INTERNATIONAL JOURNAL OF RESEARCH IN AERONAUTICAL AND MECHANICAL ENGINEERING

ISSN (ONLINE): 2321-3051

Vol.4 Issue 2,

February 2016

Pgs: 32-37

PRIORITIZATION OF FACTORS OF GREEN SUPPLY CHAIN MANAGEMENT FOR ECOFRIENDLY PERFORMANCE OF PUMP INDUSTRY USING TOPSIS METHOD

Narendra Rathore [1], Manish Soni [2] and Santosh Patidar[3]

[1] *Research Scholar, Mechanical Engineering Department, MIT, Ujjain, mitmanojparmar@gmail.com*
[2] *Associate Professor, Mechanical Engineering Department, MIT, Ujjain, soman44@rediffmail.com*
[3] *Assistant Professor, Mechanical Engineering Department, MIT Ujjain santoshpatidar14@yahoo.com*

Abstract

The focus of this research is in the area of Prioritization of factors of Green Supply Chain management for eco-friendly performance of pump industry using TOPSIS MCDM technique. Various factors of supply chain are available in different literature. Factors of supply chain can improve the performance of organization. The goal of the research is in the area of the selection of the best factors which can affect the supply chain and improve the performance of the pump industry. For selecting appropriate factors, it is felt that some Multi Criteria Decision Making Methods must be used due to their ability of converting a complex problem to a paired comparison. These methods are used to provide a hierarchy based relationship between goal of the research, criteria, sub-criteria and alternatives. Certain methods such as; Analytic Hierarchy Process (AHP), Fuzzy Analytic Hierarchy Process (FAHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) are very effective now a days. The main conclusions drawn from this study are that Web based technology has been found more desirable than other two alternatives.

Keywords: supply chain, TOPSIS, criteria, management, Execution, alternatives, Consistency.

1. Introduction

To make a decision we need to know the problem, the need and purpose of the decision, the criteria of the decision, their sub criteria and the alternative actions to take. We then try to determine the best alternative. [1] Decision making involves many criteria and sub criteria used to rank the alternatives of a decision. The criteria may be intangible, and have no measurements to serve as a guide to rank the alternatives, and creating priorities for the criteria themselves in order to weight the priorities of the alternatives and add over all the criteria to obtain the desired overall ranks of the alternatives is a challenging task. [2]

2. Supply chain Management

Field of Supply chain management is full of literature, directly or indirectly showing davelopment in the field of SCM. Some of the work of different author has been chossen to explain the proper meaning of SCM.
Sotriz Zigiaris et al (2010) in their research work titled as “dessimination of innovation and knowledge management technique” explore the SCM in the following manner, Overall activity started from raw material phase and to moving goods and up to the end user. In the recent years, green supply chain is the challenging

issue among the organizations. Environmental societies believed that many business operations like sourcing, manufacturing and logistics are accountable for maximum environmental related harms. Various internal and external groups such as government agencies, labors, neighbors, charitable societies and non-government organizations (NGOs) are increasing more pressure on organizations to make a green supply chain. Greening concept is a practice which provides an ecofriendly image of the goods, procedures, schemes and technologies. [3]

3. Objectives

a. To identify the major factors involved in green supply chain management.
b. To identify the alternatives for green supply chain management.
c. To priorities the different alternatives involved in green supply chain management with help of TOPSIS method.

4. Methodology

Collis and Hussey (2003) defined research design as "the science (and art) of planning procedure for conducting studies so as to get the most valid finding". The choice of a right research design is a key step of the empirical study and the total success of the study, Jankowicz (2005) describes research design as "the deliberately planned arrangement of condition for analysis and collection of data in manner that aims to combine relevance to the research purpose with economy procedure. [4]

5. Data Collection

There is two phase in which the information is collected from the experts. For preparing questionnaires some Criteria, Sub-Criteria and Alternatives have to be selected and then every Criteria, Sub-Criteria and Alternatives were compared with each other for formation of comparison matrix to solve the problem .For making this comparison, a visit was conducted at Kirloskar Brother LTD. Dewas the questionnaire was filled by 3 experts.

