

Research on the Conflict Analysis of Supply Chain Management based on Graph Model with MRCR

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Abstract—In this research, the conflict problem in supply chain management is studied. The method of graph model is applied to solve the conflict problem in supply chain management, then based on the matrix form, the decision support system(MRCR) is used to make auxiliary decision, considering the uncertainty to select the strategy of decision makers in supply chain management. And an empirical analysis about the conflict problem is taken in YJ Nanjing Company's supply chain management. On the basis of the characteristics of YJ Company supply chain management, model is established, then, equilibrium point is obtained by MRCR, finally, make a decision to resolve the conflict after analysis.

Keywords- supply chain management, conflict, graph model, MRCR

I. INTRODUCTION

Supply chain management refers to using system management, operations research, management science, decision support systems, information technology and other science managing methods to plan, coordinate and control the information flow, logistics, capital flow, value flow in the supply chain. Owing to the differences in awareness and target, the providers often give priority to the realization of their own goals, then, severe conflict of supply chain management will happen when the external environment and internal resources of supply chain change.

Many authors studied the conflict problems in supply chain management. Based on the perspective of the causes of conflict, Jiling Hu, Qing Fang proposed that supply chain management conflict is "the inconsistent or opposite to each other in target ,interests and awareness among at least two supply chain node enterprises, thus leading to internal or external conflict, then further confrontation or clashes"^[1] .White oak Phil proposed that errors of forecasting and delivery has caused conflicts among supply chain members, and the bigger orders, the longer replenishment cycle, the more probability an error will occur, the more conflicts between manufacturers and retailers^[2]. Ravindra Krovi

believed that information viscous reflects the conflict degree of supply chain nodes, uncertainties associated with information viscous eventually led to the bull whip effect, which material piled up along the supply chain, leading to excess inventory^[3]. Xuesha nusing the method of graph model to make an empirical analysis of the conflict of technology transfer in the process of complex product development, calculated the equilibrium of the conflict, and provided the simulation of negotiation and consultation process between policy makers^[4]. Song Hua found non-mandatory power and trust benefit conflict resolution, promote cooperation between supply chain members and the development of supply chain alliance^[5]. Zhao wei introduced the graphic model of conflict analysis, analyzed actual situation and conflict equilibrium, focused on corresponding shortest path to achieve equilibrium^[6]. Kevin and Hipel divided the four basic equilibrium solution definition of graph model into a, b, c, d four kinds of circumstances, conflict analysis problem is fully discussed under the incomplete information and uncertain preference^[7]. Hamouda established a new three-level preference strength structure weak (better than, stronger than, weak strong than) instead of the original simple preference, and introduces three preferences in stability study, discuss the impact that the preference strength made on the equilibrium of the model.^[8]

II. TYPE STYLE AND FONTS

In supply chain management, there are many kinds of conflicts. Based on the impact, content and scope, the conflict of supply chain management can be classified. Firstly, it can be divided into constructive conflict and destructive conflict according to the conflict effects of supply chain conflict. Secondly, it can be divided into goal conflict, cognitive conflict, emotional conflict and procedures conflict according to the content of the conflict. Then, it can be divided into each enterprise internal conflicts, the same node conflict between enterprises and adjacent nodes conflict between enterprises in the supply chain. And there are four

main types of conflict in supply chain with manufacturers as the core, including: conflict between suppliers and suppliers; conflict between the suppliers and the manufacturer; conflict between dealers and dealers; conflict between dealers and manufacturers.

III. CONFLICT ANALYSIS GRAPH MODEL

A. Graph Model

Conflict analysis graph model is represented by $V = \{N, S, P, G\}$. Among, $N(N \geq 2)$ represents non-empty collection of all decision makers, each decision makers choose a strategy, and all strategy combinations form a state; S represents non-empty collection of all decision makers; P represents the preference information of decision makers; G represents state transition diagram. Apply graph model to solve the conflict, firstly, understand and describe reality conflict; secondly, abstract the reality of conflict as a mathematical model; then, seek a balanced solution of conflict after modeling and stability analysis of process. Modeling process includes identifying the conflict decision makers and strategies, analysis of possible States and state transitions and preferences information of decision makers. Stability analysis is mainly calculate individual stability and global stability^[9].

