Analysis of Green Supplier Selection Using ARAS Method

Agrawal Deepa Manoj
SSt College of Arts and Commerce, Maharashtra, India.
deepaagrawal@sstcollege.edu.in

Abstract

Green supplier assessment for industrial supply chain one of the most important challenges, because environmental friendliness is very important for manufacturers. Integrating ARAS for six green suppliers, Best green suppliers Evaluation and making choices This study is a green supplier performance benchmark ARAS will be used Aims to determine significance. Criteria considered in this study and options since they are associated with uncertainty, ARAS theory for modeling uncertainties Used as one of the main tools. In this study, to evaluate green suppliers a set of criteria has been identified. Then, evaluate the best green suppliers ARAS is used to select Contribution of this study to green supplier evaluation ARAS analysis is of Hierarchical Process Techniques Based on integration. In the decision making process Uncertainty as a significant factor when it is there, ARAS reveals a solution as an optimal response.

Keywords- green procurement, green production, supply chain management, renewable energy systems, MCDM

1. Introduction

Currently, of greenhouse gases Due to increase Green supply chains a trendy topic. The latest over the years, many companies are trying to be environmentally friendly. Supply chain networks one of the essential Processes in any organization, and in all business processes can be used efficiently. Supply Chain Management The final product to the customer in providing care Managing multiple complex operations and Defined as integration. For this definition beyond, Green supply chain management refers to green procurement, green production, and Green supply and vice versa refers to logistics. Green Supply Chain Management Among the main objectives one is in the supply chain Waste disposal is to remove or reduce. Further, Manufacturers improve Waste Management Optimizing supply chain facility locations and to suppliers results in significant benefits. For example, Eliminate waste Locations of centers upgrading The MCDM analysis used a stepwise procedure. For companies Performance improvement as the primary factor in creating, an integrated Supply chain Consider strategy It is also important to have. North America, European Union and Japan etc in developed regions a major concern of manufacturers there have been environmental issues over the years. A green supply chain system, an important component of global business, and by reducing environmental risks and by improving environmental performance. Relating to increasing market share To achieve the main objectives Helps organizations develop strategies. The latest over the years, such as India and Malaysia Developing countries their green supply chains Efforts have been made. Generally, supply chain management is standard Moving towards business development is an important step. A supply chain management product of life from beginning to end all levels Includes of production; hence, consistency and supply chain management in promoting sustainable business integration will have a significant impact. Therefore, green supply chain organization and constant considered in the literature Supply chain management. Supply chain in management systems One of the most fundamental conclusions is that especially sustainable supply chain, Supplier selection and supplier policies. Organizations need to identify supplier selection criteria. Globalization and Transcontinental Outsourcing, As well as consistency, In Corporate Strategies and Survival in Competitive Environments It greatly increases Importance of supply chain management. Traditionally, supply chain management is about improving efficiency involves the coordinated direction of all members of the supply chain; It is highly productive and leads to profit. Supply chain managers are providing products and services quickly, reduce costs, of supply chain network they also tried to improve the quality. However, At the cost of the supply chain Negative environmental effects degradation have not yet been fully explored. Environmental standards and for green products Consumer demand Pressure from government regulations to meet It is a green supply chain led to the idea. Currently, leading companies Supply chain managers using their enhanced stability, In all elements of the supply chain Trying to use green practices. Supplier selection is to achieve a sustainable supply chain one of the important elements. For example, in raw materials of suppliers the hazardous materials used is enormous Can cause negative environmental effects. In previous studies, static factors were often neglected Supplier selection is considered in traditional management environment. This research is in sustainable development context Discusses supplier selection. In this paper, the new ARAS With hybrid method integrated several criteria are used to make the decision the model is used. The originality of this study is that with input from energy experts Sustainability of renewable energy systems to assess the importance of indicators with multiple criteria decision making a hybrid method model and extended ARAS. ARAS methodology is based on economy, management, industry, manufacturing, Design and Architecture, Policy and Environment Stability etc in various fields having wide application a new subjective scale weighting method. It is about a specific topic the hidden knowledge of experts, Based on experience and ideas creates its process and the number of their experience Representational can be described.

