

# Cognitive Parameters Based Supplier Agent Selection in Supply chain management

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## ABSTRACT

Multi agent systems (MAS) have been widely used by many researchers in the different applications of E-Commerce such as Supply chain management (SCM), negotiation and brokering. In this paper, we evaluate supplier agent's various cognitive parameters like adaptability, capability, reputation degree, commitment, efficiency, and trust, for selection of the best supplier agent. The selection of the best supplier from a large number of available suppliers will help organizations to increase their efficiency and this will help negotiation strategies to find out most profitable proposal by which both manufacturer and selected supplier can get profit. In this paper, a logical cognitive model is developed.

## General Terms

Supply chain management, Trust, Reputation degree.

## Keywords

Supply Chain Management (SCM), Agent, Negotiation.

## 1. INTRODUCTION

A supply chain is a network of facilities and distribution options that involves procurement of raw material from supplier, its transformation into finished products, then its delivery to distributors and finally to consumers or customers. As supply chain management involves the efficient integration of suppliers, manufacturers warehouses, transporters, retailers, and customers for distributing the right product at the right quantities, to the right locations, and at the right time, for minimizing system-wide costs while satisfying customer service level requirements. Hence, all these components of SCM are required to be very accurate. Selection of a suitable supplier in supply chain management will help organizations to increase their efficiency. By selecting best supplier from large number of available suppliers, organizations can outsource efficient suppliers for buying raw material. Also, since the very first step in supply chain activities is the procurement of raw material from the suppliers. If manufacturer is able to get raw material of the desired specification, he will be able to produce a final product of the specification given by the customer. In this way, suppliers play an important role in the success of an organization. Hence, selecting a suitable supplier will ultimately improve the performance of a supply chain management system.

Many researchers have deployed multi agent system for the selection of supplier but none of them have deployed cognitive parameters for the selection of supplier.

Fu-jiang *et al.* [1] did the empirical analysis of the supplier selection and integration effect on customer satisfaction and business performance. Yu *et al.* [2] have taken 2 parameters: reputation degree and risk for the initial selection of supplier

and then they applied time negotiation mechanism to maximize buyer's profit. Tahriri *et al.* [3] discussed about different supplier selection methods as well as their advantages and disadvantages. Wang *et al.* [4] used Rough Sets and Analytic Hierarchy Process for the selection of supplier. Sang and Qi. [5] used Analytic network process (ANP) to evaluate the performance of buyer-supplier relationship between the eco enterprises and its supplier. Mishra and Mazumdar [6] have taken cognitive parameters for the selection of seller agent in B2C E-Commerce. In this paper, supplier selection depends upon following cognitive parameters: adaptability, capability, reputation degree (R.D), commitment, efficiency and trust.

Organization of this paper is as follows: In section 2, description of three types of agents is given. In section 3, cognitive model for suitable supplier selection is presented. In section 4, implementation and result of the proposed model is presented. Section 5 includes the conclusion.

## 2. RESEARCH RATIONAL

In this model, there are three types of agents.

**1. Supplier Agent (Supplier):** Supplier agent is responsible for supplying the raw materials to the buyer agent.

**2. Intermediate agent (Broker):** Broker acts as an intermediiator between the supplier and the manufacturer. Intermediate agent helps the buyer agent to determine the most suitable supplier agent by identifying the need of the buyer agent and finally broker negotiates between buyer and supplier agent.

**3. Buyer agent (Manufacturer):** Buyer agent is one who wants to buy raw material from supplier.

## 3. PROPOSED METHOD

### 3.1 Cognitive Model

The adaptability, capability reputation degree, commitment, efficiency, and trust are the multiple attribute functions of suppliers. Cognitive parameters of supplier agents help buyer agent (manufacturer) to select best supplier agent. The above attributes are expressed in terms of logical parameters as follows:

1. Adaptability = <cost, capability, time>

$$(i) \text{Cost} = \frac{\text{cost incurred by supplier}}{\text{cost limited by buyer}}$$

$$(ii) \text{Capability} = \frac{\text{quantity delivered}}{\text{quantity demanded}}$$

$$(iii) \text{ Time} = \frac{\text{delivery time}}{\text{Deadline}}$$

2. Reputation degree is given by:

$$(R.D.) = \frac{\text{quality delivered}}{\text{quality demanded}}$$

3. Commitment = < shipment, pack size>

$$(i) \text{ Shipment} = \frac{\text{parts delivered}}{\text{items demanded}}$$

$$(ii) \text{ Pack size} = \frac{\text{size delivered}}{\text{size demanded}}$$

4. Efficiency = <adaptability, R.D., Commitment>

5. Trust = <efficiency, capability>

Levels will be assigned to each cognitive parameter of a supplier depending on the capability of the supplier. Three levels are used. High, Medium and Low.

