

# Supplier assessment and screening for good environmental performance management e...



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**Abstract:-** Suppliers assessment is a critical function within supply chain management . Green supplier assessment is also necessary for sustainable supply chain management. The purpose of this paper is to evaluate supplier performance using different methods. Since Environment protection has been concern to public in recent years, and the traditional supplier selection did not consider about this factor therefore, this paper introduces green criteria into the framework of supplier selection criteria.

**Index Terms:-** Supply chain, Logistics.

## **Introduction:-**

Logistics, or supply chain management, describe the transport, storage and handling of products as they move along the chain from the raw material source, through the production system to their final point of sale or consumption.

However over the last 10 to 15 years environmental concerns have put companies under more and more pressure to address and reduce the environmental impact of their logistics operations. The adverse effects of distributing goods are diverse including impairing air quality, generating noise and vibration, causing accidents and contributing significantly to global warming. The effect of logistics and supply chain management on climate change has increased mainly because of the realisation that global warming presents a much greater and more immediate threat than previously thought. Freight transport is estimated to contribute roughly 8 per cent of energy-related CO<sub>2</sub> emissions worldwide (Kahn Ribeiro and Kobayashi,

2007), however, making logistics “ sustainable” in the longer term will involve more than just cutting carbon emissions.

Green Supply Chain Management (GSCM) is a fastest growing concept in developing countries and having its presence both in environment management and supply chain management literature. Adding the ‘ green’ dimension to supply chain management (SCM) involves addressing the influence and relationship between supply-chain management and the natural environment. Green supply chain management (GSCM) is generally understood to involve screening suppliers based on their environmental performance and doing business only with those that meet certain environmental regulations or standards. The green supply chain known at present refers to supply chain effect brought about by green products proposed by European Community in the 21st century.

Although the focus on green logistics seems to be a recent phenomena there has been different research initiatives conducted over the past 40 years which attempted to address the environmental concerns. McKinnon (2010) discuss these under the following headings:

### **Reducing freight transport externalities**

During the 1970s the focus, especially UK , was on ‘ lorries’ that were much noisier

And more polluting than is the case today. There was substantial growth of freight by

Road and efforts were put in place to rationalise this freight , tightening regulations

On Emission levels, etc. In this way there were general reduction in transport Externalities.

## **City Logistics**

Urban freight plays a vital role in th sustainable development of cities. There are,

However, many challenges facing urban freight transport, including high levels of

Traffic congestion, environmental impacts, high energy usage and labour problems

This has led to research to what is now City logistics, a process to optimise urban

Logistics within all different conditions that impact urban freight movements

(Taniguchi et al. 2001). The work in this area has led to modelling of city logistics,

Demand and supply models, impact models, vehicle routing and scheduling, etc. All of

These efforts contributed to addressing in the environmental issue.

## Reverse Logistics

In a world of limited resources, it becomes critical that products such as 'white goods'

(washing tubs, stoves, fridges, etc.) are recovered. This has led to the extension of

Logistics to include Reverse Logistics, which incorporates the flow of goods in both

Directions. This development has a strong element of waste management and

Sustainable development.

The green suppliers can be the biggest assets to the organization but poor choice can make them biggest liability also. This paper, thus deals with issues related to supply. For vendor selection different model is proposed to show procedure involved and steps in software 'super decisions' are shown using windows for easy understanding.

### Literature review:-

Green supplier management, has captured significant interest in the current literature (Lee et al., 2009; Hsu and Hu, 2009). Sphere of influence theory states that greening a supply chain is influenced greatly by focal companies that can effectively influence suppliers to engage in the GSC projects and act as better performers (Hall, 2001). Supplier selection is a multi-criteria problem which include analytic hierarchy process (AHP) (Akarte, (2001),

Chan (2003)), Fuzzy analytic hierarchy process (FAHP) (Kuo(2007), Kahraman (2003)), case based ANP (Bayazit (2006), Gurpinar(2007)). Evaluation criteria for the supplier selection, may be tangible (measurable) or intangible (immeasurable). The criteria for supplier evaluation and selection were first proposed by Dickson (1966), who identified 23 different criteria, including quality, on-time delivery, price, performance history, warranty policy, technical capability and financial stability, and so on. Weber, Current, and Benton (1991) surveyed the frequency of Dickson's 23 criteria and found that price, delivery, quality, and productive capability were mostly used to measure suppliers' performance. Quality is considered the most decisive criterion for supplier selection (Weber et al., 1991). However, quality in itself is not sufficient to ensure that the suppliers can avoid extra costs while offering the right quality.

From the literature we can develop a broad supplier assessment process model in the context of greening a supply chain that can be separated into three managerial decision phases: indentified suppliers, classifying criteria's and evaluating suppliers' based environmental performance, and select the best supplier.

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er many areas such as on-time delivery , qualitycause an understanding of a supplier'lity Procedure:- There are different methods of green supplier evaluation.

