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A Comparative Study on Decision Making – Illustrations

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ABSTRACT: Choice making plays a really imperative part in today's lives. In spite of the fact that the arrangements are procured by applying accessible MCDM (Multi Criteria Decision Making) strategies, arrangements in this way gotten may be steady or inconsistent. T.L. Saaty as of now created a strategy to check the consistency. Despite that, Triantaphyllou recommends that, performing **Sensitivity analysis** makes strides the consistency of the arrangement. As a result, a strategy of MCDM entitled as **RSAWM** is presented in this study based on their recommendations. This paper is totally a comparative consider between two genuine life circumstances. In this think RSAWM (Revised Simple Additive Weighting Method) Strategy is connected to select best choice for two genuine life circumstances: 1. For the choice of best and superior computer framework among the three frameworks (**consistent case**) and 2. For the choice of a department of understudy for the choice of **ALLROUND EXCELLENCE Grant** from an Engineering College (**inconsistent case**). Later, sensitivity examination is connected to check the affectability by altering the weight of the criteria in three distinctive cases to confirm the alter within the choice gotten by RSAWM. It is obvious that the choices gotten for the circumstances are steady indeed after affectability investigation is connected.

Keywords: RSAWM, MCDM, consistency, sensitivity investigation, choice making.

Contents

1. Introduction

For an extended period of time, many professionals across various disciplines have struggled with the issue of using several criteria to select the best choice among all of the choices. T.L.Saaty proposed the **progressive strategy** for acquiring answers in 1980. As a result, AHP (Analytical Hierarchical Process) continues to be employed for challenges with multiple bases in a variety of contexts. AHP could be a ample easier, versatile component as well as one of the MCDM strategies. As a hierarchical hypothesis, it generates a progressive framework of objectives, options, as well as standard criteria's. The essential measurable data is constructed by depending on the comparison table created by T.L.Saaty. The results are taken as reliable managing an account on the ratio illustrated by him. P.T. Harker has portrayed the noteworthiness of AHP within the logical zone. Concurring to Triantaphyllou **sensitivity Examination** is an imperative course of action to move forward the consistency. Sensitivity investigation known as the process of observing changes within the results or comes about with the result of a few adjustments in the inputs. Present days the requisition of sensitivity examination has arrived spotlight. The most important

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aspect of sensitivity investigation in determining the most excellent choice for complex circumstances was examined by Triantaphyllou. He too examined a few strategies with suitable cases. Azizollah Memariani demonstrated his expertise in this regard with the case ponders. The facts of information and ideas/thoughts used in this work are drawn from. The goal of the current study is to provide the optimal method for selecting the best choice after a sensitivity procedure in a limited number of iterations. Supraja.S latest study describes the outcomes and process of using RSAWM to obtain a solution. This report presents the findings of an extension of the investigation conducted using three distinct criteria's.

2. Methodology

The consideration in this work is divided into two distinct sections, the first of which is the use of the **RSAW technique** to secure the arrangement (segment 2.1) at that point, furthermore performing **sensitivity examination** by changing weight of the criteria (area 2.2) to keep the track of changes within the arrangement . Be that as it may, the test information as well as criteria weights and choices gotten by AHP were examined in this paper.

2.1. RSAW Method Algorithm

STEP-1: Normalize the matrix by

$$\eta_{yz} = \frac{q_y}{\min e_{yz}} \times H \quad i = 1, 2, \ldots, u \text{ and } z = 1, 2, \ldots, v \quad (1)$$

Since $\sum_{k=1}^{v} \Omega_k = 1$.

STEP-2: Evaluate the priorities of each possible alternative by

$$J_y = \sum_{z=1}^{v} \eta_{yz} \Omega_z \quad (2)$$

The alternative with the greatest weight is ranked first.

2.2. Sensitivity Analysis

STEP-1: Consider Ω'_k is the altered weight of k^{th} criterion. Then

$$\Omega'_k = \frac{n+1}{n} \Omega_k \quad (3)$$

STEP 2: Accordingly the additional attributes alter their weights by

$$\Omega'_z = \frac{1 - \Omega'_k}{1 - \Omega_k} \Omega_z, \quad z = 1, 2, \ldots, v, z \neq k \quad (4)$$

where $n \neq 1, n = 2, 3, \ldots$ such that $\sum_{k=1}^{v} \Omega'_k = 1$.