Fuzzy Technique for Order Preference by Similarity to Ideal Solution Method:-The fuzzy TOPSIS is the extension of TOPSIS approach; it includes the fuzzy valuations of considered criteria/ factors and alternatives/parameters (Hwang and Yoon, 1981). In these approaches selection of alternatives is based on the distance nearby to positive ideal solution and extreme from the negative ideal solution. A positive ideal solution is the key concern for the top performance ideals of each factor while the negative ideal solution gives poorest performance ideals.

6. Data Analysis

By using equation fuzzy aggregate ratings for criteria are calculated and then aggregated fuzzy weights of each criterion are calculated by using Eq.2 as given in the table 3. For example aggregated fuzzy weight for criteria C_2 is calculated as: $\tilde{p} = (p_{j1}, p_{j2}, p_{j3})$ where $p_{j1} = {}^{min}{}_k\{7, 5, 7\}$ $p_{j2} = 1/3\sum_{k=1}^{k}\{9,7,9\}$ $p_{j3} = {}^{max}{}_k\{9, 9, 9\}$
$\tilde{p}_j = \{5, 8.3\ 3, 9\}$

Fuzzy Linguistics Scale:

Linguistics term for criteria	**Linguistics term for alternatives**	**Triangular fuzzy number**
Very Low	Very Poor	(1,1,3)
Low	Poor	(1,1,5)
Medium	Fair	(3,5,7)
High	Good	(5,7,9)
Very High	Very Good	(7,9,9)

Linguistics terms for the seven criteria:-

	Linguistics Ratings for the seven criteria		
C1	L	M	L
C2	VH	H	VH
C3	VH	M	H
C4	H	Vh	H
C5	VH	H	VH
C6	H	M	H
C7	H	M	M

Aggregate fuzzy Criteria weight:-

Criteria	D1	D2	D3	Aggregate fuzzy weight
C1	(1,3,5)	(3,5,7)	(1,3,5)	(1,3.67,7)
C2	(7,9,9)	(5,7,9)	(7,9,9)	(5,8.33,9)

C3	(7,9,9)	(3,5,7)	(5,7,9)	(3,7,9)
C4	(5,7,9)	(7,9,9)	(5,7,9)	(5,7.67,9)
C5	(7,9,9)	(5,7,9)	(7,9,9)	(5,8.33,9)
C6	(5,7,9)	(3,5,7)	(5,7,9)	(3,6.33,9)
C7	(5,7,9)	(3,5,7)	(3,5,7)	(3,5.67,9)

Now by using the Eqs. 1 and , calculate the aggregate fuzzy weight for alternatives. As an example: collective rating of alternatives A_2 for criteria C_2 by considering the scores suggested by a team of three decisions makers is calculated as follow:-

$\tilde{x} = (l_{ij}, m_{ij,} u_{ij})$ where $l_{ij} = {}^{min}{}_k \{7,5,7\}$ $m_{ij} = \sum_{k=1}^{k}\{9,7,9\}$ $u_{ij} = {}^{Max}{}_k\{9,9,9\}$

$\tilde{x} = \{5, 8.33, 9\}$

Similarly calculate the aggregate rating for remaining alternatives with respect to corresponding criteria.

Aggregate fuzzy ratings for the alternatives are shown in table below;-

Aggregate fuzzy ratings for alternatives;-

Criteria	Alternatives		
	A1	A2	A3
C1	(3,5.67,9)	(3,5.66,9)	(5,7.66,9)
C2	(3,6.33,9)	(5,8.33,9)	(1,4.33,7)
C3	(3,6.33,9)	(3,5.66,7)	(5,8.33,9)
C4	(3,5.66,9)	(1,3.67,7)	(3,6.33,9)
C5	(5,8.33,9)	(5,7.67,9)	(1,4.33,7)
C6	(1,3.66,7)	(5,8.33,9)	(1,4.33,7)
C7	(3,5.66,9)	(3,5.66,9)	(1,4.33,7)