2. Green Supplier

Global quality, Continuous improvement and complete customer satisfaction to demonstrate ability to meet customer needs as key components of the organization a company implemented an integrated management system. This study is of the company Tends to evaluate suppliers. Suppliers of these suppliers and purpose Table 1 lists. Important step in supplier selection is determining the selection criteria. To evaluate suppliers by scholars various criteria have been proposed. These criteria are very broad; they find the best supplier form the basis of many studies. Therefore, supplier evaluation and Traditional criteria for selection and integrated green criteria Criteria extracted by Hashemi and Dehkanian This study uses Among these criteria Although some may appear slightly overlapping, To evaluate green suppliers These criteria are used, It is in literature The most complete used And is a comprehensive scale. Green supply chain management over the past two decades Initial practical sense-making and from conceptual development Up to the most rigorous theory As far as driven empirical and analytical studies it has seen significant growth. Green supply chain management is Natural environment Distribution of concerns Integration with chain management. In this organizational practice many functions and factors can be combined. In examples choosing green suppliers, In Green Enterprise Practices Incorporating supplier input, of products in supplier processes Embedding environmental life cycle analysis, to develop In organizational structure Environmental Management Systems of suppliers. Assist in implementation and many other procedures are involved. As firms face competitive and environmental influences supply chains Greening Argued to be important. Potential functions in Green supply chain management and of operations considering the width, Institutional resources may not be available for the development of these projects. This resource constraint is small and medium For companies Especially deep. In fact, Many times these projects are rather than 'must-haves' are pushed to 'good-to-be' organizational decisions. Large and for supplier development More fertile of supply chain partners engagement and support, Successful when partners are less resourceful Green supplier management will be critical to the project. Unresponsive to these external pressures Research shows that there are external pressures to become green suppliers. Implementation of greening initiatives by companies requires internal resources and capabilities and has been found to play an important role. It is impossible for small suppliers to develop these capabilities, They can be soft (knowledge) or hard (technology, finance), Without additional evidence. This green supply chain management To pursue initiatives, A business case is made if you want of higher management There should be support. Customers' resources are shared with suppliers It is easy to get top management support through joint GSDP type projects. In supplier capacity building. Management and Organization Supplier development in 4 practices, for mandatory ISO 14000 certification Developing a formal process and this includes building better management commitment. Green supplier performance evaluation and Table 1 in development commonly used Provides approaches. Table 1 and table 2 alternatives and evaluation parameters. Table 1 shows supplier list. Table 2 shows Criterion, Economic and commercial, Environmental, Delivery, Technology, Quality.

Table 1: Alternatives

Supplier	Scope	Symbol
Robin	Paykan Pickup differential supplier	A1
Musharaf	Decorative parts suppliers	A2
Ruba	206 and 405 gearbox supplier	A3
Usain	405 seat supplier	A4
Ravidhir	Steering box supplier	A5
Arisan	206 full steering supplier	A6

Table 2: Evaluation parameters

Criterion	Symbol
Economic and commercial	C1
Environmental	C2
Delivery	C3
Technology	C4
Quality	C5

To evaluate green supplier development projects Criteria in a group meeting Nominal with three academic green supply chain experts Obtained using panel technique. Independently of the list of conditions Experts were asked to develop. In Green Supplier Development Program Evaluation An initial Literature review Compiled using List of criteria, to start the idea generation process Available to experts upon request. Until all experts have completed their lists, from the evaluation committee members in a round-robin format at a time A criterion was recorded. Dependence of each criterion on others for clarity or experts was allowed to discuss only without influence. Experts have also evaluated these criteria independently. Once the process is complete, Based on voting and math panel of individual rankings Prioritization of criteria was determined.

