APPRAISING VALUE OF MATERIAL PROVIDER'S ORGANIZATION UNDER GREY-REFERENCE POINT APPROACH

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ABSTRACT:

Utilization of grey sets theory in multi practices decision making model to benchmark material provider's under integrated approach help for decision making. Environmental-economic-waste minimization measurement is the complex chain for each manufacturing system of each firm. In the presented research work, the authors proposed a DSS, consist of module 'Environmental-economic-waste minimization practices' and grey-Reference Point Approach to evaluate the performance of stuff providers. Proposed DSS can make decision under incomplete information of committee of professionals (P) against vague practices.

Keywords: GEL sustainability model, professionals, grey number, RPA (Reference Point Approach).

I. INTRODUCTION:

Environmental (Green) concerns assist the material providers to improve the sale of their stuffs / products by playing with the emotions of their partners (stuffs purchasers / manufacturing firm). Minimization of the waste is related to lean manufacturing to eliminate the waste, although, it is time, material effort, money, capital etc. It also overcome the trust of product purchasing organization. Economic deliver message to material providers for maintaining the contracted rate, fast response against claim for purchased goods and best service level for their partners firm.

II. MULTIPLE-OBJECTIVE PROBLEMS:

These problems consist of a finite number of alternatives experiments /options, explicitly known at the starting of the solution process. Each alternative is represented by its performance in multiple-objective. The problem may be defined as finding the best alternative for the decision-making group, or finding a set of suitable alternatives. One may also be interested in 'sorting' or 'classifying' alternatives. Sorting refers to placing the alternatives in a set of preference-ordered classes (such as assigning credit-ratings to countries), and classifying refers to assigning alternatives to non-ordered sets (such as diagnosing patients based on their symptoms).

III. OBJECTIVE:

Grey-based GEL sustainability appraisement model constructed by identifying and short momentous measures and measures' interrelated practices. The Grey-based GEL sustainability

appraisement model is valid towards assessing the sustainability of material supplier organizations. Fig. 1 has shown the GEL sustainability model.

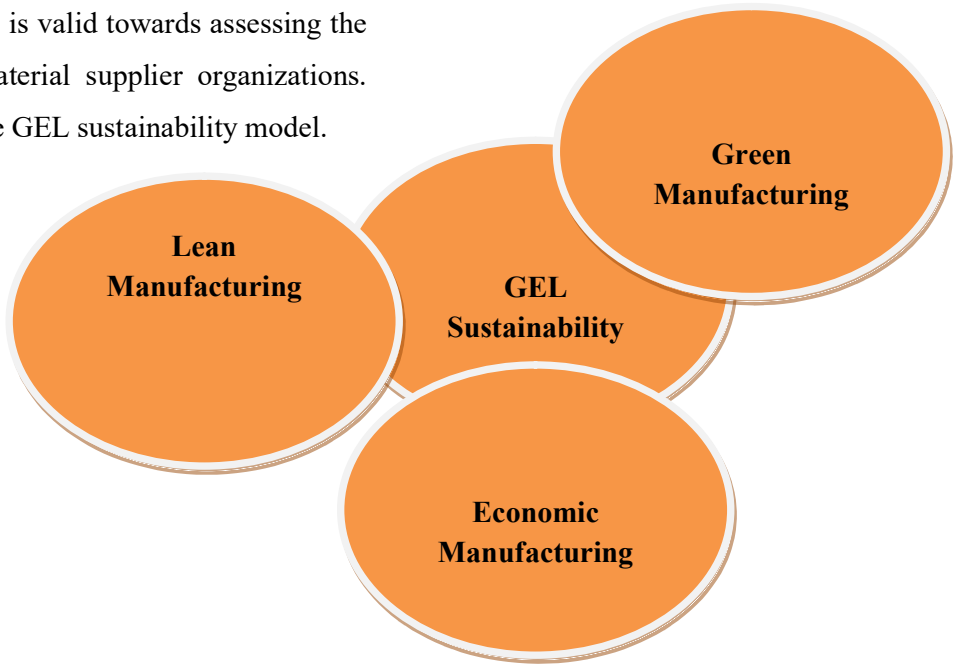

Fig. 1 GEL sustainability mode

IV. GREY SET THEORY:

In present context, the authors have fruitfully implemented grey theory (discrete information system) deals with utterly known cum unknown information, where utterly known information is being enveloped passing through white number, while unknown information is enveloped passing through black number. In grey theory, discrete information aligns the amputation of information that cope the range of the grey system itself. Grey theory has now been applied to various areas such as forecasting, system control, and decision-making and computer graphics. Here, we give some basic definitions regarding relevant mathematical background of grey system, grey set and grey number in grey theory Deng, the concept of a grey system.

V. NOVELTY OF RESEARCH WORK:

The authors has proposed a crisp AHP significance ratio evaluation technique with the new concept of global weight evaluation coupled with Grey- Reference point approach (RPA) to tackle the incomplete information of decision makers against vague practices.

