Multi-Criteria Site Selection for Municipal Solid Waste Disposal by Integrating DEMATEL and AHP Methods

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***Abstract*—The sanitary landfill has been recognized as the cheapest form of disposing the Municipal Solid Waste (MSW) and also been commonly adopted by every country in the world. However, selecting a suitable Landfill Disposal Sites (LDS) is an extremely complex task mainly due to the fact that the identification and selection process involves many factors and strict regulations. For proper identification and selection of suitable LDS needs very careful and systematic procedures. Wrong sitting may result to environmental degradation and other consequences often lead to public opposition. As the existing LDS has reached its saturation point, the Corporation of Chennai (CoC) is searching for alternate sites for disposing of its MSW for current and future needs. Since, the present method of selection of LDS lack practical applications, the authors made an attempt to develop a Multi Criteria Site Selection for MSW Disposal by Integrating Decision Making Trial and Evaluation Laboratory (DEMATEL) and Analytic Hierarchy Process (AHP) method. The proposed hybrid method is superior to existing methods since it has the capability of representing qualitative data and presenting all possible results with different degrees of priority. The end results also shows that the integrated approach of DEMATRL and AHP method is more precious than that of the individual approach.**

Keywords*—Municipal Solid Waste; Corporation of Chennai; Delphi Technique; Decision-Making Trial and Evaluation Laboratory; Analytic Hierarchy Process.

I INTRODUCTION

India generates about 1,33,760 Metric Tones Per Day (TPD) of MSW (MoEF Report). According to the definition from U.S. Environmental Protection Agency (EPA) MSW is composted by everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. Due to increase in population, urbanization, change in life style and consumption pattern, the Municipal Solid Waste Management (MSWM) in urban areas are become a tenacious problem for the waste managers[1]. The arising of MSW in Chennai, the fourth largest metropolitan city in India, has increased from 600 to 4500 TPD during the last 20 years [2]. Urban MSW is considered as one of the burning and serious environmental problems confronting for municipal authorities. As the existing two LDS of CMA namely Kodungaiyur and Perungudi have reached their saturation point, the Corporation of Chennai (CoC) is searching for alternate sites for disposing of its MSW for current as well as future needs. Sanitary LDS selection needs to address not only the technical issues but also the political, legal, economic, environmental, geological, hydrological as well as socio-economic, socio-political and socio-cultural factors[3]. Choosing the appropriate LDS for MSW has already become a hot point for the decision-maker. This paper applies an effective solution based on an integrated DEMATEL and AHP method[4,5] to assist the expert group for evaluating LDS selection for CMA, since the degree of influence each criterion may differ, depending on the various ecological conditions. The hybrid model of integrated DEMATEL and AHP in combination with Decision Delphi has been found to be a powerful tool to solve the LDS selection problem, since the Decision Delphi Technique will help to converge the criteria and DEMATEL will prioritize the criteria and finally AHP will rank the potential LDS[6].

II LITERATURE REVIEW

An extensive review literature on site-selection process shows that a number of researchers used the Geographical Information System (GIS) to deal with the LDS selection process[7,8]. Identifying the LDS for urban solid waste disposal made easy by using GIS and Remote Sensing(RS) techniques[9]. The article gives the detailed account of optimizing the sitting technique for MSW landfills and its management issues. The assessment of the resident's satisfaction level in MSW system gives more insight to researchers dealing with LDS site selection[10,11]. Selection of LDS for MSW can be treated as one of the Multiple Criteria Decision Making (MCDM) problem, which requires the consideration of a large number of complex criteria[12]. As such the researchers approached this issue by adopting the multi-cretiria technique to improve the selection process [13,14]. A beefy MCDM method needs numerous factors and the RAND Delphi Technique correlate judgments on a topic spanning a wide range of disciplines which aims to achieve a convergence of opinion on a specific real-world issue[15]. A robust MCDM method needs to consider the interactions among the influencing criteria and DEMATEL is one such tool which can evaluate such interaction among the influencing factors[16]. DEMATEL will not only convert the relations between cause and effect of criteria into a structural model, but also can be used as a way to handle the inner dependencies within a set of criteria[17]. AHP is another relatively robust MCDM method which can be dealt with all kinds of interactions systematically by decomposing the complex decision making problem into a much simpler one by using the paired comparisons to weigh the criteria based on hierarchical structure which provides easiness during decision making[18]. Notably, the AHP method has the advantages of yielding more precise results and verifying consistency of judgments[19]. In the current research work the authors made an attempt to combine all these three methods for LDS selection process to get better solution. The impact of the landfill leachete on ground water is a serious issues and several research papers addressed this issue [20, 21, 22].