3. ARAS Method

The ARAS system is complex World events simplified using relative comparisons it is based on the argument that it can be understood. Normalized and of weighted scales for sum of values, It is under consideration Describes an alternative. These criteria are optimal and describe the degree of optimality; this is achieved by substitution in comparison. Most useful and from rated to select the actual alternative, the best alternative is artificially created. Analyzed real from the xi indicator data of AI Alternatives Modeling the best alternative. While doing calculations, Alternative is better the alternative is compared to a0. Calculation process Taking into account, Optimum function ~ sivalues of the studied parameters xij and weights ω~ j and their corresponding in the final result Live with influence and has a proportional relationship. Therefore, the value of the optimal function ~ Si, A very useful alternative. Priorities of alternatives can be determined according to the value of Si.

Because of this, When using this method, Evaluate decision alternatives Ranking is convenient.

Table 3: Green supplier selection work

	C1	C2	C3	C4	C5
A1	24.13	34.12	91.43	84.13	97.43
A2	28.43	39.76	82.46	87.46	98.34
A3	29.16	32.58	97.43	69.48	90.54
A4	19.74	30.71	95.46	75.43	88.73
A5	27.28	28.65	88.64	78.12	99.46
A6	21.34	27.43	84.36	76.18	79.54

Table 3 is given for the data set. This is for hundreds of values that the supplier works with, all supplier C1 values are the lowest and C5 values are the highest. Therefore, as economic and business values are very low and quality is very high, as seen in Figure 1, suppliers' performance is very high.
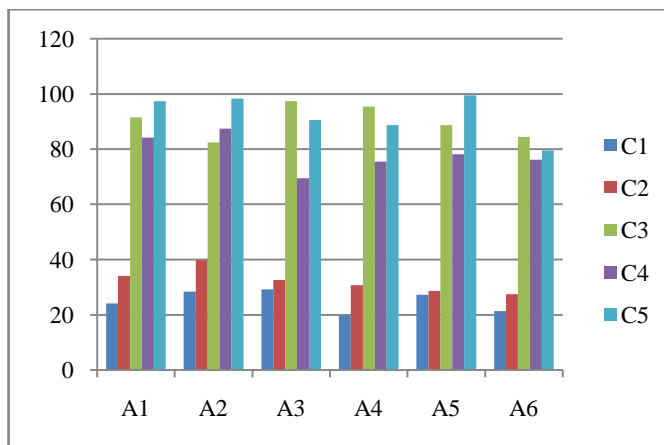

Figure 1: graph of Green supplier selection work

Table 4: maximum value

	C1	C2	C3	C4	C5
Max	**29.16**	**39.76**	**97.43**	**87.46**	**99.46**
A1	24.13	34.12	91.43	84.13	97.43
A2	28.43	39.76	82.46	87.46	98.34
A3	29.16	32.58	97.43	69.48	90.54
A4	19.74	30.71	95.46	75.43	88.73
A5	27.28	28.65	88.64	78.12	99.46
A6	21.34	27.43	84.36	76.18	79.54

Table 4 calculated for maximum value for data set. Is taken for ranking in finally.

Table 5: normalized for data set

	C1	C2	C3	C4	C5
Max	**0.162687**	**0.170636**	**0.152901**	**0.156665**	**0.152196**
A1	0.134624	0.146431	0.143485	0.1507	0.14909
A2	0.158614	0.170636	0.129408	0.156665	0.150482
A3	0.162687	0.139822	0.152901	0.124458	0.138546
A4	0.110132	0.131797	0.149809	0.135116	0.135777
A5	0.152198	0.122956	0.139106	0.139935	0.152196
A6	0.119058	0.11772	0.13239	0.13646	0.121714

Table 5 Data for analysis are transformed into normalized data. In which all values are less than 1. This makes the analysis easier. A weight age value of 0.25 is taken for all the data to get the weighted normalized matrix.