VI. METHODS:

The Grey-Multi-objective optimization on the basis of simple ratio analysis:

Determining overall ranking index based on ***Reference Point Approach*** decision making evaluation techniques, it was the extensive part of **MOORA** formula **Stanujkic et al. [1]; Vinodh and Balaji [4] Samantra [2]; Naim and Gosling [6] Sahu et al. [40]; Liu et al. [5].**

$$\otimes x_{ij}^{*} = \frac{\otimes x_{ij}}{\sqrt{\sum_{j=1}^{m}(\underline{x}_{ij}^{2} + \overline{x}_{ij}^{-2})}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where,

$$\otimes Rp_{j} = \min\left(\max_{j} \left| \otimes r_{j} - \otimes s_{i}\, x_{ij}^{*} \right| \right) \quad \ldots\ldots\ldots\ldots\ldots(2)$$

Here, y_{j}^{*} as the overall ranking index of alternative j; y_{j}^{+} and y_{j}^{-} as total sums of maximizing and minimizing responses of alternative j to objectives respectively; s_{i} as significance coefficient of objective i; x_{ij}^{*} and $\otimes x_{ij}^{*}$ … as the normalized responses of alternative j on different objectives, which are expressed in the form on crisp or interval grey numbers; $\Omega_{\overset{+}{C}}$ and $\Omega_{\overset{+}{G}}$ assets of objectives to be maximized expressed in the form on crisp or interval grey numbers; $\Omega_{\overset{-}{C}}$ and $\Omega_{\overset{-}{G}}$ are sets of objectives to be minimized expressed in the form on crisp or interval grey numbers.

VII EMPIRICAL CASE RESEARCH:

Step 1: Construction of a cluster of expert's panel for assessing the overall performances of material provider firm under proposed module, shown in Table1 1.

Step 2: Evaluation of suitable linguistic grey scale in terms of appropriateness ratings, shown in Table1 2.

Step 3: Evaluation of performance ratings. Weights is given by DM in crisp values are given here i.e. *[0.019,0.023,0.039,0.051,0.072,0.105,0.153, 0.223,0.314]*.

For 2nd level hierarchy and global weight of 1st level. The computed global weights for first level are i.e. 0.081, 0.228 and 0.691, shown in fig 3.

Step4: Transform the linguistic variables into grey set and then assigned linguistic terms (as rating) shown in Table 3-5. Then converts into single responses.

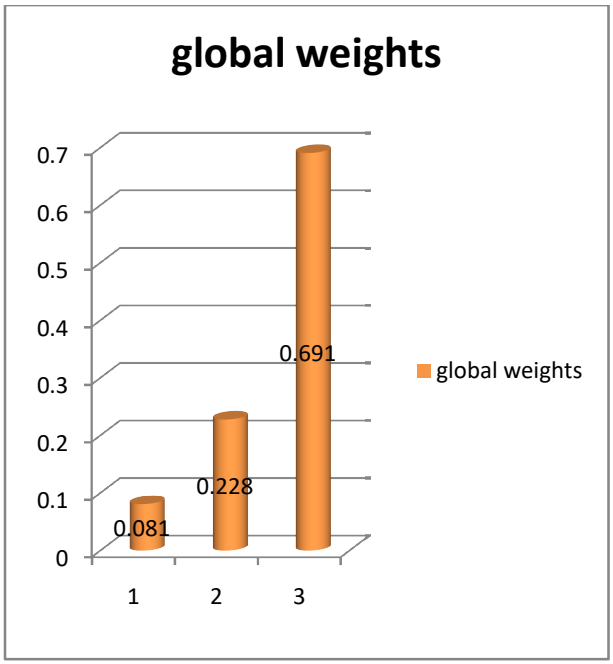

Fig. 3: Global weight

Step 5: Applied equation 1 to normalize data and multiplied by global weight.

Step6: Estimation of overall performance of material supplier firm by using equation 2. The result shown in table 6

Table: 1. Grey-based GEL sustainability appraisement hierarchical structural evaluation model

Vinodh and Balaji [4]; Sahu et al. [3]; Matawale et al. [8]

Goal, (C)	Measures, (C_i)		Practices, (C_{ij})	Attitudes
Material Provider Sustainability Measurement	Green Manufacturing, (C_1)	**(+)**	Continues utility of eco friendly equipments, ($C_{1,1}$)	**(+)**
			Environmental management certification (C1,$_2$)	**(+)**
			Restriction of hazardous substance, ($C_{1,2}$)	**(+)**
	Economic, (C_2)	**(-)**	Enhancement in purchasing rate, ($C_{2,1}$)	**(-)**
			Claim against purchasing goods, ($C_{2,2}$)	**(-)**
			Delay in service level, ($C_{2,3}$)	**(-)**
	Lean manufacturing (C_3)	**(-)**	Over processing, ($C_{3,1}$)	**(-)**
			Unwanted production, ($C_{3,2}$)	**(-)**
			Unnecessary movement, ($C_{3,3}$)	**(-)**