III STUDY AREA

Greater Chennai is city of Indian state Tamil Nadu located on the eastern coast (Latitude 13º 07’ N and Longitude 80º 16’ E). The total area of Greater Chennai city is 174 square kilometer. Presently the CMA covers the CoC and 16 other adjourning local bodies of Municipalities, Town Panchayats and Panchayat Unions. The present population of Greater Chennai City is 6.5 millions and it has been estimated that each individual is generating 700 grams of solid wastes per day. It has been estimated that 4500 TPD of solid waste generated in CMA, which are currently disposed in two LDS viz. Kodungaiyur and Perungudi only. As the existing two LDS have reached their saturation point, the CoC is searching for alternate sites for disposing its MSW for current and future needs. The proposed LDS should adopt a multi-technology approach to deal with different waste streams of MSW as listed below:

- Biological Treatment (BT)- including composting and anaerobic digestion which would treat source-separated biodegradable materials such as food waste;
- Mechanical-Biological Treatment (MBT) - comprising mechanical and biological processes which recover recyclable materials and treat biodegradable fraction from mixed waste;
- Thermal Treatment – incinerating the unavoidable mixed waste not handled by biological treatment or MBT and recovering the energy contained

IV RESEARCH DESIGN

LDS selection is a difficult, complex, tedious, and protracted process requiring evaluation of many different criteria since it has to combine social, environmental, technical, and financial factors. Economic factors must be considered in the sitting of landfills, which include the costs associated with the acquisition, development, and operation of the site. Social and political opposition to landfill sitting have been identified as the greatest obstacle for successfully locating the LDS. The “not in my backyard” (NIMBY) and “not in anyone’s backyard” (NIABY) syndrome are becoming a common attitude and creating a tremendous pressure on the decision makers involved in the selection of a LDS. In the first phase literature survey and interview are used for collecting the basic theoretical and practical information. The article demonstrate that how the integration of two or more methods can produce better results than using only one method of site selection[23]. The collected data are presented to an Expert Committee (EC) comprising of 4 academicians, 2 volunteers from NGO, each one MSW planners from TNPCB, CoC and private conservancy firm contracted by the CoC. In the next phase Delphi Technique has been applied to identify the influential factors on site selection of LDS for the MSW. In the third phase DEMATEL method has been utilized to prioritize the influential factors. In the fourth phase AHP has been applied with 6 fictitious LDS for the shortlisted factors are par wise compared with the Global weights as well as with the Prioritized factors obtained through the DEMATEL. The consistency of the result is verified by sensitivity analysis. The overall Site Selection Process involves three step procedures:

- Establishing of selection criteria by Delphi Technique.
- Prioritization of selection criteria by DEMATEL and
- Evaluation of weight of criteria and ranking of site selection by AHP.

A. Hybrid DELHI, DEMATEL and AHP

Research design used in this study using a hybrid Decision Delphi, DEMATEL and AHP methods. The LDS selection process has been structured into three main phases as depicted in Fig. 1. The first is the input stage, where in Factors and Criteria for LDS selection will be established by Decision Delphi. In the next stage Factors and Criteria will be prioritized through DEMATEL method. In the third stage weighting the criteria by AHP and rank the sites.

