ISSN:0975-9646

Data mining and the News Boy Model in B2B E-Commerce Supply Chain

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Abstract— In recent years, with high speed development of internet and rise of B2B e-commerce. In such situation it is necessary to cope with resource allocation, dynamic order, flexible pricing, market scheduling. Hence the paper would include different types of model in B2B and news boy model.

Keywords— Data mining, B2B, E-commerce, market analysis, B2C, newsboy model, supply chain.

I. INTRODUCTION

In day to day life business as well as market competition is increasing. Because of that the commercial environment and enterprise organization structure is more and more complex and enterprise management is professional in a higher and higher degree. Especially in manufacturing, life cycle of product is becoming shorter and shorter, and division of labour of the product value-added chain is more and more detailed, and different enterprises is participate in the procurement, logistics, product sales and other activities. In the distributed production and business market environment, enterprises are demanded to response quickly and make decisions correctly in resource allocation, dynamic order, flexible pricing, market scheduling and other problems. Supply chain management is across every stage from purchasing of raw material to delivery of finished product, involving product and process design, supply, production planning and inventory planning and internal and external logistics planning and other aspects of the management decision problems.

Supply management refers to under the condition that meet a certain level of customer service, effectively organize suppliers, manufacturers, warehouses, distribution centers and channel partners together to carry out product manufacturing, transport, distribution and sales management, in order to make the entire supply chain system cost minimum.

B2B is marketing relationship between enterprise and enterprise. E-commerce is a specific main form of modern B2B. B2B promotes many things in varying degree, such as enhancement of enterprise sales, decrease of operating costs, efficiency of cash flow, customer satisfaction, inventory management and visualization of material transportation state. Online supply chain management based on B2B has become an important research content in decision-making in the network times.

Online marketplaces are among the most prominent and faster growing markets on the internet. The internet has become a new market channel for goods and services that fosters innovative market structures and novel approaches to commerce [1].

II. DATA MINING

Data mining is a new information technology, which appears with the development of database and artificial intelligence technology. Data mining is the process that discovering significant new relational patterns and trends through exploring large amount of data in the data warehouse.

Through mining the customer access information, they can know customers' browsing behaviour, thereby identifying loyalty, preferences and satisfaction of the user and understanding the customer's interests and needs.

Presently, there are many applications of data mining in the electronic commerce.

For example through the browsing behaviour of business website reflecting the user’s interest and purchase intention, and finding potential customers.

By grouping the customers with similar browsing behaviour and anglicizing customers’ common characteristics, the organizers of electronic commerce can understand their customers better, adjust pages and content of pages timely so that business activity can meet customer requirements to a certain extent, and provide customers with more suitable and more humanized service to make business activities to customers and dealers more meaningful.

A. Data Mining Methods

Data mining is used to build six types of models aimed at solving business problems:

1) *Classification:* A predictive model is generated based on the historical data. These models are used to assign instances to a group or class by calculating the value of a categorical variable. The value of this categorical variable is generally binary in nature. It can include multiple but discrete values.
2) *Regression:* Regression is used to predict values for categorical variables. The values are continuous, real numbers, i.e., it has decimal values, and it has no fixed range in which the values of the variables are fitted.
3) *Time-series forecasting***:** This method uses a series of existing values and their attributes to forecast future values, except that the values of the categorical variables are dependent on time. Using various data-mining tools, the distinctive features of time can be exploited.
4) *Clustering:* Clustering is used to segment a database into clusters, with the members of each cluster sharing a number of interesting properties. These clusters are not predefined and have two basic uses: 1) summarizing the contents of the target databases; and

2) as inputs to the other methods like supervised learning.

5) *Association:* Association is used to describe behavior that is captured in the database. This method relates the occurrences of various events by identifying patterns or groups of items.

6) *Sequencing:* Sequencing defines items that are likely to occur together on a sequence basis. This could help marketers in timing their promotions to correlate with the sequential buying order exhibited by their customers [2].