### Qualitative composition rules

The composition of qualitative variables L, M, H is based upon the following rules:

**Rule 1:** If two qualitative variables are equal then their composition will be the same as that of the variable. For example:

$$L \oplus L = L, M \oplus M = M, H \oplus H = H.$$

**Rule 2:** If two qualitative variables are unequal then their composition will be equal to the greater level of the variable:

$$L \oplus M = M, L \oplus H = H, M \oplus H = H.$$

**Rule 3:** If the two qualitative variables differ by two levels then the composition level is the average level between the two levels. For example:  $H \oplus L = M$ .

## 4. IMPLEMENTATION AND RESULT

The pseudo-code given below is used for selecting the most suitable supplier, that is, supplier agent with maximum trust. According to the pseudo-code, numerical value of trust for five supplier agents fall in H, H, M, H, H. Using this searching technique, broker finds that supplier agents whose trust value is high. Supp1, Supp 2, Supp 4 and Supp5 have high trust logical value among given agents. The intermediate agent now searches the supplier agent with the highest logical value for all available cognitive parameters. Broker finds that Supp1 has all cognitive parameters in high logical range. Thus, Supp1 will be selected as best supplier agent for negotiating with buyer agent.

### Pseudo-code for the selection of Maximum Trust Supplier Agent:

Start.

Input ta(i), ta(j), n.

While (i<=n)

```
{
  If (ta(i)<ta(j) and ta(j)<=max_ta)
  {
    max_ta
  }
  Elseif (ta(i)<ta(j) and ta(j)>=max_ta)
  {
```

```
max_ta=ta(j)
}
Elseif (ta(i)>ta(j) and ta(j)>=max_ta)
{
  max_ta=ta(i)
}
Elseif (ta(i)=ta(j) and max_ta=ta(j))
{
  If (count_h_ta(i)>count_h_ta(j))
  {
    max_ta=ta(i)
  }
  Else
  {
    max_ta=ta(j)
  }
}
Else
{
  max_ta
}
Increment j by i+1 and i by i+1
}
Stop.
```

### Terms used in the pseudo-code:

**Input:** ta(i) is the trust agent of supplier agent i.

ta(j) is the trust agent of supplier agent j.

max\_ta is the maximum trust agent.

n is the total number of supplier agents.

**Output:** max\_ta is the maximum trust agent.

count\_h\_ta is used for counting high logical value of input agent.

Supplier	capability	Adaptability	R.D.	Commitment	Efficiency	Trust
Supp 1	H	H	H	H	H	H
Supp 2	M	H	H	M	H	H
Supp 3	L	M	M	M	M	M
Supp 4	M	H	H	H	H	H
Supp 5	L	L	H	M	H	H

Figure 1. Showing the output of selection of maximum Trust.

From above computation we find that, the supplier agent Supp1 has maximum trust as per Figure 1. So buyer agent selects supplier agent Supp1 for negotiation. The experiment has shown various communications between buyer and various supplier agents through intermediate agent and achieves maximum trust for supplier agent Supp1. Supp1 can effectively satisfy the buyer's need.

## 5. CONCLUSION

A lot of work has been done for the selection of supplier in supply chain management but none of the work deployed cognitive parameters. In this paper, cognitive parameters such as: adaptability, capability, reputation degree (R.D.), commitment, efficiency and trust are used for the selection of supplier. Various suppliers are evaluated on the basis of various cognitive parameters and supplier with the high value of these parameters is selected as the most suitable (trusted) supplier. Selection of a suitable supplier in supply chain management helps organizations to increase their efficiency.

## **6. REFERENCES**

- [1]. Fu-jiang, Ye-zhuang and Xiao-lin. 2006. "Empirical Analysis of the Effects of Supplier Selection and Integration on Customer Satisfaction and Business Performance". School of Management, Harbin Institute of Technology, China.
- [2]. Yu, Ying and Qiuyue. November 18-20, 2007. "An Approach of Supplier Selection Based on Multi-agents System". Nanjing, China.
- [3]. Tahriri, Osman, Ali and Mohd Yusuff. 2008. "A review of supplier selection methods in manufacturing industries". University of Putra Malaysia, Serdang.
- [4]. Wang, Ye and Li. 2010. "Supplier Selection Based on Rough Sets and Analytic Hierarchy Process". School of Information Science & Technology, Southwest Jiaotong University, China and Dept. of Computer Science and Technology, Nanchang Institute of Technology, China.
- [5]. Sang and Qi. 2010. "Empirical Analysis of the Performance Evaluation of Supplier Selection in Eco-Enterprises". School of Management, Shandong University of Technology, Zibo.
- [6]. Bhushan Mishra and Dass Mazumdar. 2011. "Cognitive Parameters Based Seller Agent Selection in B2C E-Commerce". Banaras Hindu University, India.