If there are N decision makers and S possible states in a graph model, the preference of decision makers i is encoded by preference relation $\{>i, \sim i\}$ of state S (such as, state s, q). “ $s >iq$ ” represents decision makers i prefers state s ; “ $s \sim iq$ ” represents decision makers i has the same preference to the two states. Generally, to each decision makers i , we assume that $>i$ is irreversible, $\sim i$ is reversible, but when the preference information is very difficult to obtain or not sure, there would cause problems, for example, bring about uncertainty preferences. So a new preference structure is proposed by some scholars, which is $\{>i, \sim i, U_i\}$, the meaning of $>I$ and $\sim I$ is consistent with simple preference structure, “ sU_iq ” represents decision makers i might tend to state s , also might tend to state q . sU_iq reflects that decision makers i is lack of the preference information of state s, q , or decision makers i don't want to make a comparison between two states. Preference uncertainty theory expands the application range of the existing method of graph model^[10]. Currently, MRCR system has realized the uncertain preference input, which makes the conflict decision analysis system more accurate on the analysis of the case model.

B. Stability Analysis in Graph Model

The main problem of the stability analysis is: whether a decision maker would choose to removed from one state where possible or not. So a steady state is that decision makers will not urge unilaterally to remove from this state. If all the decision makers achieve stability in a certain state point, the state is stable for all decision makers, and says the point is an equilibrium point. It is one solutions of the decisions conflict analysis.

According to the different decision-making style and background, there are four kinds of concepts about the

solutions in the stability analysis (i.e. stability definition), including: Nash, GMR, SMR and SEQ^[11]. GMR equilibrium includes the GMR、SEQ and Nash equilibrium. It shows that the stability of the Nash is the best, and the stability of the GMR is the weakest. In this paper, the stability analysis is mainly used under uncertain preference information. Based on uncertain preference structure, uncertain stability divides into the new four kinds of stability under four kinds of basic stability. With a, b, c, d on behalf of the four new form of stability definition, each basic stability can be divided into four kinds of circumstances, a total of 16 kinds.

IV. APPLICATION CASES

A. YJ Nanjing Company Profiles

In this case, YJ Nanjing Company supply chain management conflict is taken as a example. YJ Nanjing is a Company which produce car seats taken by JIT, it supplies for the major Nanjing local automotive manufacturers, Shanghai Volkswagen Company in Nanjing as one of the Company's major customers. Currently, the large suppliers of YJ companies mostly have established short warehouses in Nanjing in order to meet with JIT production requirements. This reduces both YJ Company site inventory, save inventory space and also improved controllability of the entire supply chain, reducing the out of stock due to incidents during transport.

Leather seating surfaces of YJ Nanjing Company are supplied by the Guoli Company, as Guoli set up no warehouse in Nanjing, in order to meet customer's supply, YJ had to set up more safety stocks, however, with Shanghai Volkswagen increasing production, YJ has been unable to provide so many venues. Every morning two cars arrive, it led to a lot of backlog, and leather jacket is often placed outside, products with damp or wet, causing difficulties in production. YJ presented that Guoli should set up warehouse in Nanjing, for cost reasons, Guoli have not yet replied. Because Guoli is specified sentinel providers, YJ hopes Shanghai Volkswagen can coordinated. SVW absolutely hope that YJ Company will meet its JIT production requirements, but if the two parties can coordinate by themselves and it will not want to intervene. This causes conflict.

B. Conflict graph model of supply chain management for YJ Nanjing

a) Decision Makers and Behaviors .

The YJ Nanjing Company's supply chain, there are three main decision makers: YJ Nanjing Company (DM1) 、Guoli Company (DM2) and Shanghai Volkswagen Company in Nanjing (DM3). Guoli as a sentinel providers of Shanghai Volkswagen, YJ Company cannot terminate cooperation; If Shanghai Volkswagen stops production as YJ Company failed to timely supply, YJ Company needs to bear the losses. Decision makers could take the three strategies as follows:

YJ Nanjing Company (DM1) :①Guoli set up short barge warehouse in Nanjing, and bear the relevant expenses;

②Guoli set up short barge warehouse in Nanjing, costs borne by the two companies of YJ and Guoli.

Guoli Company (DM2): ①Agreed to set up a short barge warehouse in Nanjing, bear the full cost;②Agreed to set up a short barge warehouse in Nanjing, bear the full cost with YJ;③Continue to delay time: Need to bear losses.

