



## A study of using RST to create the supplier selection model and decision-making rules

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### ABSTRACT

Building the model of supplier selection is a critical role to improve competitiveness and business process. The purpose of this study was to build a model of supplier selection to better encourage organizational capability and competitiveness and apply the model to solve practical problems. After literature reviewing, this study chooses the critical criteria for supplier evaluation and then develops the questionnaire which differentiates class 1 (excellent firms), class 2 (common firms), and class 3 (disappointed firms) from suppliers to evaluate by participants. And next step was to use rough set theory (RST) to analyze the rules of supplier selection. After attributes reduct and core, the decision-making rules could be created by the supplier selection model. In the future, the model and rules may assist procurement personnel or manager responsible for supplier selection to execute relevant policies. The model can also be readjusted in order to accord with actual needs and changes in the competitive environment.

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### 1. Introduction

With competition intensifying of global market, the distance between product quality and performance becomes shorter gradually. This situation arouses attention from scholars and industries and facilitates them to reflect on how to manage the enterprise operation more effectively and more efficiently (Sarmah, Acharya, & Goyal, 2006).

Supply chain (SC) refers to an organizational network which conveys the values of product and service to customer through different procedures and activities. While supply chain management (SCM) indicates a method to design, manage and control supply chain by integrating orientation through procedure. The main goal of SCM is to create value by promoting customer service and decreasing cost. From view of enterprise organization, SCM is a new management method to upgrade the supplier relationship to suppliant chain partnership. When referring to the tendency of primary supplier relation management in current supplicant management, it transfers the supplier from arm's length relationship to strategic partnership of collaboration. Through share of risk and benefit, exchange of production work and financial information, investment of plant equipment and system, performance promo-

tion and new product development, the members in the supply chain help each other successfully (Albino, Carbonara, & Giannoccaro, 2007).

For practice of supply chain, however, not every activity in supply chain can be solved perfectly. In researches on global supply chain, Stratton and Warburton (2006) have mentioned a trade-off relationship between low cost and rapid response in supply chain activity. With the increase in global market competition and customer expectation, it is impossible for enterprise to extricate itself from predicament unless it pays more attention to supply chain running. Therefore, how to discover and solve the problems in supply chain management has special significance.

When referring to recent researches of supply chain management, however, many of them solve the practice problem in supply chain with mathematical model. For example, Canakoglu and Bilgic (2007) focus on communication industry to deduce how many resources we shall cast into product development and technology research in supply chain. In such case, it can optimize the benefits for members in supply chain. Under Markov model, Kurata and Liou (2007) put forward the best promotion plan for retail dealers in supply chain. While Tempelmeier (2006) and Jain (2007) apply mathematical model to calculate the optimum allocation of product manufacturing and stock in supply chain when there are different requirements of customers. Surely, there are other subjects that are applied frequently in the literatures of previous years and recent years, such as production scheduling problem (Lin, Cheng, & Chou, 2007), demand forecasting (Aburto & Weber, 2007), planned best customer order lead time (Choi, Bai, Geunes,

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& Romeijn, 2007), production and inventory management (Boute, Disney, Lambrecht, & Van-Houdt, 2007; Schwartz, Wang, & Rivera, 2006), and material cost management (Tsai, 2007), etc.

The supplier selection is one key point for establishing the supply chain, but there are various factors that affect supplier selection. Moreover, it is a complicated course with several aspects. Generally speaking, the enterprise operators cannot make decision directly but set up a systemized model to make accurate selection by applying effective decision-making tool. On the basis of previous researches on supplier selection (Andrabi, Ghatak, & Khwaja, 2006; Chan, 2003; Handfield, Walton, Sroufe, & Melnyk, 2002; Jayaraman, Srivastava, & Benton, 1999; Kauffman & Popkowski Leszczyc, 2005; Moller & Torronen, 2003; Verma & Pullman, 1998), there are various methods that can assist evaluation procedure going justly and objectively. Then, we have a decision-making basis for final judgment.

Hereby, this research aims to develop a selection model for supplier primarily. It adopts rough set theory (RST) as main analysis method for enterprise to find the optimum supplier partner quickly and accurately in the designing and organizing of supply chain. In the second part of text, it does literature exploration on SCM, supplier selection and RST, etc. The third section focuses on the interpretation of research method, procedure and data source. The fourth section explains analysis content and result. According to analysis results, the fifth section performs exploration practically and theoretically and then put forward suggestions.