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## **Analytic Heirarchical Process:**

U. S. operations researcher A. L. Saaty put forward the Analytical Hierarchy Process (referred to as the AHP method) in the 1970s; it is a decision analysis method which combine the qualitative and quantitative. It is a process which make decision-makers' thought for a complex system modelling and quantitative. Applying this approach, decision-makers decompose the complex problem into a number of levels and a number of factors, through this way, make simple comparison and calculations between the factors, then we can get the weights of di↵erent programs, can provide the basis for the selection of the best option. As a tool combine the qualitative and quantitative, AHP has been widely used in many areas.

Application procedures of AHP are as follows:

Step 1 Con↵rming problems.

Step 2 Building hierarchy structure.

Step 3 Establishing multiple comparisons judgment matrix.

Step 4 Checking consistency.

The consistency index of judgment matrix is CI (Consistency Index). Its expression is:  $CI = \frac{\lambda_{max} - n}{n - 1}$

$n - 1$

And the greater the value of consistency index CI is, the greater the degree of the judgment matrix deviate from complete consistency will be; the smaller the value of CI is, the closer the judgment matrix and complete

consistency will be. Generally, the greater the order (n) of judgment matrix is, the greater the value of CI which shows the deviation from complete consistency caused by human will be; the smaller the n is, the smaller the value of CI which shows the deviation from complete consistency caused by human will be. In this paper, we use ANC to have consistency test.

Step 5 Total taxis of hierarchy.

Arranging weights which come from the factors in same level shows the relative importance of the top-level (overall objective); known as total taxis of hierarchy, this process is from high level to low level and step by step. The total taxis of hierarchy which come from the lowest level (program level) are the total order of all evaluation schemes.

### **Analytic Network Process:-**

The Analytic Network Process (ANP) developed by Thomas Saaty, in his work on multi criteria decision making. It applies network structures with dependence and feedback, among the criteria, to complex decision making. It is an extension of his Analytic Hierarchy Process (AHP) for decision making which involves breaking down a problem into its decision elements, arranging them in a hierarchical structure, making judgments on the relative importance of pairs of elements and synthesizing the results.

ANP is combination of two parts:

Network of criteria and sub criteria that control the interactions

The network of influences of elements and clusters

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Hierarchies in AHP do not represent relationship among the levels. This shortcoming is removed in ANP feedback approach. For example, in AHP, importance of criteria determines the importance of alternatives but does not represent importance of alternatives may have impact on importance of criteria. Therefore linear structure of top to bottom is not applicable for a complex system. A feedback system is represented by a network where nodes correspond to levels or components. The structural difference between AHP and ANP is shown in Figure 1. The nodes in a cluster (level) may influence some or all the nodes in another cluster. Relationships in a network are represented by arcs and direction of arcs signifies dependency. Interdependency between two clusters is shown by two way arcs and inner dependencies are represented by loop arcs.

Hierarchical (b) Network

(a) (b)

Figure 1: Structural Difference

There can be many control criteria and sub criteria, these can be classified into four merits, namely, Benefits, Opportunities, Costs and Risks. For each control criterion of these B, O, C, R, one derives the priorities for alternatives of the decision with respect to all the significant influences that cause some of the alternatives to have higher priorities. After rating the top ranked alternative for each B, O, C, R, resulting weights are combined for each alternative of each merit to obtain the final answer in the form of priorities

whose relative values are important in choosing the best alternative. Table 1 gives Saaty scale used for pair wise comparison matrix.

## **Table 1 : Saaty Scale Used For Pair Wise Comparison Matrix**

Intensity of Importance

Definition

1

Equal importance

3

Moderate importance of one over the other

5

Essential or strong importance

7

Very strong importance

9

Absolute importance

2, 4, 6, 8

Intermediate Values

Working of ANP: Supplier Selection: ANP - BOCR Analytic network model, with BOCR is prepared as shown in Figure 2. The pair wise comparison matrices were made by taking opinion of the team. Calculations were performed by Super Decision software. Ranks of the alternatives are obtained and suppliers are selected.

## **Supplier Selection**

**Risks**

**Costs**

**Opportunities**

**Benefits**

**OD**

**FS LS**

**FR CC**

**CD MBD**

**PC**

**LC ASC**

**SC**

**SD MC**

**EC**

**R PR**

**V1 V2 V3 V4**

**Figure 2: Network model**

**Table 2: Criteria for ANP**

Benefits

Opportunities

Costs

Risks

Response(R)

Supplier collaboration(SC)

Product cost(PC)

Order delays(OD)

Product Reliability(PR)

Supplier development(SD)

Logistics cost(LC)

Field return(FR)

Environmental Control(EC)

Increase in manufacture capacity(MC)

After sales cost(ASC)

Financial strength(FS)

Changes in demand(CD)

Labour strikes(LS)

Customer complaints(CC)

Machine break down(MBD)

**Conclusion:-**

In the current scenario of global operating conditions and competitive environment, it has become highly necessary for organizations to select the best Green supplier. Any inaccurate selection of Green supplier will affect the company's overall performance. This shows that supplier selection procedure is a highly essential decision making process for companies. This paper endeavour to utilise

AHP and ANP for ranking the potential suppliers and making the final selection.