Supply Chain Management Research
Based on Data Mining

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Abstract: Applying data mining technology to find out hidden knowledge, relationship and trend from a huge amount of data information accumulated in the supply chain will help enterprises use the acquired knowledge to improve decision quality of supply chain management. Based on the discussion of data mining function and the problems in supply chain management, this paper analyzed the application of data mining technology as a whole and proposed methods and steps for the implementation of data mining technology in supply chain management.

Keywords: Data Mining; Supply Chain Management; Cooperation Partner

1 Introduction

The supply chain management is a powerful tool for an enterprise to lower costs, increase revenues, accelerate turnover and enhance core competency. However, it is well known that massive information has been generated and stored on every node of the whole supply chain, which is increasing tremendously like a snow slide. Confronting such massive information, it is difficult for an enterprise to find out the rules between suppliers and customers on the basis of its own business data, and then analyze and make decisions accordingly as before. Without a powerful tool for data analysis and processing, it is not possible for nodal enterprises in the supply chain to process the information in time, nor can they use the information to react quickly and correctly. If nodal enterprises fail to establish their own core competency, it will waken the whole supply chain [1]. As a new kind of information processing technology, data mining with its powerful function of data analysis and processing will play an important role in supply chain management.

2 Problems in Supply Chain Management

Supply chain management is an integrity of management thoughts and methods, which regards the supply chain as an organized whole with the same strategic objective in the entire chain. As a systematic management thought, it emphasizes the information sharing among members in the supply chain and their strategic partnership. However, there are many problems to be solved in supply chain management.

2.1 Mass Information to be Processed Duly in the Supply Chain

Every enterprise and its internal organizations in the supply chain have accumulated a great deal of historical information during previous development, who will also generate plenty of new information everyday. In order to cooperate better and meet the competition together, all enterprises in the supply chain have to collect massive information on competitors and exchange and share the information continually, which will also increase the traffic in the supply chain.

2.2 Risks in the Supply Chain

“Bullwhip Effect” will come into being because the “disruption” of any link in the supply chain may lead up to chain reaction of all enterprises, and a tiny mistake on any node may be magnified through the entire supply chain, which usually cause enormous losses to relevant enterprises that depend greatly on the supply chain [2]. It has been found that the dependence of enterprises on the supply chain has raised business risks.

2.3 Seamless Integration for All Enterprises in the Supply Chain

In modern market competition, the key is speed. Only when each nodal enterprise or organization in the system is integrated seamlessly, can it realize the benefit maximization on the basis of giving full play to their individual functions, so as to enhance the competency of the whole supply chain [3]. However, many of the so-called dynamic strategic alli-
ance established on the basis of supply chains is neither “dynamic”, nor a real “strategic alliance” due to various factors in the current supply chain management, such as the information of the enterprise, the cultural diversity, etc.

2.4 Reaction to Market in the Supply Chain

In modern market competition, the key is speed. Only when network systems are built among supply chains with the help of advanced communication technology and the rapid and powerful tools for information analysis and processing are applied, can supply chain management process relative information in time and then transfer the results to each nodal enterprise or organization rapidly and correctly, so that the enterprises can make rapid reaction to the market. Thus it will enhance the economic benefit of each enterprise or organization in the chain as well as the competency of the whole supply chain.

3 Applications of Data Mining in Supply Chain Management

In the following, the application of data mining in the supply chain will be analyzed as a whole.

3.1 Selection of Cooperation Partners

The principal problem for an enterprise to carry out supply chain management is to select cooperation partners. The enterprise can analyze all resources and historical data with the tool to determine its core competency and competitive strategy, and select its partners and the alliance pattern accordingly; then the enterprise can also analyze its upstream suppliers and their suppliers, downstream retailers and logistic services with the tool to find out their competitive strengths and individual characteristics, so as to select the best partners with the foregoing analytical results of its own characteristics as references [4].

3.2 Construction of Supply Chains

During the construction of supply chains, data mining can help the enterprise analyze its organizational structure, information flow, fund flow and logistics as well as those of its selected partners. It is inevitable to reconstruct the operation and data flows within the enterprise or among enterprises during the establishment of the supply chain. With the technique of variance analysis in data mining, the enterprise can analyze and process various data information to find out the existed problems in the flows, thus to lay a solid foundation for the construction of supply chains.

3.3 Timely Processing and Prediction of Mass Information in the Supply Chain

The problem in supply chain management, in the final analysis, is whether the information in the chain can be analyzed and processed in time and whether the acquired knowledge and decision information can be transferred to every nodal enterprise and organization without obstruction [5]. Data mining technology can search models in the database, quickly and automatically find out the models and useful information hidden in the data, and help users understand reasons and make predictions. The enterprise can analyze and process the massive relative data accumulated in the supply chain, such as logistics, information flow, fund flow, etc.