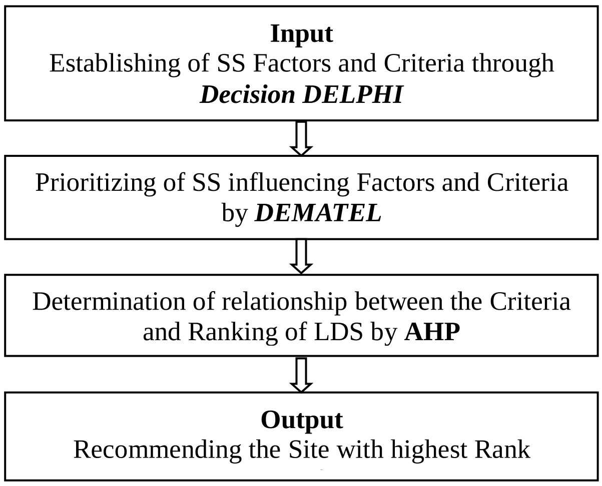

Fig. 1. Research Design of Hybrid DEMATEL and AHP

B. Establishment of Factors and Criteria

The RAND Decision Delphi technique is an important data collection methodology with a wide variety of applications[6]. The EC members are immersed and imbedded in the topic of interest and can provide real-time and real-world knowledge within their domain of expertise. Delphi technique is well suited for consensus-building by multiple iterations on selected data and provides structured alternative anecdotal approach. Firstly factors and criteria obtained from the literature review were presented to the EC to apply the Decision Delphi technique.

Round 1: The Decision Delphi process traditionally began with an open-ended questionnaire, which served as the cornerstone of soliciting specific information about MSW subjects. The first round was started with 72 criteria under nine factors. After the completion of first round, some criteria which were regarded as unimportant excluded from the list.

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Round 2: During the second round the areas of disagreement and agreement are identified. The second round starts with 7 factors and 59 criteria, and at the end 11 more criteria which were associated with none of the factors were excluded from the list.

Round 3: In the third and last round, experts came to an agreement on the factors and criteria. More specifically 6 factors and 40 criteria associated with the LDS selection for MSW collected from CMA are determined and depicted in Table I.

TABLE I, ESTABLISHMENT OF FACTORS AND CRITERIA

Sl.No.	Factors	F-Code	Criteria	C-Code
1.	Receptor	F_1	Site capacity	F_1C_1
			Technical and operational	F_1C_2
			Lateral expansion	F_1C_3
			Type of approach road	F_1C_4
			Traffic nuisance	F_1C_5
2.	Distance	F_2	From waste generating zone.	F_2C_1
			Nearest residential locality	F_2C_2
			Nearest drinking water sources	F_2C_3
			Nearest public utility facility	F_2C_4
			Nearest religious sites	F_2C_6
			Nearest archaeological sites	F_2C_7
			Nearest coastal precinct	F_2C_8
3.	Environment	F_3	Odor, dust and noise nuisance	F_3C_1
			Threat to ecology	F_3C_2
			Risk of leachete leaking	F_3C_3
			Risk of explosive gases	F_3C_4
			Weather and Climate	F_3C_5
			Threat to Flora and Fauna	F_3C_6
			Risk to contiguous area	F_3C_8
			Vector vulnerability	F_3C_9
			Spoil of vicinities air quality	F_3C_{10}
			Fire hazard and wind path	F_3C_{11}
4.	Hydrology and hydrogeology	F_4	Ground water contamination	F_4C_1
			Wetlands	F_4C_2
			Floodplains	F_4C_3
			Soil permeability	F_4C_4
			Soil erosion risk	F_4C_5
			Slope pattern	F_4C_6
			Geomorphology	F_4C_7
			Topography	F_4C_8
5.	Social, Legal and Political	F_5	Vicinity's aesthetics	F_5C_1
			Public tolerability	F_5C_2
			Agreement with pressure group	F_5C_3
			Synchronize with local bodies	F_5C_4
			Concord with UNEP	F_5C_5
			Compliance to EPA 1986.	F_5C_6
6.	Financial	F_6	Land cost	F_6C_1
			Transportation costs	F_6C_2
			Operation and maintenance	F_6C_3
			Cost for after care	F_6C_4