Table 2: The scale of attribute ratings $\otimes G$

Scale	$\otimes r$
Very Poor (VP)	[0, 1]
Poor (P)	[1, 3]
Medium Poor (MP)	[3, 4]
Fair (F)	[4, 5]
Medium Good (MG)	[5, 6]
Good (G)	[6, 9]
Very Good (VG)	[9, 10]

Table.3 Appropriateness grey rating against practices for A_1

Metrics, (C_{ij})	P1	P2	P3	P4	P5
Continues utility of eco friendly equipments, ($C_{1,1}$)	G	VG	G	VG	G
Environmental management certification (C1,$_2$)	VG	MP	VG	VG	VG
Restriction of hazardous substance, ($C_{1,2}$)	MP	MP	F	MG	F
Enhancement in purchasing rate, ($C_{2,1}$)	MP	VG	F	G	F
Claim against purchasing goods, ($C_{2,2}$)	MP	F	F	VG	F
Delay in service level, ($C_{2,3}$)	MP	F	P	MG	F
Over processing, ($C_{3,1}$)	VG	F	VG	MG	MP
Unwanted production, ($C_{3,2}$)	MG	G	F	MG	MP
Unnecessary movement, ($C_{3,3}$)	MG	G	F	F	MP

Table.4 Appropriateness grey rating against practices for A_2

Metrics, (C_{ij})	P1	P2	P3	P4	P5
Continues utility of eco friendly equipments, ($C_{1,1}$)	MG	G	MG	F	G
Environmental management certification (C1,$_2$)	G	G	MG	G	MG
Restriction of hazardous substance, ($C_{1,2}$)	G	G	MG	MG	MP

Enhancement in purchasing rate, ($C_{2,1}$)	G	G	F	MG	MP
Claim against purchasing goods, ($C_{2,2}$)	G	MG	F	MG	F
Delay in service level, ($C_{2,3}$)	MG	MG	VG	VG	F
Over processing, ($C_{3,1}$)	MG	MG	F	F	VG
Unwanted production, ($C_{3,2}$)	G	F	F	MG	MP
Unnecessary movement, ($C_{3,3}$)	G	MG	VG	MG	MP

Table.5 Appropriateness grey rating against practices for A_3

Metrics, (C_{ij})	**P1**	**P2**	**P3**	**P4**	**P5**
Continues utility of eco friendly equipments, ($C_{1,1}$)	G	MG	F	MG	MP
Environmental management certification (C1,$_2$)	G	MG	F	VG	MP
Restriction of hazardous substance, ($C_{1,2}$)	G	MG	F	F	VG
Enhancement in purchasing rate, ($C_{2,1}$)	VG	MG	G	F	F
Claim against purchasing goods, ($C_{2,2}$)	VG	VG	P	MG	F
Delay in service level, ($C_{2,3}$)	MG	G	VP	F	F
Over processing, ($C_{3,1}$)	MG	G	VP	F	VG
Unwanted production, ($C_{3,2}$)	MG	G	G	G	F
Unnecessary movement, ($C_{3,3}$)	MG	VG	G	MG	VG

Table.6 Ranking results obtained using Reference point approach (RPA)

Alternatives	$\otimes Rp$	Ranking
A_1	0.000	1.000
A_2	0.0046	2.000
A_3	0.0051	3.000

VII RESULTS:

Grey-RP (Reference Point) approach is applied on the Grey-based GEL sustainability appraisement hierarchical structural evaluation model (constructed by identifying and short listing **3** momentous measures and **9** interrelated practices For evaluating the performances of material supplier firms. The applied Grey-RP (Reference Point) approach gives optimum result. The sustainability of 1st candidate material provider is best than rests. Ranking shown in Fig.4.

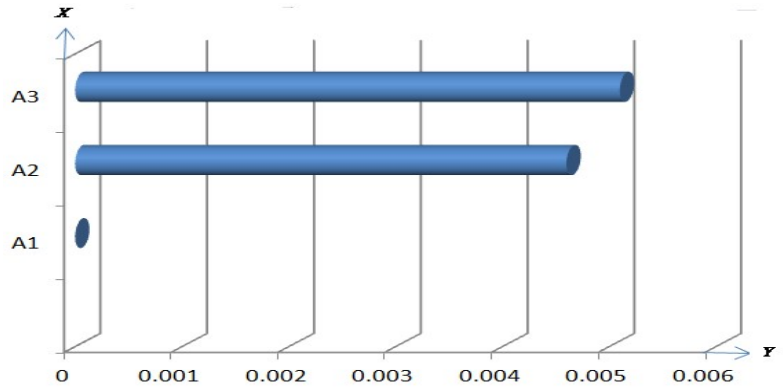

Fig.4. Ranking results obtained using Grey-RPA (Ranking is based on minimum value is best)

IX. CONCLUSION:

In the presented work, the constructed multi practices decision making performance appraisement module (constituted by mixing the segregated the green-economic-Lean measures and their corresponding interrelated practices) is proposed conjunctive with Grey- Reference point approach (RPA) to tackle the incomplete information of decision makers against vague practices.

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