# Quick Response Merchandising With Products Demand Structure In the Business to Business Electronic Commerce

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**Abstract**

Customers' demand changes continuously. Especially in BTB Electronic Commerce environment, customers' demand may become very diverse and change rapidly and companies should adapts to the change of customers' demands quickly in order to success. But traditional forecasting methods are usually based on past data and we can't chase the change of customers' demand. In this paper, we suggest a new method for analyzing customers' present needs rapidly using demanding product profiles that are from buying agents of customers and by the methods we can get Product Demand Structure. With Product Demand Structure companies can reflect change of customers' demand very quickly in merchandising including coordinating production, marketing, developing advertising, etc. so that they can success in BTB Electronic Commerce.

## 1. Introduction

In 1990's, Rapid development of computer technology and an great increase in population using Internet are the motive of enormous growth of electronic commerce. Specially, WWW (World Wide Web) is becoming an important channel for BTC (business-to-customer) transactions as well as BTB (business-to-business) transactions.

Customers' demand changes continuously. Especially in BTB Electronic Commerce environment, customers' demand may become very diverse and change rapidly. To success in BTB Electronic Commerce environment, a company should adapts to the change of customers' demands rapidly. In this stage, demand forecasting is most important. But because traditional forecasting methods are usually based on past data, they have problems that we can't grasp customers' demand accurately and especially that customers leaving empty-handed, which are not recorded in past data, are not considered in analyzing customers' demand. So companies depending on traditional forecasting methods may fail in the competition because they can't satisfy customers needs and customers would not return to the companies.

Companies have to minimize empty-handed customers in order not to lose their customers and minimize products which are not on demand in order to reduce costs. For that purpose, we must grasp customers demand at present accurately and rapidly and respond to the demand quickly. In this paper, we suggest a new method for analyzing customers' present needs rapidly using *demanding product profiles* that are from buying agents of customers in BTB EC environment and reflect customers' present needs. A new scoring method used for putting a demanding rate on each product is proposed and artificial intelligence tools such as SOM(self-organizing map) and C5.0 are used for building Products Demand Structure which are useful and necessary for merchandising which includes coordinating production, marketing, developing advertising, etc.

## 2. Literature Review

### 2.1 Agent-Based Virtual Marketplace

Agents support the buying and selling of products and services in the Internet for their users [Chavez and Maes, 1996] and the agent-based marketplaces are an extended concept for the support of the use in the buying or selling of products

and services in the Internet.[Brenner et al, 1998]. The agent-based architecture for electronic commerce allows the creation of a virtual marketplace in which a number of autonomous or semi-autonomous agent trade goods [Zarnekow et al. 1996]. In the agent-based virtual marketplace, buying- and selling- agents communicate and negotiate with each other instead of buyers and sellers. The buying-agent collects information about a number of products and presents its conclusions to the buyer. If the buyer is interested in purchasing the product the buying-agent contacts the selling agent and start the negotiate process [Zarnekow et al. 1996].

But in order to implement the agent-based virtual marketplace, a number of interfaces such as interface of buying- and selling- agents, directory of goods, etc. have to be specified and standardized [Zarnekow et al. 1996].

### 2.2 Demand Forecasting

The aim of demand forecasting is to estimate the amount of product and accompanying service that customers will require at some point in the future by using subjective analyses and/or conducting scientific statistical studies on the relevant historical data of the product [Stock & Lambert, 1987; Lo, 1994]. Traditional forecasting techniques can be grouped into three categories – Qualitative methods, time series methods, and casual methods [Korpela & Tuominen, 1996]. But these methods have inherent problems. They includes a few explanatory variables and don't consider developing new relationships among variables and possible changes in trends. And traditional forecasting methods assume that the dimension on which prediction takes place is autonomous and are based on past data. Moreover, they are both deterministic and structurally stable leading to error in forecasting [Korpela & Tuominen, 1996].

## 3. Quick Response Merchandising with Products Demand Structure

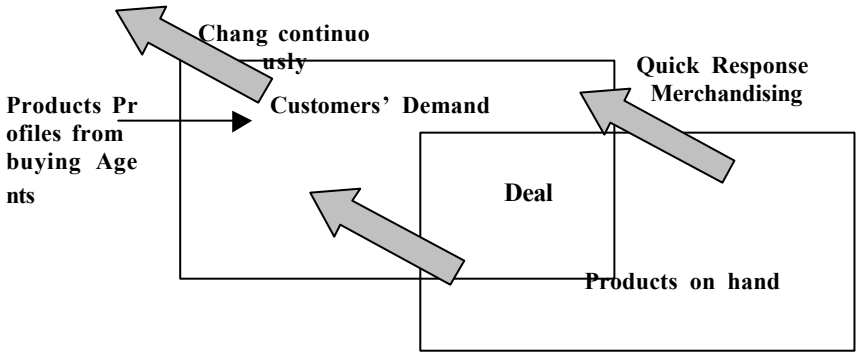


**Fig. 1 Quick Response Product in Electronic Commerce**

In electronic commerce, customers search products which they want to buy using buying agents. Customer gives demanding product profile to buying agent and the buying agent search products meeting the profile. The demanding product profiles may include style, color, size, material, etc. of product. Buying agents decide to buy products when there are the wanted ones. But if there are not the wanted ones, buying agents leave the company with empty handed. Hence companies should predict the customers' demand and maintain products which customers want and dispose of ones which are not demanded so that adapt their products on hand to customers' present demand quickly and accurately.

