

PERFORMANCE ASSESSMENT OF MATERIAL PROVIDER'S ORGANIZATION UNDER GREY-MULTI-OBJECTIVE OPTIMIZATION ON THE BASIS OF SIMPLE RATIO ANALYSIS TECHNIQUE

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ABSTRACT:

Green-economic-lean' measurement is the holistic chain which stresses on strengthens the means of implementation and regeneration of the manufacturing system of each firm globally. In last decade, each firm has begun to establish the production with rapid rate in compensating the high demand of goods with rich-quality of service level. In order to respond these matters, firm perceived the necessity to balance their production chain of organization. In the presented research work, the authors proposed a DSS, consist of module 'green-economic-lean' and grey--to evaluate the performance of stuff providers. Proposed DSS can make decision under incomplete information of committee of decision makers (DMs) against vague practices. This is core novelty of this paper.

Keywords: GEL Sustainability Model, Professionals, Grey Number, MOOSRA Techniques.

I. INTRODUCTION OF GEL PRACTICES:

GEL i.e. Environmental (Green) concerns help the material providers to hike 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 wins 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 appraisal model constructed by identifying and short momentous measures and measures' interrelated practices. The Grey-based GEL sustainability appraisal model is valid towards assessing the sustainability of material supplier organizations.

Fig. 1 has shown the GEL sustainability model.

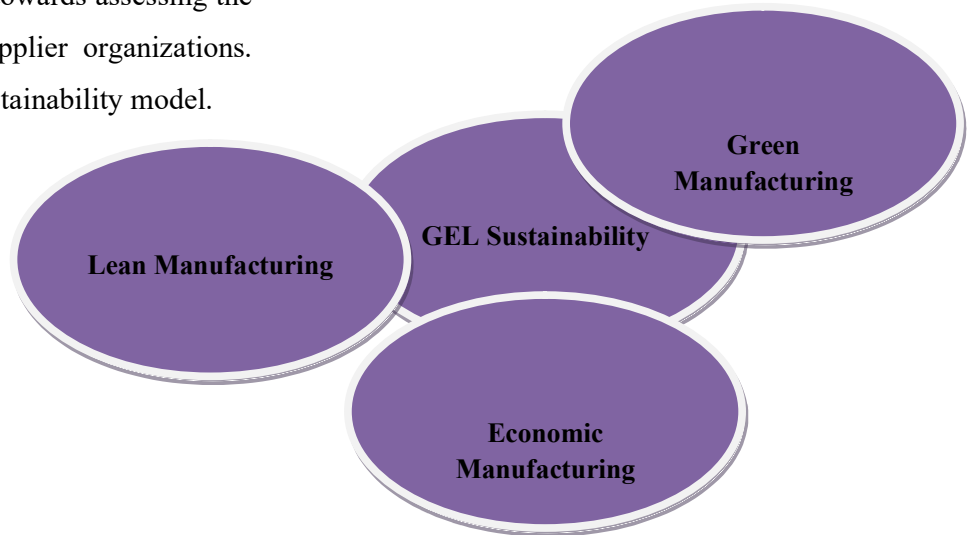


Fig. 1 the GEL sustainability model.

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 both

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. grey set and grey number in grey theory Deng, the concept of a grey system is shown in fig. 2

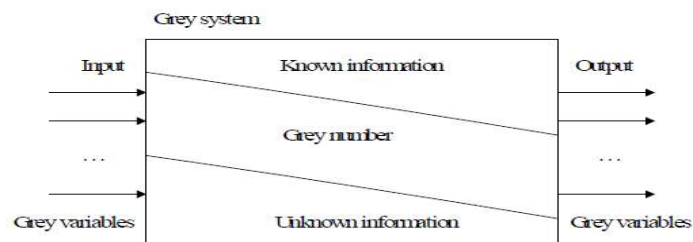


Fig: 2 Grey Set

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- to tackle the incomplete information of

decision makers against practices new concept of global weight evaluation coupled with Grey- to tackle the incomplete information’s decision makers against vague practices.

VI. METHOD

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

Determining overall ranking index based on Multi-objective optimization on the basis of simple ratio analysis decision making evaluation techniques, it was the extensive part of MOOSRA formula Stanujkic et al. [1]; Vinodh and Balaji [4] Samantra [2]; Naim and Gosling [6] Sahu et al. [40]; Liu et al. [5].

$$\otimes x_{ij}^* = \frac{\otimes x_{ij}}{\sqrt{\sum_{j=1}^m (\otimes x_{ij}^2 + \otimes x_{ij}^{-2})}} \dots\dots\dots(1)$$

Where,

$$y_j^+ = \frac{\sum_{i \in \Omega_c^+} \otimes s_i x_{ij}^*}{\sum_{i \in \Omega_g^+} \otimes s_i x_{ij}^*} \dots\dots\dots(2)$$

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 $\otimes x_{ij}^* \dots$ as the normalized responses of alternative j on different objectives, which are expressed in the form on crisp or interval grey numbers; Ω_c^+ and Ω_g^+ assets of objectives to be maximized expressed in the form on crisp or interval grey numbers; Ω_c^- and Ω_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 Lean-Agile (L-A) performances of material provider firm under proposed module, shown in Table 1.