C. Priororitzion of Factors and Criteria

The DEMATEL method has been applied in 8 steps procedure as shown as Fig.2, formulating Direct Answer Matrix, Original Average Matrix, Normalizing the Direct Influence Matrix, Deriving the Total Relation Matrix and deciding threshold value to get the Cause and Effect Relationship diagram [16]. The Direct Answer Matrix for each dimensions are to be constructed by the scores awarded by 'm' Decision Makers (DM) with 'n' factors. The degree to which the DM perceived factor 'i' affects on factor "j" is denoted by a^k_{ij}. The integer score of '0' to '4' is assigned for each pairs as per the values given in the Table II.

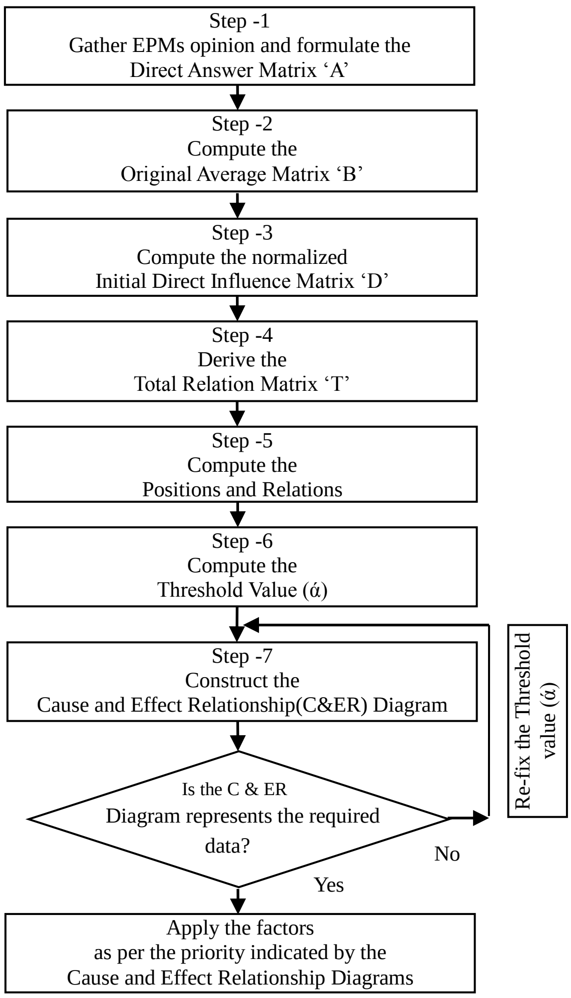

Fig. 2 DEMATEL application procedure

TABLE II, SCORE FOR PAIR WISE COMPARISONS [16].

Sl.No.	Degree of influence	Score
1.	No influence	0
2.	Low influence	1
3.	Medium influence	2
4.	High influence	3
5.	Very high influence	4

The sum of rows and the sum of columns of the total relation matrix 'T' are denoted as vector 'r' and vector 'c'. The sum (r_i+c_j) gives an index called the 'Position' representing the total effects both given and received by the

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i^{th} factor, ie, (r_i+c_j) shows the degree of importance that the i^{th} factor plays in the system (total sum of effects given and received). The difference (r_i-c_j) gives an index called the 'Relation' shows the net effect, the i^{th} factor contributes to the system. If (r_i-c_j) is positive, then i^{th} factor is a 'net causer' and if (r_i-c_j) is negative, then i^{th} factor is a 'net receiver'. The Cause and Effect Relationship diagram is constructed by mapping all coordinate sets of $(r_i+c_j,\ r_i-c_j)$ to judge the significant factors and their influence on other factors.