The demanding product profiles from buying agents show the most recent customers' demand very exactly. So if we utilize the profiles, we can grasp the customers' needs very quickly. In this chapter, We propose a method for constructing Products Demand Structure, which gives useful hint for merchandising processes such as coordinating production and marketing and developing advertising, display, and sales strategies, from demanding products profiles. Figure 2 is the process of building Product Demand Strcuture.

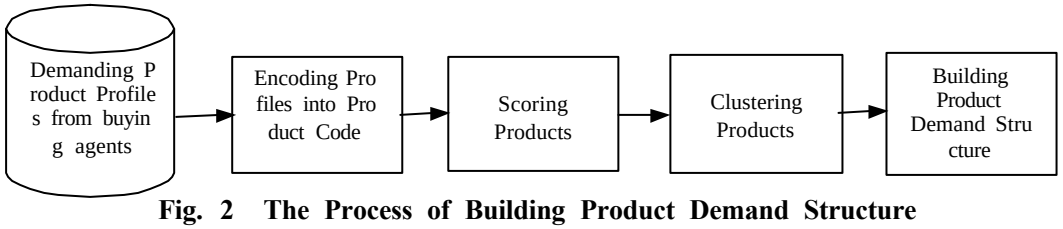


**Fig. 2 The Process of Building Product Demand Structure**

### 3.1 Encoding Demand Product Profile into Product Code

The demanding product profiles are not represented in a standard product code form. The profiles just present outlines of products needed by customers. Hence in order to use the profiles in next step, we must encode the profiles into a standard product code. Figure 3 shows an example of product code structure of 'Sunglass'.

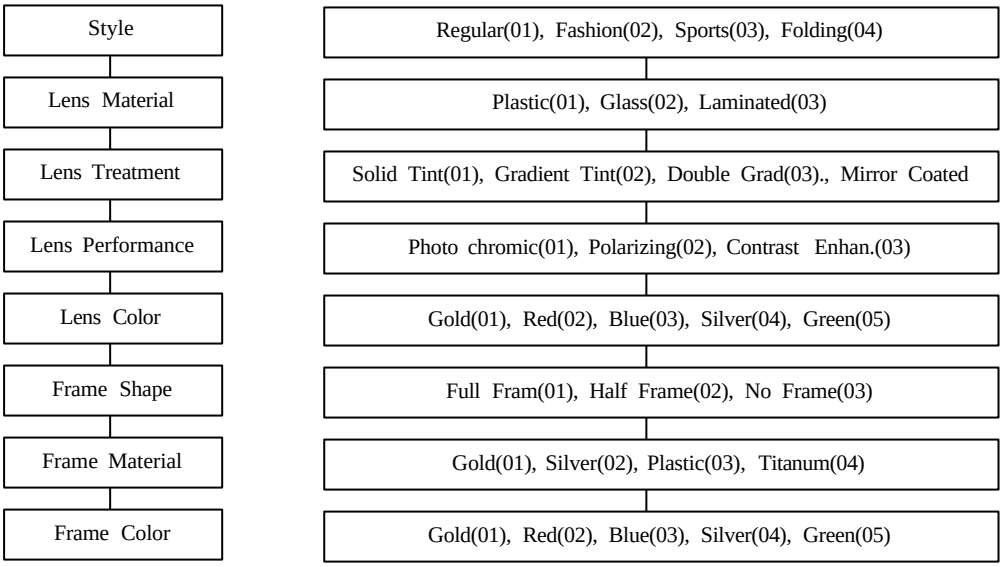


**Fig. 3 An example of Product Code Structure of 'Sunglass'**

The product code structure in figure 3 is hierarchical but may have other forms like Multi Dimensional, Object Oriented structures in Electronic Commerce. For example, if a profile includes 'Regular', 'Plastic', 'Blue', 'Full Frame' as Style, Lens Material, Lens Color, Frame Shape respectively, it is encoded into '0101----0301----'.