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

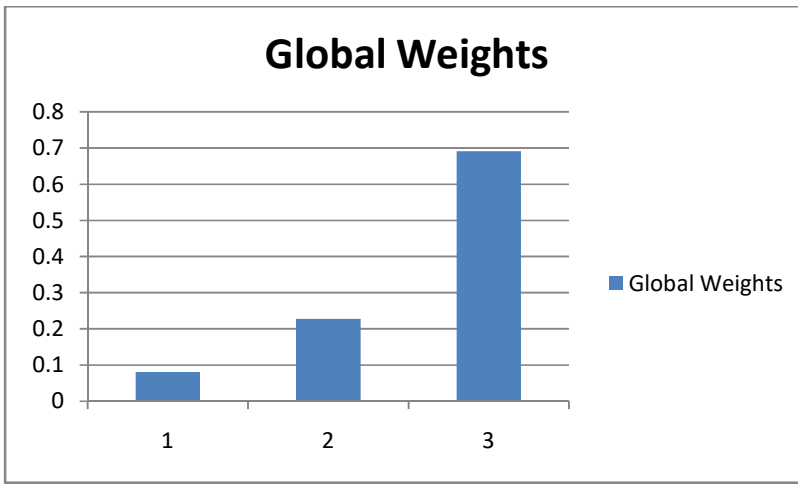


Fig: 3 Global weights

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.

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 appraisalment 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 (C _{1,2})	(+)
			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 A₁

Practices, (C _{ij})	P1	P2	P3	P4	P5
Continues utility of eco friendly equipments, (C _{1,1})	G	VG	G	VG	G
Environmental management certification (C _{1,2})	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 A₂

Practices, (C _{ij})	P1	P2	P3	P4	P5
Continues utility of eco friendly equipments, (C _{1,1})	MG	G	MG	F	G
Environmental management certification (C _{1,2})	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 A₃

Practices, (C _{ij})	P1	P2	P3	P4	P5
Continues utility of eco friendly equipments, (C _{1,1})	G	MG	F	MG	MP
Environmental management certification (C _{1,2})	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 Grey-Multi-objective optimization on the basis of simple ratio analysis form technique for $\lambda = 0, 0.5, 1$

λ	$\lambda=0$	$\lambda=0.5$	$\lambda=1$
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Alternatives	y_j^+	Ranking	y_j^+	Ranking	y_j^+	Ranking
A ₁	1.562	1.000	1.750	1.000	1.375	1.000
A ₂	1.171	2.000	1.254	2.000	1.089	2.000
A ₃	1.061	3.000	1.196	3.000	0.926	3.000

VIII. RESULTS:

Grey-multi-objective optimization on the basis of simple ratio analysis technique is applied on the Grey-based GEL sustainability appraisalment hierarchical structural evaluation model (constructed by identifying and short listing 3 momentous measures and 9 measures’ interrelated practices via literature review i.e. **Matawale et al. [34]; Sahu et al. [40]; Vinodh and Balaji [43].**

The result found was Grey-multi-objective optimization on the basis of simple ratio analysis technique is optimum. The sustainability of 1st candidate material provider is best than rests. It must be elected. Ranking results obtained using Grey-Multi-objective optimization on the basis of simple ratio analysis technique for $\lambda = 0, 0.5, 1$ is shown in Fig.4.

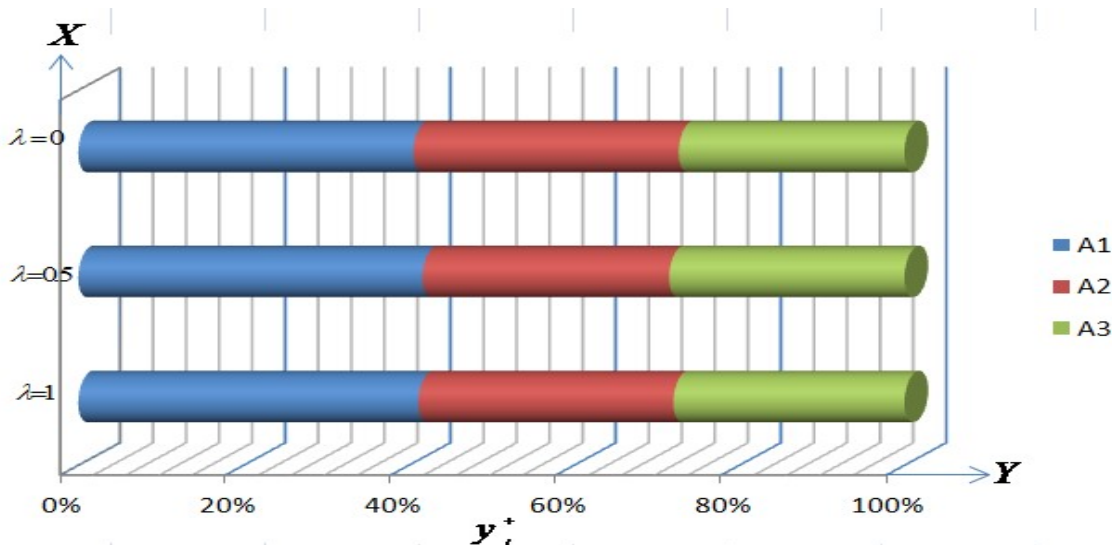


Fig.4. Ranking results obtained using Grey-Multi-objective optimization on the basis of simple ratio analysis technique for X- $\lambda = 0, 0.5, 1$, Y- y_j^+ (Ranking is based on maximum value is best)

IX. CONCLUSION:

In the presented work, the constructed multi practices decision making performance appraisalment module (constituted by mixing the segregated the green-economic-Lean measures and their corresponding interrelated practices) is

proposed conjunctive with Grey-Multi-objective optimization on the basis of simple ratio analysis to tackle the incomplete information of decision makers against vague practices

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