## 2. Literature review

The subjects and practices on SCM have flourished since 1990s. Some enterprises have realized that a large amount of direct and indirect profits can be generated from effective and efficient supply chain management, such as cost decrease, delivery performance promotion, and technology acquirement, etc. From late 1980s to early 1990s, the economic environment forces enterprise to face global market competition with greater competitive capability. In order to promote competitive ability, the enterprise must have better production technology internally and externally, such as supplier capability and customer requirement. For upgrading the supply chain to the level of rapid response to fit dog-eat-dog environment, the enterprise must have rapid and effective communication with its supplier. Generally, the enterprise must change its attitude toward supplier from enemy to partner. The supplier is not the cost but a resource for enterprise (Cousins & Menguc, 2006).

In short, the supply chain management is an essential enterprise activity of supply chain management under global competition. The successful supply chain management must focus on several subjects, such as supplier selection and relationship management, information technology application, internal and external integration of supply chain, etc. The following paragraphs will explore the important literatures according to the points above, so as to complete the research frame more systematically.

### 2.1. SCM

SCM can apply integral systematical model to control information flow, raw material and service of enterprise so as to satisfy the requirement of customer. This argument is derived from basic theory of enterprise management field. Traditionally, the manager attaches great importance on management of internal operation to promote profits. What SCM emphasizes, however, is to integrate internal activity and decision with external partner of enterprise, so as to promote enterprise competitive capability (Li & Wang, 2007).

In recent 20 years, the supply chain management attracts more and more attention from academic circles. Therefore, there appear many important knowledge and theories. In view of pervasive development of SCM, it witnesses increasing number of participators, academic publications, seminars, professional development plans, and school courses. The research participators adjust constantly or create various technologies to assist the implantation of supply chain management, so as to promote implementation performance of enterprise. Either private enterprises or listed companies have recognized that good SCM can bring them to success (Cousins, Lawson, & Squire, 2006). SCM, with a comprehensive range, can be divided into various functional fields for enterprise according to expertise, such as purchase, operational management, information technology, and marketing (Burgess, Singh, & Koroglu, 2006).

Some relevant literature of SCM tendency has pointed out that SCM has transferred itself from competition model to collaborative running model, so the application tools for supplier selection are developed prosperously. Since it aims to enhance efficiency and performance of supplier management, the SCM integration and partnership cultivation with supplier seem very important. In terms of practical implementation of supply chain, it requires cross-functional integration within enterprise as well as external integration of supplier and customer outside if we want to promote relevant performances into a predominant degree such as cost, quality, flexibility, and delivery performance (Kim, 2006).

It is recognized by many enterprises that good supplier can enable the enterprise to concentrate on its core competitive capability. On one hand, it decreases cost and shortens product development period. On the other hand, it increases product quality. According to different contract content, contract period, information exchange type, price combination, or delivery schedule, etc., the relation between enterprise and supplier falls into following types: vendor, preferred supplier, exclusive supplier and partner (Tang, 2006).

Therefore, the sound supply chain relation can bring many positive benefits for enterprise. The supply relationship is a strategic task that does contributions to competitive capability of a manufacturer or integral supply chain and profit-making capability. The supply relationship management contains several aspects such as production integration degree, information exchange degree, and even working condition management of supplier employee (Locke & Romis, 2007).

Not only can external integration development of supply chain promote product schedule performance in large-scale, but it will promote more remarkably when the internal integration combines internal group members with external customers and suppliers to enhance mutual recognition on product prospect (Tessarolo, 2007).

The improper management of supply chain relationship will result in some direct or indirect bad effects. For example, in wholesale or retail market, the manufacturer faces different marginal cost and uncertain situation, so the manufacturer will maximize the profit through strategic decision rather than optimum profit of integral channel. Hence, the retail dealer will price the product higher, order product of smaller quantity, or serve fewer customer (Lee & Rhee, 2007).

In a word, the supplier selection has a great impact on the integration degree of supply chain relationship. The improper management of supply chain relationship will affect SCM effect directly. Hence, this research expects to solve the problem and promote SCM performance through good supplier selection performance by means of quantity method.

### 2.2. Supplier selection

The supplier differentiation refers to the differences derived from some characteristics among suppliers, such as organiza-

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