D. Ranking of Factors and Criteria.

Principle of Decomposition, Principle of Comparative Judgment and Principle of Synthesis of Priorities are the three basic principles of AHP. In this article AHP is applied in nine steps as follows[19]:-

Step 1: Set-up Hierarchy: The basic linear hierarchical structure shown in Fig.3 is a top down approach consisting of Goal (Level-1), Criteria (Level-2) and Alternatives (Level-3).

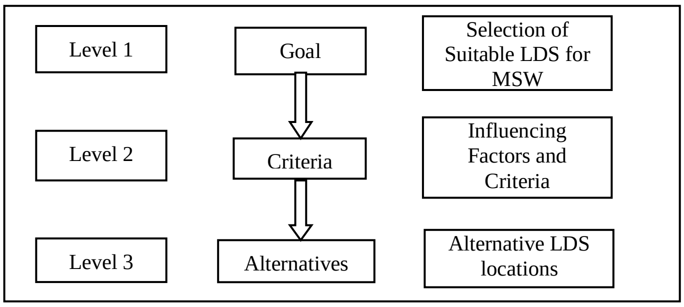

Fig. 3, Model Linear Hierarchy of "AHP"

In this current research the 'Goal' is to select an alternative LDS for CMA by pair-wise comparison with Factor/Criteria shown in Fig. 4.

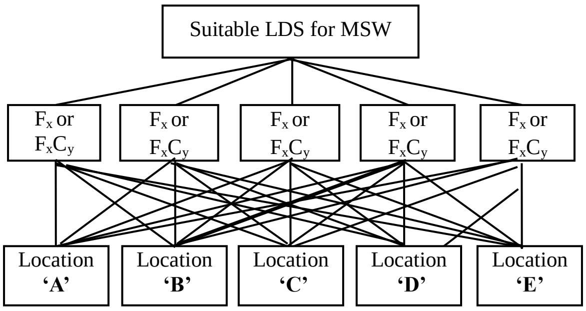

Fig. 4, The Proposed Hierarchy Structure of "AHP"

Step 2: Compare Criteria: The pair-wise comparison elements of one level with another level in their strength of influence are made by collecting the data through survey conducted in MTC. The pair wise comparisons are rated by nine point Saaty's scales for pair wise comparisons[18] as given in Table III.

TABLE III, THE SAATY'S SCALE [18].

Comparison Judgments	Numerical value
Equally preferred	1
Moderately preferred	3
Strongly preferred	5
Very strongly preferred	7
Extremely preferred	9
Intermediate values	2,4,6 8
Reciprocals for inverse comparisons	

Let C_1,.., C_n are elements of some level in a hierarchy and w_1,…, w_n, are weights of influence on some elements in the next level to be found. The elements of the matrix are selected representing judgment of pair-wise comparisons. If "a_{ij}" is the element of row "i" and column "j" of the matrix, then "$1/a_{ij}$" is the element of row "j" and column "i" of the matrix. ie "$a_{ji}=1/a_{ij}$". If the element "a_{ij}" indicate the strength of "C_1" when compared with "C_j". This matrix is denoted by matrix "A". When "$a_{ji}=1/a_{ij}$", matrix "A" becomes reciprocal. If judgment is perfect in all comparisons, then "$a_{ik} = a_{ij*} a_{jk}$"., for all i,j,k and the matrix "A" becomes consistent. The matrix "A" has been shown as Fig. 5.

$$\begin{array}{c} \\ C_1 \\ C_2 \\ \vdots \\ C_n \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{pmatrix} \frac{w_1}{w_1}=a_{11} & \frac{w_1}{w_2}=a_{12} & \cdots & \frac{w_1}{w_n}=a_{1n} \\ \frac{w_2}{w_1}=a_{21} & \frac{w_2}{w_2}=a_{22} & \cdots & \frac{w_2}{w_n}=a_{2n} \\ \vdots & \vdots & & \vdots \\ \frac{w_n}{w_1}=a_{n1} & \frac{w_n}{w_2}=a_{n2} & \cdots & \frac{w_n}{w_n}=a_{nn} \end{pmatrix} \end{array}$$

Fig. 5, Comparison Reciprocal Matrix

Step 3: Priority Vector for Criteria: The pair-wise comparison reciprocal matrix is obtained by:-

i. Sum the values in each column of the pair-wise comparison reciprocal matrix.
ii. Divide each value by the corresponding column sum to get the "Normalized Matrix".
iii. Average the values in each row of the normalized matrix and compute the "Priority Vector".