STEP-3: Step 2 of Section 2.1 should be repeated with new weights. The alternative with the greatest weight is ranked first.

3. Illustrations

Two real life circumstances are considered for the test evaluation. They are portrayed in 3.1 & 3.2.

3.1. Illustration-1:

Let us consider a hypothetical situation in which one needs to advance a **computer framework** in a computer fabricating workplace. Several framework arrangements may be available to make a decision. Our choice to make a choice that can take into account a number of additional factors such as price/cost, execution, programme, **expandability**, **upkeep** and so on. At that moment, these elements will also be used an important criteria to make a choice. In this particular circumstance, we must identify the most best alternative. But, in a certain circumstance, one may need to know the relative relevance of all accessible options for example, when it comes to financing a group of fighting ventures, acknowledging their relative significance gets to be inescapable. When it comes to selecting the leading and best computers, there were arrangements at first as **A**, including **B**, and as well as **C** are all available. Furthermore, equipment expansible nature is one of the selection factors at that moment, as A is far superior to B, at the same time it is extensively superior to C.

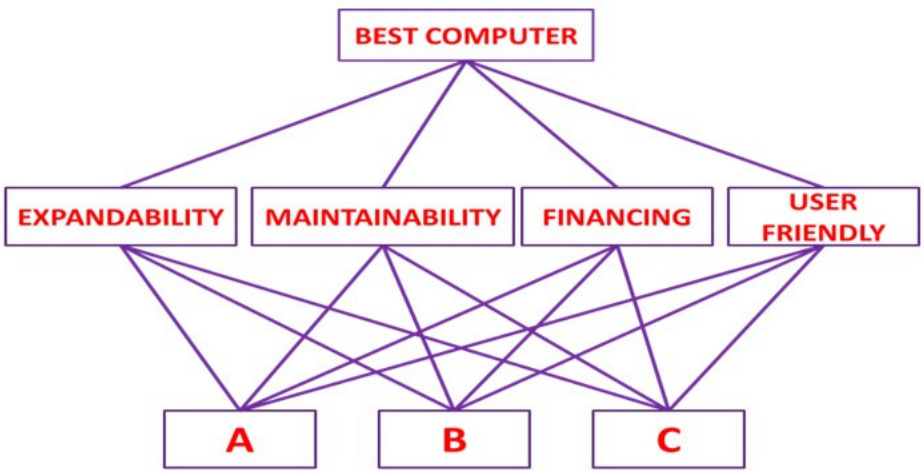

Figure 1: Hierarchical Structure

3.1.1. **Alternative Ranks by the RSAWM.** The placements of the options in Table 1 are obtained by applying section 2.1.

Table 1: Ranks of the alternatives

Alternatives	**Criteria**				**PV**	**RANK**
	$\mathbf{G_1}$	$\mathbf{G_2}$	$\mathbf{G_3}$	$\mathbf{G_4}$		
	0.553	0.131	0.271	0.045		
A	0.116	0.089	0.058	0.011	0.273	1
B	0.022	0.017	0.030	0.003	0.072	3
C	0.105	0.002	0.018	0.002	0.128	2

3.1.2. Changing the Weight of Criteria (Illustration-1). Some analysts can choose the criteria with the highest rank as basic, while others may choose the criteria with the most reduced ranking as basic. Within this area, the highest positioned weight Criteria is $\mathbf{G_1}$, criteria taken at random $\mathbf{G_2}$, and the least positioned $\mathbf{G_4}$ were changed in this region by applying section 2.2. Tables 2,3,4 show the order of priority values for the choices in the three scenarios.

Table 2: Rank of Alternatives (Highest ranked Criteria)

Alternatives	Criteria				PV	RANK
	G_1	G_2	G_3	G_4		
	0.691	0.090	0.187	0.031		
A	0.145	0.061	0.040	0.007	0.253	1
B	0.027	0.012	0.021	0.002	0.062	3
C	0.131	0.002	0.013	0.002	0.147	2

Highest Ranked Criteria (Altering $\mathbf{G_1}$).