3.4 Risks Control for the Supply Chain

As the supply chain is basically a virtual enterprise system between enterprises and markets, various risks from all parties exist in the supply chain. Data mining can help extract their characteristics according to plenty of historical statistic information from each nodal enterprise or organization in the supply chain and make association analysis to provide an objective evaluation on these partners. The results will be demonstrated after induction and summary, so as to minimize the risks in the supply chain.

4 Implementation of Data Mining in Supply Chain Management

The implementation includes two aspects, one is the whole process for the construction of the supply chain management system, the other is how to give full play to the supply chain management with data mining after the system construction.

4.1 Construction of Supply Chain Management System with Data Mining

The process for the construction of supply chain management system with data mining is divided into the following several steps.

Step 1 Analyze competitive environment and identify market opportunity. Firstly, the enterprise needs to investigate and visit its suppliers, users, existing and potential competitors by means of modernized information collection to acquire accurate first-hand data and information. Then the en-
The enterprise makes a thorough and deep analysis on the data and information with data mining tools and identifies different opportunities in the market quickly and correctly.

Step 2 Analyze customer needs and expectations. The enterprise analyzes and processes the collected historical information of customers with data mining and predicts their needs and expectations. From the viewpoint of customer needs, the enterprise defines its products and service, and seeks for the methods of lowering transaction costs on the basis of satisfying customer needs.

Step 3 Analyze core competencies and determine competitive strategy. Before the construction of the supply chain, the enterprise must analyze plenty of historical statistic information from internal and external environment through functions of data mining tools, such as association analysis, clustering analysis, concept/class description, etc. and then determine its core competency based on the consideration of various factors and provide decision makers with different competitive strategies that are applicable to the enterprise.

Step 4 Select cooperation partners. It is based on the foregoing analysis of the enterprise’s core competency and competitive strategy. When an enterprise decides to adopt the overall cost leadership and focus strategies, it will ally with enterprises that possess similar resources to pursue economies of scale; and when an enterprise decides to adopt differentiation strategy, it will usually select those enterprises with strong innovative and adaptive abilities as its partners.

Step 5 Construct the supply chain. The enterprise will start the construction of the supply chain management system after selecting cooperation partners, determining competitive strategy, analyzing customer needs and expectations, and grasping characteristics of itself and partners as well.

4.2 Implementation of Data Mining in Supply Chain Management

The supply chain management system based on data mining is shown as Figure 1.

In the supply chain management system, the steps for the implementation of data mining are as follows:

Step 1 Data preparation. In the supply chain management, data preparation includes two phases: data collection and data pre-processing.

The primary task for this step is to know about the operation requirements and the objectives to be achieved in the supply chain management, evaluate the feasibility of the project and define problems and users; then collect relevant data on this basis. The supply chain management involves the information of each nodal enterprise or organization in the entire chain as well as the information of customers and the industrial background of the enterprise, so great attention should be paid to the timely, extensive and comprehensive collection during the process.

The data from nodal enterprises and customers in the supply chain and the industrial background of the enterprise collected in the prior phase are inevitable to be exposed to this or that kind of quality problems. The pre-processing of data includes processes of browsing, verifying, selecting, integrating and transferring, which will help improve data quality, reduce data dimension and generate an appropriate data set for mining.

Step 2 Data mining. In this step, the data set generated during the data preparation will be mined with the tools and the knowledge and models hidden behind the massive data relevant to the supply chain will be discovered, so as to provide a better information and knowledge support for the supply chain management of the enterprise. This is the key link in the whole supply chain management.

When mining data in the supply chain management, it deserves attention that the data mined refers to all the data collected in the first step, and the generation of the knowledge base for alternating between data mining and on-line analysis processing...
is composed of industrial knowledge, expert knowledge and the knowledge accumulated by all enterprises in the supply chain.

Step 3 Application of data mining results. How to provide the results discovered by data mining and on-line analysis processing to the users? How can the users understand these results better? The problems of human-machine interface means utilizing database development technology and visual technology. The users in the supply chain management include both of core enterprises in the chain and the upstream suppliers and the downstream retailers [6]. Moreover, the supply chain management puts emphasis on the rapid share of mining results, so that each nodal enterprise in the supply chain can receive timely results and make corresponding reaction quickly. It is an important information guarantee for the whole supply chain to accelerate logistic distribution, reduce inventory, lower costs and enhance competency of the whole chain.

5 Conclusions

Data mining is a multi-disciplinary field, which derives nourishment from database technology, artificial intelligence, machine learning, neural net, statistics, pattern repository system, knowledge acquisition, information extraction, high performance computing, digital and visual technology, etc. With the continuous development of supply chain management, the application of data mining and the discovery of hidden situation, trend and relationship from massive data will help the enterprises in the chain to improve decision quality and the efficiency of the supply chain management with the acquired knowledge, so as to build competitive strengths of the supply chain.

References