Step 4: Compare Alternatives: Repeat the step "i" to "iii" for each alternatives.

Step 5: Priority Vector for Alternatives: Compute the overall score for each decision alternatives.

Step 6: Overall Priority Vector: Rank the decision alternatives, according to the magnitude.

Step 7: Consistency Index: $CI=(\lambda_{max} - n)/(n-1)$, where, λ_{max} is the Principal Eigen value and "n" is the order of the matrix.

Step 8: Consistency Ratio: CR = CI/RI, where RI is the Random Index as given in Table V.

TABLE V, VALUES FOR RANDOM INDEX [18].

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Step 9: Check for Consistency: If $0 \leq CR \leq 0.1$, then the judgment is perfectly consistent and the criteria/alternative can be accepted and if CR>0.1, the judgment is inconsistent and untrustworthy. Hence it need to revise the subjective judgment.

V. AN ILLUSTRATIVE CASE APPLICATION

The proposed hybrid model is demonstrated with the help of 6 conjured LDS to show that how suitable sites could be identified and ranked by the combination of DEMATEL and AHP methods. MS-Excel spread sheet has been used for all numerical calculations throughout this research work. This proposed technique allowed for an often qualitative assessment of site selection to be replaced by a more quantitative, informed and unbiased method.

A. Applying DEMATEL on six Factors

Each Expert Committee members performed the pair-wise comparisons of 6 Factors and hence nine Direct Answer Matrix are formulated as per the Step-1 of Fig.2. and Original Average Matrix 'B' has been computed as per Step-2. The Normalized Initial Direct Influence Matrix 'D' has been computed by as per Step-3 and Total Relation Matrix 'T' has been computed as per Step-4 and presented in Table VI, VII and VIII.

TABLE VI, POSITIONS AND RELATIONS AMONG FACTORS.

	F_1	F_2	F_3	F_4	F_5	F_6	r_i	c_j	$r_i + c_j$	$r_i - c_j$
F_1	1.18	1.29	1.33	1.24	1.14	1.34	7.52	8.77	16.29	-1.25
F_2	1.24	1.31	1.27	1.34	1.19	1.42	7.77	8.69	16.46	-0.92
F_3	1.69	1.73	1.81	1.75	1.83	1.74	10.55	8.92	19.47	1.63
F_4	1.73	1.68	1.96	1.67	1.51	1.57	10.12	8.51	18.63	1.61
F_5	1.64	1.56	1.34	1.37	1.49	1.64	9.04	8.29	17.33	0.75
F_6	1.29	1.12	1.21	1.14	1.13	1.14	7.03	8.85	15.88	-1.82

The Cause and Effect Relationship (CER) among the six factors are constructed and shown in Fig.6.

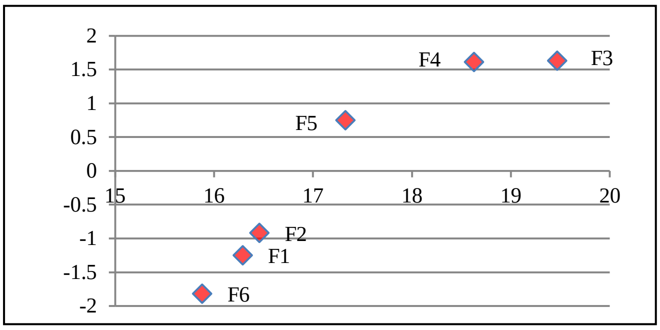

Fig. 6, Cause and Effect Relationship among the Six Factors

B. Applying AHP to rank the sites

The AHP has been applied on the six factors and the Expert Committee members are acted upon the role of Decision Makers (DM). Since AHP technique can be applied using different methods i.e. Eigen Vector/Value Method, Geometric Mean Method and Arithmetic Mean Method. In this current research work Geometric Mean Method has applied and MS-Excel spread sheet was used for arithmetic calculations.