Table 3: Rank of the Alternatives (Criteria at Random)

Alternatives	Criteria				PV	RANK
	G_1	G_2	G_3	G_4		
	0.532	0.163	0.260	0.043		
A	0.112	0.111	0.055	0.010	0.288	1
B	0.021	0.021	0.029	0.003	0.074	3
C	0.101	0.003	0.018	0.002	0.124	2

Criteria at Random (Altering $\mathbf{G_2}$).

Table 4: Rank of the Alternatives (Lowest ranked Criteria)

Alternatives	Criteria				PV	RANK
	G_1	G_2	G_3	G_4		
	0.546	0.129	0.267	0.056		
A	0.115	0.088	0.057	0.013	0.272	1
B	0.022	0.017	0.029	0.004	0.072	3
C	0.104	0.002	0.018	0.003	0.127	2

Lowest Ranked Criteria (Altering $\mathbf{G_4}$).

3.2. Illustration-2: Inconsistent Case (All Round Excellence Award)

Assume the issue of picking a department of understudy for an **All ROUND EXCELLENCE AWARD** in an Engineering institution. As possibilities, the many branches available are considered to choices. Additionally, there are several attributes from which to choose as criteria such as to select among them to be to be specific: **scholastics**, **participation**, **curricular**, **extracurricular** and so on. The aforementioned criteria are considered a major portion when making a choice. Also, imagine that there are **sub-criteria** beneath the seven primary criteria. Some of the illustration on the off chance that we consider extracurricular criteria, which contain two sub-conditions, for example, **choreography** and **singing**. First, suppose that, in comparison to the understudies of **CSE** department, the **ECE** are more energetic in the classroom and during extracurricular activities. The understudy from the **EIE** also participates in sports less than the **Mechanical** department.

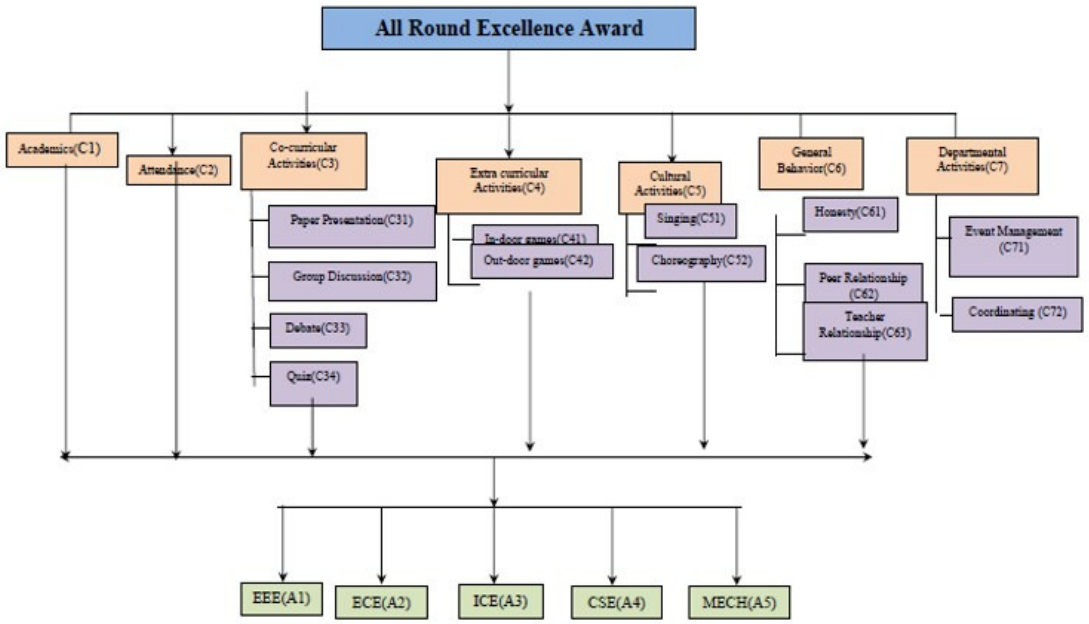

Figure 2: Hierarchical decomposition of criteria, sub criteria and alternatives

Table 1: Rank of the Alternatives (Illustration-2)