After that, a normalized fuzzy decision matrix for alternatives is computed as shown in table -5

Normalized fuzzy decision matrix for alternatives:-

Criteria	Alternatives		
	A1	A2	A3
C1	(0.33,0.63,1)	(0.33,0.63,1)	(0.56,0.85,1)
C2	(0.33,0.70,1)	(0.56,0.93,1)	(0.11,0.48,0.78)
C3	(0.33,0.70,1)	(0.33,0.63,1)	(0.56,0.93,1)
C4	(0.33,0.63,1)	(0.11,0.41,0.78)	(0.33,0.63,1)
C5	(0.56,0.93,1)	(0.56,0.85,1)	(0.11,0.48,0.78)
C6	(0.11,0.41,0.78)	(0.56,0.93,1)	(0.11,0.48,0.78)
C7	(0.33,0.63,1)	(0.33,0.63,1)	(0.11,0.48,0.78)

In the next step, construct a normalized fuzzy weights decision matrix for alternatives matrix for alternatives by using an Eqs. 8. As an example, normalized fuzzy weight for alternatives A_2 with respect to criteria C_2 is given as follows

$V_{ij} = \{0.56,0.93,1\} \text{ X } \{5,8.33,9\} = \{2.78,7.72,9\}$

Similarly the fuzzy weights for remaining alternatives are calculated as follow:-

Normalized fuzzy weight for alternative, FPIS, FNIS

Criteria	Alternatives			FNIS (A^-)	FPIS (A^+)
	A_1	A_2	A_3		
C1	(0.33,2.31,7)	(0.33,2.31,7)	(0.56,3.12,7)	0.33	7.00
C2	(1.67,5.86,9)	(2.78,7.72,9)	(0.56,4.01,7)	0.56	9.00
C3	(1,4.93,9)	(1,4.41,9)	(1.67,6.48,9)	1.00	9.00
C4	(1.67,4.83,9)	(0.56,3.12,7)	(1.67,5.40,9)	0.56	9.00
C5	(2.78,7.72,9)	(2.78,7.10,9)	(0.56,4.01,7)	0.56	9.00
C6	(0.33,2.58,7)	(1.67,5.86,9)	(0.33,3.05 ,7)	0.33	9.00
C7	(1,3.57,9)	(1,3.57,9)	(0.33,2.73,7)	0.33	9.00

7. Results

Thus alternative web based technologies has been found to be considerably more desirable than other two alternatives.

8. Conclusion

Today various pump manufacturing industries are working in India for manufacturing various varieties of pumps. In every Industry proper and accurate supply chain planning is necessary for reducing cost of manufacturing and manufacturing cycle time and for improving environmental performance also. This is also important for increasing the capacity of production and for improving the working conditions.

Various alternatives such as: web based technologies, suppliers and advanced manufacturing technologies etc are present now a day. For selecting the best alternatives, certain Multi Criteria Decision Making Methods (based on different criteria and sub-criteria) are employed. These methods based on pair wise comparison matrices and after calculating the weights of all selected alternatives, it can be concluded that, the alternative web based technologies has been found to be considerably more desirable than other two alternatives.

References

[1] Thomas L. (2008) Saaty "Decision making with the analytic hierarchy process" Katz, Int. J. Services Sciences, Vol. 1, No. 1.

[2] Bauer, R.A., Collar, E. and Tang, V. (1992) The Silverlake Project, New York: Oxford University Press. Bhushan, N. and Ria, K. (2004) Strategic Decision Making: Applying the Analytic Hierarchy Process, London: Springer-Verlag London Limited.

[3] Mohit Tyagi et al. Parametric selection of alternatives to improve performance of green supply chain management system XVIII Annual International Conference of the Society of Operations Management (SOM-14).

[4] Reninhard Hubner, (2007), "Strategic Supply Chain Management inProcess Industries: An Application of Research andDevelopment" Springer Science andBusiness Media, pp. 33-35.