TABLE VII, PREFERENCE (PAIR-WISE COMPARISON) NORMALIZED MATRIX FOR FACTORS BY SINGLE DM

Factors	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**Sum**	**Priority Vector**
F1	0.08	0.07	0.09	0.06	0.07	0.09	0.46	0.08
F2	0.08	0.07	0.09	0.06	0.05	0.18	0.53	0.09
F3	0.31	0.30	0.35	0.39	0.39	0.27	2.01	0.34
F4	0.23	0.22	0.18	0.19	0.20	0.18	1.20	0.20
F5	0.23	0.30	0.18	0.19	0.20	0.18	1.28	0.21
F6	0.08	0.04	0.12	0.10	0.10	0.09	0.52	0.09
			Principal eign value λmax=				**6.21**	
			Consistency index (I)				0.04	
			Consistency Ratio (CR)				0.03 < 0.1	

TABLE VIII, PREFERENCE (PAIR-WISE COMPARISON) NORMALIZED MATRIX FOR FACTORS BY DM GROUP

Factors	**F_1**	**F_2**	**F_3**	**F_4**	**F_5**	**F_6**	**Sum**	**Priority Vector**
F_1	0.06	0.03	0.08	0.06	0.05	0.08	0.36	0.07
F_2	0.13	0.06	0.06	0.04	0.04	0.17	0.50	0.08
F_3	0.31	0.38	0.38	0.45	0.33	0.33	2.18	0.32
F_4	0.25	0.19	0.19	0.22	0.33	0.17	1.35	0.25
F_5	0.19	0.31	0.19	0.11	0.16	0.17	1.13	0.221
F_6	0.06	0.03	0.10	0.11	0.08	0.08	0.47	0.09
			Principal eign value λ_{max}=				6.35	
			Consistency index (I)				0.07	
			Consistency Ratio (CR)				0.06 < 0.1	

Initially the ranking of LDS was formulated by applying the global weight obtained from AHP and results are presented in Table IX.

TABLE IX, RANKING OF LDS BY AHP GLOBAL WEIGHT

	F_1	F_2	F_3	F_4	F_5	F_6	AHP Global Weight	Priority Vector
Site A	0.09	0.07	0.06	0.08	0.06	0.06	0.08	06.79%
Site B	0.14	0.15	0.18	0.16	0.17	0.17	0.09	16.70%
Site C	0.26	0.26	0.24	0.31	0.22	0.25	0.34	25.52%
Site D	0.19	0.14	0.20	0.15	0.19	0.10	0.20	17.43%
Site E	0.22	0.18	0.20	0.23	0.26	0.28	0.21	22.42%
Site F	0.10	0.21	0.11	0.07	0.10	0.14	0.09	11.14%

Next the CER computed from the DEMATEL has been synthesized and applied to AHP as global weight to rank the LDS. The results are presented in Table X.

TABLE X, RANKING OF LDS BY DEMATEL GLOBAL WEIGHT

	F_1	F_2	F_3	F_4	F_5	F_6	DEMATEL Global Weight	Priority Vector
Site A	0.09	0.07	0.06	0.08	0.06	0.06	0.05	06.47%
Site B	0.14	0.15	0.18	0.16	0.17	0.17	0.06	16.30%
Site C	0.26	0.26	0.24	0.31	0.22	0.25	0.37	25.98%
Site D	0.19	0.14	0.20	0.15	0.19	0.10	0.21	18.01%
Site E	0.22	0.18	0.20	0.23	0.26	0.28	0.23	23.23%
Site F	0.10	0.21	0.11	0.07	0.10	0.14	0.08	10.01%

The comparative analysis among the six locations chosen for the study to select the best suitable LDS as per the local conditions has been depicted in Table XI.