Alt.	G_1	G_2	G_3	G_4	G_5	G_6	G_7	G_8	G_9	G_{10}	G_{11}	G_{12}	G_{13}	G_{14}	G_{15}	SUM	RANK
	0.32	0.04	0.20	0.20	0.20	0.50	0.50	0.50	0.50	0.50	0.33	0.33	0.33	0.50	0.50		
H_1	0.03	0.01	0.02	0.02	0.02	0.03	0.08	0.06	0.04	0.06	0.03	0.04	0.03	0.05	0.04	0.55	2
H_2	0.01	0.00	0.01	0.01	0.01	0.01	0.11	0.12	0.08	0.05	0.02	0.03	0.02	0.03	0.05	0.58	1
H_3	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.06	5
H_4	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.11	3
H_5	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.08	4

3.2.1. Alternatives ranks by RSAWM.

3.2.2. Modifying the criteria weights (Illustration-2). The options obtained by adjusting the criteria weights in each of the three scenarios are arranged according to their respective positions in Tables 2, 3, and 4.

Table 2 : Highest Rank Attribute Weight Change Choices

Alt.	G_1	G_2	G_3	G_4	G_5	G_6	G_7	G_8	G_9	G_{10}	G_{11}	G_{12}	G_{13}	G_{14}	G_{15}	SUM	RANK
	0.47	0.03	0.15	0.15	0.15	0.15	0.38	0.38	0.38	0.38	0.25	0.25	0.25	0.38	0.38		
H_1	0.04	0.01	0.02	0.02	0.02	0.02	0.06	0.05	0.03	0.05	0.02	0.03	0.02	0.04	0.03	0.44	2
H_2	0.02	0.00	0.01	0.01	0.01	0.01	0.08	0.09	0.07	0.04	0.02	0.02	0.02	0.03	0.04	0.45	1
H_3	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.05	5
H_4	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.09	3
H_5	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.07	4

Highest ranked Criteria.

Table 3 : Random Attribute Weight Change Choices

Alt.	G_1	G_2	G_3	G_4	G_5	G_6	G_7	G_8	G_9	G_{10}	G_{11}	G_{12}	G_{13}	G_{14}	G_{15}	SUM	RANK
	0.16	0.02	0.10	0.10	0.10	0.10	0.75	0.25	0.25	0.25	0.17	0.17	0.17	0.25	0.25		
H_1	0.01	0.00	0.01	0.01	0.01	0.01	0.12	0.03	0.02	0.03	0.01	0.02	0.01	0.02	0.02	0.35	2
H_2	0.01	0.00	0.01	0.01	0.01	0.01	0.16	0.06	0.04	0.03	0.01	0.02	0.01	0.02	0.02	0.39	1
H_3	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	5
H_4	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.07	3
H_5	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.04	4

Criteria assigned at Random.

Table 4 : Least Rank Attribute Weight Change Choices

Alt.	G_1	G_2	G_3	G_4	G_5	G_6	G_7	G_8	G_9	G_{10}	G_{11}	G_{12}	G_{13}	G_{14}	G_{15}	SUM	RANK
	0.31	0.06	0.20	0.20	0.20	0.20	0.49	0.49	0.49	0.49	0.32	0.32	0.32	0.49	0.49		
H_1	0.02	0.01	0.02	0.02	0.02	0.02	0.08	0.06	0.04	0.06	0.03	0.04	0.03	0.05	0.04	0.54	2
H_2	0.01	0.00	0.01	0.01	0.01	0.01	0.10	0.12	0.08	0.05	0.02	0.03	0.02	0.03	0.05	0.57	1
H_3	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.06	5
H_4	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.12	3
H_5	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.08	4

Criteria of least rank.

4. Conclusions

It is evident from the above comparative study between the two circumstances the decisions attained by RSAWM is remained unchanged with respect to the alter weights of criteria in three ways. Finally, optional **A** is considered as the leading choice in order to the circumstance under consideration and **ECE** department understudies were qualified to obtain grant for the taken circumstance for both the taken situations correspondingly. Hence from the above study it is concluded that the given methodology yields **steady** (i.e., the consistency of their proportion is less than 0.1), decisions for both Consistent and inconsistent cases.

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