III. TYPES OF MODEL OF B2B

A. *Merchant models:*

Merchant models allow traditional wholesalers to sell their goods and services via the internet based on list prices or through auctions (Hardaker & Graham 2001; Afuah & Tucci 2000). These models are initiated by wholesalers and usually evolve from a traditional "bricks-and-mortar" storefront that seeks to establish a new distribution or marketing channel via the internet. The merchant model most relevant to B2B e-commerce is the online storefront model which is usually operated by wholesalers and retailers over the internet and allows the provision of updated information on products and services while having the ability to instigate immediate business transactions (Rappa 2001; Timmers 1998). In addition, this model also provides customer support and includes the marketing of products and services that are being offered with minimal costs incurred in sales and promotion (Lawrence et al. 2000; Timmer1998).

B. *Manufacturer model:*

The manufacturer model permits manufacturers to reach buyers directly through the internet, hence eliminating middlemen and shortening the distribution channel. This results in improved efficiency, better customer service, a better understanding of customers' (business buyers) preferences and the ability to reach a larger customer base (Afuah & Tucci 2000; Rappa 2001). Furthermore, this model is supplier centric in nature and involves a major supplier providing its products or services to potential buyers (usually large in size) via the internet (Chan 2000).
However, this model has the potential for creating conflicts within a manufacturer's supply chain because buyers can bypass the middlemen to conduct business activities directly with the manufacturer (Afuah & Tucci 2000; Rappa 2001). This action causes disintermediation, where the service and support from middlemen is no longer required.

C. *Buy-side model:*

A buy-side model is buyer centric in nature and it refers to a major buyer seeking products or services from potential suppliers (usually large in size) via the internet (Chan 2000; Kippola 2000). This model encourages potential suppliers to initiate business relationships or transactions by approaching the buyer in the hope of providing them with the required products or services (Chan 2000). In addition, this model has not only enabled buyers to reduce their costs with the ability to view the list of products or services being offered to them, but has also enhanced customer relationship management through the acquisition of prompt replies or responses from suppliers (Chan 2000).

D. *Brokerage models:*

Brokerage models refer to central hubs that bring together buyers and sellers for transactions, where each is charged a fee for each transaction completed (Rappa 2001; Hardaker & Graham 2001). Brokerage models involved in B2B e-commerce are the e-speculator model, the procurement portal model (buyer aggregator), the specialist originator model, the distributor model (distribution portal), the sell-side asset exchange model, the mega-exchange model (independent marketplace) and the solution provider model [4].

Advantage of Newsboy model:

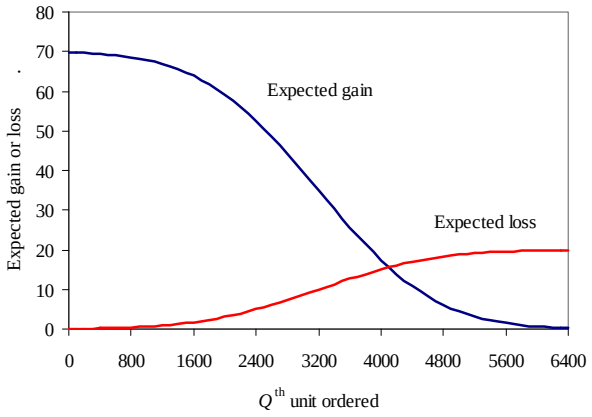
1. *If order quantity is known then it maximizes expected profit.*
   C_o = overage cost
   The cost of ordering one more unit than what you would have ordered had you known demand. In other words, suppose you had left over inventory (i.e., you over ordered). C_o is the increase in profit you would have enjoyed had you ordered one fewer unit.
   C_o = Cost – Salvage value
   C_u = underage cost
   The cost of ordering one fewer unit than what you would have ordered had you known demand. In other words, suppose you had lost sales (i.e., you under ordered). C_u is the increase in profit you would have enjoyed had you ordered one more unit.
   C_u = Price – Cost

2. *Balancing the risk and benefit of ordering unit.*
   Ordering one more unit increases the chance of overage …
   Expected loss on the Q^{th} (+1) unit = C_o x $F(Q)$
   $F(Q)$ = Distribution function of demand = $Prob\{Demand <= Q\}$
… but the benefit/gain of ordering one more unit is the reduction in the chance of underage:
   Expected gain on the Q^{th} (+1) unit = C_u x (1-$F(Q)$)
   From fig 1 As more units are ordered, the expected benefit from ordering one unit decreases while the expected loss of ordering one more unit increases.