### 3.2 Scoring Products

In this step, we score each product a demanding rate. The demanding rate show how many the product is demanded by buying agents and is given by

$$DR_k = P(M = m_k) = \sum_{i \in S_{pf}} P(M = m_k \mid PF_i) P(PF_i)$$

$$= \frac{1}{N_{pf}} \sum_{i \in S_{pf}} P(M = m_k \mid PF_i)$$

$$= \frac{1}{N_{pf}} \sum_{i \in S_{pf}} \frac{1}{n_i} \qquad (1)$$

$DR_k$ = the Demanding Rate of the k$^{th}$ product, $m_k$ = the k$^{th}$ product, $PF_i$ = the i$^{th}$ encoded profile, $S_{pf}$ = a set of all encoded profiles, $N_{pf}$ = the number of encoded profiles, $n_i$ = the number of products included in $PF_i$

For example, if $S_{pf}$ ={'0101----0301----', '0101----0301--05'} and $m_k$ ='0101010203010305', then

$$DR_k = \frac{1}{N_{pf}} \sum_{i \in S_{pf}} \frac{1}{n_i} = \frac{1}{2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right) = \frac{1}{2}\left(\frac{1}{4 \times 3 \times 4 \times 5} + \frac{1}{4 \times 3 \times 4}\right) = 0.0125$$

$n_1 = 4 \times 3 \times 4 \times 5$ and $n_2 = 4 \times 3 \times 4$ are from figure 3.

### 3.3 Clustering Products according to Demanding Rate

In this step, we so divide products into several classess that members of each group have similar DR value using clustering algorithms like K-means [Kennedy, et al, 1998], SOM [Haykin, 1999], etc.

**Table 1 Clustering Results**

| Product Code | Demanding Rate | Class |
|---|---|---|
| 0101010103010105 | 0.001 | 2 |
| 0101010103010205 | 0.0005 | 3 |
| 0101010103010305 | 0.05 | 1 |
| 0101010103010405 | 0.0004 | 3 |
| 0101010203010105 | 0.002 | 2 |
| 0101010203010205 | 0.0007 | 3 |
| 0101010203010305 | 0.07 | 1 |
| 0101010203010405 | 0.0003 | 3 |
| 0101010303010105 | 0.0012 | 2 |

Table 1 is an example of clustering. We clustered 9 products into 3 Classes. Members of class 1 are products with the highest demand rate and those of class 3 are ones with the lowest demand rate.

### 3.4 Building Products Demand Structure

We can get rules for products classification from the clustering results using rule induction algorithms such as ID3 [Mitchell, 1997], C5.0 [Quinlan, 1989], etc. These rules show the structure of customers' demand. So we name the rules Products Demand Structure. Figure 4 is an example of Products Demand Structure.

From figure 4, we can see that if Style is '02', Frame Shape is '02', and Lenz Color is 01, 03 or 05, then the product is included in class 1, products of which are ones with the highest demanding rate. But though Style of a product is '02', it is included in class 5 if Frame Shape ofit is '01' or '03'. Products of class 5 are ones with lower demand rate than those of class 1.

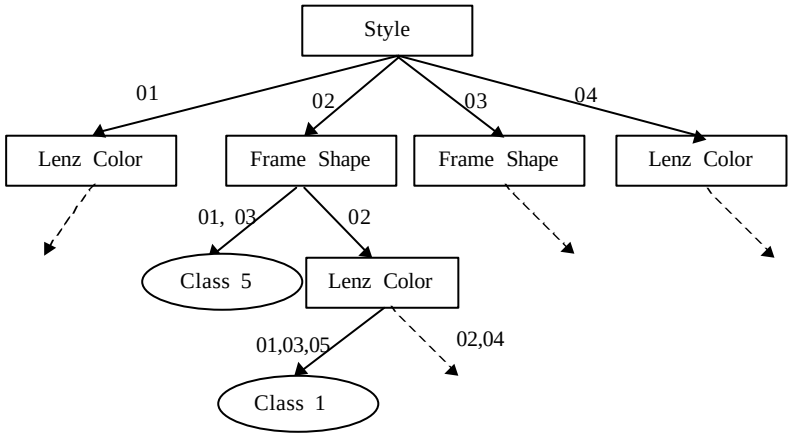


**Fig. 4 An example of Product Demand Structure**

Manufacturers should coordinate production so that their products meet Product Demand Structure. If a product is included in product group with low demanding rate, then its production should be reconsidered. If a product is included in product group with high demanding rate, then its production should be increased or started if it has not been produced before. In this way, we can dispose of products which are produced but are not wanted by customers and produce ones which are not produced but are wanted by customers. And this merchandising process can be accomplished very quickly while running after the most recent customers' demand because Product Demand Structure is built from demanding product profiles which reflect customers' needs at present.

## 4. Conclusion

In this paper, we suggested a method for Quick Response Merchandising which enables sellers or manufacturers in BTB Electronic Commerce to grasp customers' demands not in the past but at present and to pursue every changes of customers' demand rapidly. We used demanding product profiles from buying agents of customers in order to get information on customers' present demand which are reflected by the profiles. By proposed scoring method, we put a demanding rate on each product and clustered product according to the demanding rate. With the clustering results and product code structure, we could get Product Demand Structure which explains customers' present demand. With Product Demand Structure we can reflect change of customers' demand very quickly in merchandising including coordinating production, marketing, developing advertising, etc. By proposed method, companies in BTB Electronic Commerce can minimize customers leaving empty handed and products which are not on demand rapidly so that they can adapt their products on hand to customers' present demand quickly and accurately.

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