TABLE XI, FINAL RANKING OF LDS

	AHP	DAHP	Rank
Site A	06.79%	06.47%	VI
Site B	16.70%	16.30%	IV
Site C	25.52%	25.98%	I
Site D	17.43%	18.01%	III
Site E	22.42%	23.23%	II
Site F	11.14%	10.01%	V

The results are also been presented graphically as bar chart in Fig. 7.

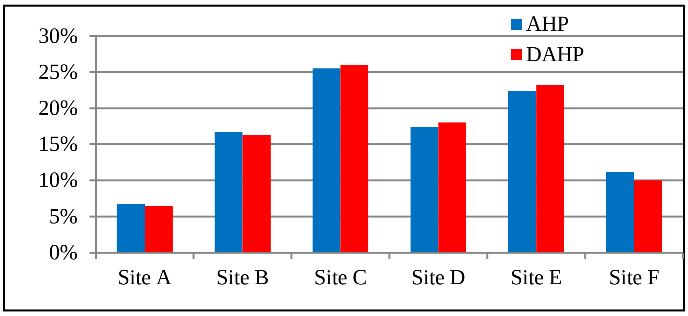

Fig. 7, Final Ranking of LDS

VI RESULTS AND DISCUSSION

A. Prioritization of factors by DEMATEL

The analysis of Total Relation Matrix depicted as Table VI and CER diagram given in Fig.6 shows that Environmental Factor (F_3) is the most important factor having the largest (r+c) value ie. 19.47, whereas Financial Factor (F_6) is least important factor having the smallest (r+c) value ie. 15.88. According to the degree of significance, the magnitude of the factors are recognized as $F_3>F_4>F_5>F_2>F_1>F_6$. And also the (r-c) values helps to classify the factors into:- (1) Cause Group and (2) Effect Group.

1) Cause Group Factors

Factors with positive (r-c) value are classified as 'Net Causer' or 'Cause Group' which directly affects other factors and their degree of impact are proportionate to their numerical values. The CER diagram shown as Fig.6, reveals that, Environmental Factor (F_3), Hydrology and Hydrogeology Factor (F_4), Social, Legal and Political Factors (F_5) are fall into the Cause Group, since their (r-c) values are 1.63, 1.61 and 0.75.

2) Effect Group

Factors with negative (r-c) value are classified as 'Net Receiver' or 'Effect Group' and largely influenced by other factors. Accordingly Transport Factor (F_2), Receptor Factor (F_1) and Financial Factor (F_6) are fall into the Effect Group, since their (r-c) values are -0.92, -1.25 and-1.82.

B. Ranking of sites by AHP

Ranking of sites by AHP has been worked out separately with global weight obtained from AHP method as well the DEMATEL method. The end results of both the methods agree that Site 'C' is most preferred and Site 'A' is least preferred. The order of preference is Site 'C' > Site 'E' > Site 'D > Site 'B' > Site 'A'.

VII CONCLUSIONS

This paper presents a hybrid model of MCDM approach by integrating DEMATEL and AHP to identify the most suitable site for disposing of MSW from Greater Chennai Metropolitan Area. The study was based upon a set of factors and key criteria, which were selected based upon the already available knowledge from research literature as well as the pre-existing local level factors of the area. Even though the basic factors to be assessed for LDS are universally the same, different area may have different sets of local conditions. The uniqueness of the current study stems from the fact that the Environmental Factors were consider as the crucial governing factors for selection of suitable LDS for MSW. Even though the AHP method and the integrated DEAMTEL and AHP methods are yielding to the identical results, the integrated approach converged into more precisely distinguished the goals. This helps the waste planners from pitfall of selecting a wrong LDS which follows very close to the best one with marginal difference. The superiority of the proposed integrated MCDM method stems from its inherent flexibility in its application to dissimilar sites with diverse local conditions[24].

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