Table 6: Weighted Normalized Matrix

	C1	C2	C3	C4	C5
Max	0.040672	0.042659	0.038225	0.039166	0.038049
A1	0.033656	0.036608	0.035871	0.037675	0.037272
A2	0.039654	0.042659	0.032352	0.039166	0.037621
A3	0.040672	0.034956	0.038225	0.031115	0.034637
A4	0.027533	0.032949	0.037452	0.033779	0.033944
A5	0.03805	0.030739	0.034777	0.034984	0.038049
A6	0.029765	0.02943	0.033097	0.034115	0.030428

Weighted Normalized Matrix is obtained in Table 6. With this we can get sum of value.

Table 7: Si and Ki value

Si	Ki	
0.198771	1	Max
0.181083	0.911009	A1
0.191451	0.963174	A2
0.179604	0.903569	A3
0.165658	0.833408	A4
0.176598	0.888447	A5
0.156835	0.789024	A6

From table 7 sum of value is obtained and Ki value is obtained. Ki value is obtained by dividing Si Max value. This can be seen in Figure 2.
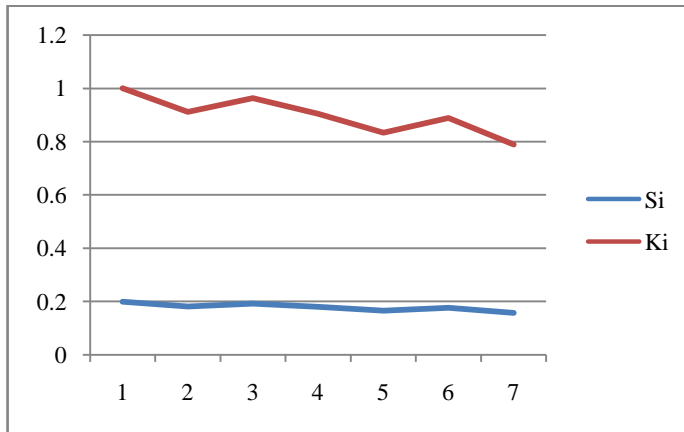

Figure 2: graph for Si and Ki value

Table 8: Rank

Supplier	Symbol	Rank
ROBIN	A1	2
Musharaf	A2	1
Ruba	A3	3
Usain	A4	5
Ravidhir	A5	4
Arisan	A6	6

The ranking is obtained from Table 8. It is not multiplied by Table 7. In this, Musharraf is the first and Arisan is the last.
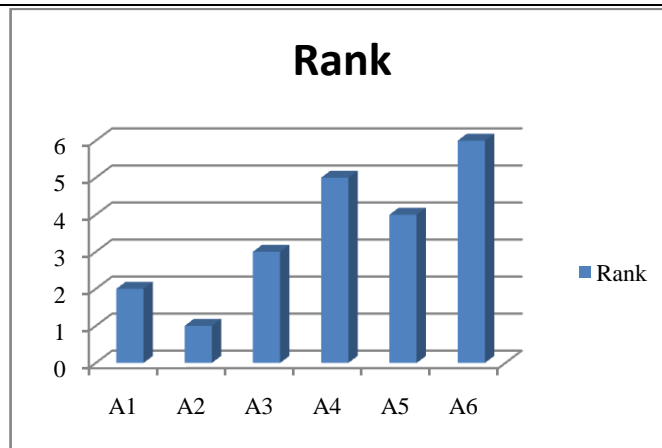
Figure 3: Rank

4. Conclusion

The study provides a model for ARAS to integrate and evaluate the best green suppliers. Based on criteria defined by ARAS In addition to implementing supplier selection, in the decision making process also accurately controls uncertain parameters. For this purpose, For Green Supplier Rating Five criteria were identified. Because experts' judgments about criteria and preferences were uncertain, to calculate the uncertainties vague concepts were used. The company the results show that Musharraf has been selected as the best green supplier. Considering environmental aspects Supplier selection is a global business and prevent serious damage to human quality of life. In traditional supply chain management, organizational agility, Low delivery cost and high service quality were the main objectives. Nowadays, sustainability of supply chain systems New remarkable the supply chain target is exposed. So, choosing the best green suppliers, it is necessary to evaluate the sustainable capacity of suppliers. Regarding green supply chain one of the main processes, Ability of suppliers to recycle used material. In this case, to recycle used materials Capacity of suppliers and by suppliers and the quality of recycled materials consumed May be explored in future.