Shanghai Volkswagen Company in Nanjing (DM3): ① Negotiations with Guoli and promote the establishment of the warehouse, make the mass production is not affected;② Leave them solve itself.

They are based on its own interests:

If YJ Company in Nanjing is unable to keep up with the mass production, lead to stop line, it will be required to pay damages of \$7000 per minute. For not affect production, requirements to set up warehouse in Nanjing will not be changed.

Guoli Company: do not want to pay all the costs generated by short warehouses, while the losses could be huge problems. Hope YJ Company may be granted on the establishment and management of warehouse.

Shanghai Volkswagen Company in Nanjing: hope that the two parties can resolve the issue, the most important thing is not to affect their production.

b) States and States Transfer

YJ has two choices, Guoli has three, and Shanghai Volkswagen Company in Nanjing has two. For their own interests, when YJ chooses action 2 "Guoli set up short barge warehouse in Nanjing, costs borne by the two companies of YJ and Guoli", the Shanghai companies must not be selected 1 "Agreed to set up a short barge warehouse in Nanjing, bear the full cost". According to the all possible states, form (Table 1) is as follows:

TABLE I. AVAILABLE STATES

DM	ac	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
DM1	1	1	1	1	1	1	1	0	0	0	0
	2	0	0	0	0	0	0	1	1	1	1
DM2	1	1	1	0	0	0	0	0	0	0	0
	2	0	0	1	1	0	0	1	1	0	0
	3	0	0	0	0	1	1	0	0	1	1
DM3	1	1	0	0	0	1	0	1	0	1	0
	2	0	1	1	1	0	1	0	1	0	1

Originally $2 * 3 * 2 = 12$ state, excluding the two combinations: the YJ choice behavior of 2, Guoli choice behavior of 1, it is concluded that the above table of 10 different feasible conditions. state 1 means YJ and the Shanghai Company choose to set up short warehouse in Nanjing, fees paid by Guoli, Shanghai Volkswagen to promote conflict resolution. According to table 3.1 can conclude the state transition matrix (Ji refers to state transition matrix of DMi):

$$J1 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

c) Preferences and Graph Model

For DM1, it hopes that related fees shall be borne by the DM2, most do not want the DM2 to chose delay strategy, so the DM1 prefer 1, 2 more than 3, 4, 7, 8, and 3, 4, 7, 8 more than 5, 6, 9,10. At the same time, the DM1 surely hopes DM3 can take positive measures to solve the conflict, promote the establishment of the warehouse. Therefore, DM3 preference information is as follows:

DM1: S1>S2>S3>S4>S7>S8>S5>S6>S9>S10

For DM2, its preference is uncertain, from long term and short-term interests, there are different preferences.

For long-term interest considerations, DM2 will agree to establish short warehouses to promote supply chain management. DM2 preferences for three policies: 2>1>3. DM2 also hope the DM1 share the costs of the decision, and the DM3 could advance the settlement of the conflict. Therefore, under the long-term benefits, DM2 preference information is as follows:

DM2: S7>S8>S3>S4>S1>S2>S9>S10>S5>S6

For short term-interest considerations, DM2 does not agree to the establishment of short warehouse, it will give priority to adopt delaying tactics, followed by wish to bear the cost as little as possible. DM2 preferences for three policies: 3>2>1. Therefore, under the short term interests, DM2 preference information is as follows:DM2: S9>S10>S5>S6> S7>S8>S3>S4>S1>S2

To sum up, DM2 uncertain information is as follows:

DM2: S7>S8>S3>S4>S1>S2; S9>S10>S5>S6

For DM3, it more hope do nothing, and the two sides could agreed to establish Nanjing warehouse, ensure the normal production, but as a threat to its own interests, it will also take the appropriate action. If DM1 and DM2 can build warehouse, both of which bear the relevant expenses by either party, DM3 will be satisfied, as a result, DM3 preference is divided into two parts, one contains the preference of uncertainty, and the other part is a simple preference:

DM3 uncertain preference information: S8>S7; S2>S1.

DM3 simple preference: S4>S3>S10>S9>S6>S5

Although DM3 separate the two pieces of information to consider, but DM3 of S8, S7, S2, S1, preference is always greater than S4, S3, S10, S9, S6 and S5. DM3 preference to the latter point is fixed.

According to the state transition matrix of three decision makers J1, J2, J3 can get state transition diagram model (Figure1) as follows:

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