3. *Expected profit maximizing order quantity.*
   To maximize expected profit order Q units so that the expected loss on the Q^{th} unit equals the expected gain on the Q^{th} unit:
   Rearrange terms in the above equation ->
   The ratio $C_u / (C_o + C_u)$ is called the *critical ratio*.
   Hence, to maximize profit, choose Q such that we don't have lost sales (i.e., demand is Q or lower) with a probability that equals the critical ratio

4. *It increases the performance [5].*

Fig no 1:Example of Balancing the risk and benefit of ordering unit.



Disadvantage of Newsboy model:

The newsvendor problem is a one-time business decision that occurs in many different business contexts such as:

1) *Buying seasonal goods for a retailer* – Retailers have to buy seasonal goods (sometimes called style goods) once per season. (A "season" can be a day, week, year, etc.) For example, most swimsuits can only be purchased seasonally. If a buyer orders too few swimsuits, the retailer will have lost sales and dissatisfied customers. If the buyer orders too many swimsuits, the retailer will have to sell them at a clearance price or even throw some away. Gupta, Hill, and Bouzdine-Chameeva (2006) extend the newsvendor model to handle multiple seasons (periods), each with a different price elasticity of demand.
2) *Making the last buy or last production run decision* – Manufacturers have to make a last buy (or last production run) for a product (or component) that is near the end of its life cycle. If the order size is too small, the firm will have stockouts and disappointed customers. If the order size is too large, the firm will only be able to sell the items for their salvage value. Hill, Giard, and Mabert (1989) considered a similar problem within the context of selecting a "keep" quantity for an aging service parts inventory.
3) *Setting safety stock levels* – A distributor has to set the safety stock level for an item. If the safety stock is too low, stockouts will occur. If safety stock is too high, the firm has too much carrying cost. Nearly all safety stock models are newsvendor problems with the selling season being one order cycle or one review period.
4) *Setting target inventory levels* – A salesperson carries inventory in the trunk of a vehicle. The inventory is controlled by a target inventory level. If the target is too low, stockouts will occur. If the target is too high, the salesperson will have too much carrying cost.
5) *Selecting the right capacity for a facility or machine* – If the capacity of a factory or a machine over the planning horizon is set too low, stockouts will occur. If capacity is set too high, the capital costs will be too high.
6) *Overbooking customers* – If an airline overbooks too many passengers, it incurs the cost of giving away free tickets to inconvenienced passengers. If the airline does not overbook enough seats, it incurs an opportunity cost of lost revenue from flying with empty seats [6].

V. Data Mining Used In B2B And Newsboy Model

There are some prediction models now, such as attenuation model, Box and Jenkins model based on the index, neural network and fuzzy system models. Because the sales data affected by many factors, such as macro-economic environment at home and abroad, seasonal characteristics of products, advertising investment, consumption habits and climate, sales prediction is more difficult. The paper applied the under methods to predict market demands.

1. *Clustering* [2]: Processing sales data by clustering.
   - Gather economic inputs:
   – Selling price, production/procurement cost, salvage value of inventory
2. *Classification* [3]: Distinguishing characteristics of the data that mining from different groups, commonly used methods include decision tree, neural network and the Bayesian network and C5.0.
   - Generate a demand model:
   – Use empirical demand distribution or choose a standard distribution function to represent demand, e.g. the normal distribution, the Poisson distribution.
   - Choose an objective:
   – E.g. maximize expected profit or satisfy a fill rate constraint.
   - Choose a quantity to order.
3. *Curve fitting*: Three spline curve fitting [1].

VI. Conclusion

This paper first reviews the development of modern supply chain technology and introduces data mining technology: 1) Clustering analysis method and the decision tree classification method. 2) Next, based on the theoretical anglicizing of the newsboy model combining with probability distribution function and probability density function, pricing and production model of B2B manufacturers combining with sales curve is studied. Finally, according to all kinds of apparel commodity sales record are used for experiment, and the result is good.

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