5. References

[1]. Govindan, Kannan, Sivakumar Rajendran, Joseph Sarkis, and Parasurama Murugesan. "Multi criteria decision making approaches for green supplier evaluation and selection: a literature review." *Journal of cleaner production* 98 (2015): 66-83.

[2]. Wang, Ke-Qin, Hu-Chen Liu, Liping Liu, and Jia Huang. "Green supplier evaluation and selection using cloud model theory and the QUALIFLEX method." *Sustainability* 9, no. 5 (2017): 688.

[3]. Torabzadeh Khorasani, Sasan. "Green supplier evaluation by using the integrated fuzzy AHP model and fuzzy copras." *Process Integration and Optimization for Sustainability* 2, no. 1 (2018): 17-25.

[4]. Zavadskas, Edmundas Kazimieras, and Zenonas Turskis. "A new additive ratio assessment (ARAS) method in multicriteria decision-making." *Technological and economic development of economy* 16, no. 2 (2010): 159-172.

[5]. Zavadskas, Edmundas Kazimieras, Zenonas Turskis, and Tatjana Vilutiene. "Multiple criteria analysis of foundation instalment alternatives by applying Additive Ratio Assessment (ARAS) method." *Archives of civil and mechanical engineering* 10, no. 3 (2010): 123-141.

[6]. Stanujkic, Dragisa, and Rodoljub Jovanovic. "Measuring a quality of faculty website using ARAS method." In *Proceeding of the International Scientific Conference Contemporary Issues in Business, Management and Education*, vol. 545, p. 554. 2012.

[7]. Kutut, Vladislavas, E. K. Zavadskas, and M. Lazauskas. "Assessment of priority alternatives for preservation of historic buildings using model based on ARAS and AHP methods." *Archives of civil and mechanical engineering* 14, no. 2 (2014): 287-294.

[8]. Demir, Leyla, Muhammet Enes Akpınar, Ceyhun Araz, and Mehmet Ali Ilgın. "A green supplier evaluation system based on a new multi-criteria sorting method: VIKORSORT." *Expert Systems with Applications* 114 (2018): 479-487.

[9]. Awasthi, Anjali, and Govindan Kannan. "Green supplier development program selection using NGT and VIKOR under fuzzy environment." *Computers & Industrial Engineering* 91 (2016): 100-108.

[10]. Keshavarz Ghorabaee, Mehdi, Maghsoud Amiri, Edmundas Kazimieras Zavadskas, and Jurgita Antucheviciene. "Supplier evaluation and selection in fuzzy environments: A review of MADM approaches." *Economic research-Ekonomska istraživanja* 30, no. 1 (2017): 1073-1118.

[11]. Freeman, James, and Tao Chen. "Green supplier selection using an AHP-Entropy-TOPSIS framework." *Supply Chain Management: An International Journal* (2015).

[12]. Fu, Xiaoyong, Qinghua Zhu, and Joseph Sarkis. "Evaluating green supplier development programs at a telecommunications systems provider." *International Journal of Production Economics* 140, no. 1 (2012): 357-367.

[13]. Chiou, C. Y., Chia-Wei Hsu, and W. Y. Hwang. "Comparative investigation on green supplier selection of the American, Japanese and Taiwanese electronics industry in China." In *2008 IEEE International Conference on Industrial Engineering and Engineering Management*, pp. 1909-1914. IEEE, 2008.