0.275982	0.224781	0.280038	0.12247	0.107738	0.120877	0.089189	0.083265
$C_{2.5}$	0.284311	0.304648	0.288345	0.269673	0.122797	0.129249	0.115942	0.096947
$C_{2.6}$	0.269668	0.317159	0.371347	0.199893	0.201413	0.117817	0.116939	0.101629
$C_{2.7}$	0.327445	0.276603	0.420476	0.305004	0.224695	0.229622	0.119075	0.123864
$C_{2.8}$	0.375164	0.357269	0.369918	0.357526	0.29617	0.272115	0.209784	0.123712

Table 22: Importance for sub criteria C1.

	Importance
$C_{2.1}$	-1.1377
$C_{2.2}$	-1.01602
$C_{2.3}$	-1.26819
$C_{2.4}$	-0.27151
$C_{2.5}$	0.376444
$C_{2.6}$	0.577905
$C_{2.7}$	1.134303
$C_{2.8}$	1.60477

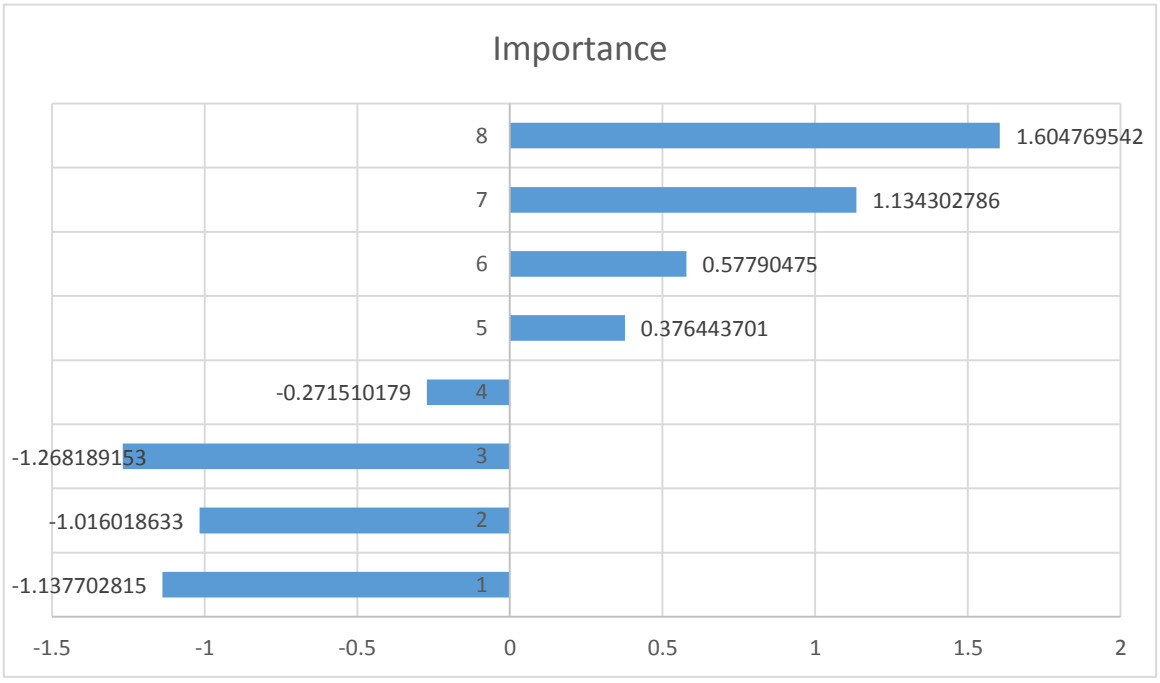

Figure 3: Importance of sub criteria c2.

In sub-criteria C3. The new media process is essential, and new media elements are the lowest importance sub-criteria C3. In sub-criteria C4. The business objectives are the highest importance, and business product & service is the lowest importance sub-criteria C4. . In sub-criteria C5. Finance & logistics is the highest essential, and business Training or sales is the lowest importance sub-criteria C5.

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4. Conclusions

We conclude in this paper a new problem is first solved under a neutrosophic environment. The DEMATEL method is integrated under a new media retrieval system in a neutrosophic environment: the five main criteria and twenty-two sub-criteria were collected from the literature review. Three experts evaluated criteria and sub-criteria.

Employ another MCDM method in a new media retrieval system and select a new scale for representing data in future work.

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