

# A new location-inventory policy with reverse logistics applied to B2C e-markets of China

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## Abstract

Based on the characteristics of consumer purchasing behavior over business-to-consumer (B2C) electronic markets in China, we consider a supply chain with one supplier, one B2C firm and multiple distribution centers (DCs) to jointly study supply chain location and inventory policies when product returns are allowed for. A new location-inventory policy is proposed and modeled as a bi-level programming problem: The upper level determines appropriate locations of third checking sites (3CS), and the lower level presents a coordinated inventory replenishment  $QS_R$  policy in light of the 3CS locations. An abstract network based on a B2C firm in China is adopted to illustrate the proposed model. We find that a  $QS_R$  policy is more effective on inventory control than the independent control policy is; 3CS added into the network improves the B2C firm's profit, and sensitivity analysis provides interesting managerial insights into the B2C firm's profit improvement in China.

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## 1. Introduction of B2C e-commerce in China

The business-to-consumer (B2C) electronic market has experienced explosive growth in China in recent years. According to the 17th Annual Official Report issued by the China Internet Network Information Center (CNNIC, 2006), China had 111 million internet users in January 2006, second only to the US. Among Chinese internet users, around 24.5% have some experience using the

Internet to purchase books and magazines, audio/video publications, computers and electronics, clothes, mobile phones, etc.

However, e-commerce sales in China as a percent of GDP still lags behind other developed countries such as Japan and US (Gibbs et al., 2003). Several factors, highlighted in literature and numerous Chinese e-commerce websites, hinder online purchasing behavior. The first factor is poor product quality (Wee and Ramachandra, 2000; Wong et al., 2004). Customers do not have confidence in the quality of online products in China. For example, customers may receive pirated or counterfeit software, a used cell phone or second-hand electronics

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products in place of the licensed software, new cell phone or electronic product they ordered. A second factor is security concerns (Tan and Wu, 2004). Customers are afraid that their private information will be disclosed on the Internet. A third factor is payment method (Bin et al., 2003). The use of credit cards is still very limited in China, and the validation time is lengthy, sometimes as long as 15 days. Other payment methods, all relatively inconvenient, include bank transfers, postal orders and cash on delivery. A fourth factor is delivery reliability (Wee and Ramachandra, 2000). The main delivery modes in China are regular postal delivery, express delivery, in-door delivery, and email or download for digital products. However, delivery reliability is not guaranteed; for example, customers may order some fashion clothes online, but receive the product much later than expected.

A final factor is a convenient returns policy. A recent survey (Wang and Huang, 2004) showed that given the convenience to return a product they were unsatisfied with, about 40% of customers in China would like to repeatedly make purchases from the same B2C firm. In addition, 30% of potential customers without online shopping experience were interested in trying to purchase over the Internet if an appropriate returns policy existed. Another similar survey (Huangpu, 2003) also indicated that up to 80% of online users had no confidence in product returns for online products.

Until recently, many products in China could not be returned after purchase. Fortunately, because of online giants like eBay and Amazon, many B2C firms in China are realizing that a returns policy plays a pivotal role in the B2C marketplace. Without a convenient returns policy, online demand and eventually the profit of a B2C firm is adversely affected. According to Beijing's new e-commerce regulations, customers now can return or exchange products (except some products such as custom-made goods, perishable items, software, and audio-visual products) within seven days of receiving the products. Unlike other developed countries, since online product return is a new business practice in China, how to design a convenient returns policy is a big concern for many B2C firms in China.

A convenient returns policy may trigger more demand, thus leading to higher profit; however, designing a returns policy is a costly activity due to additional rent fees or construction costs; transportation costs and inventory holding costs. Therefore, an appropriate location and inventory policy with

returns logistics needs to be designed to a B2C firm's advantage. Furthermore, electronic market in China has the following unique characteristics: (1) Many B2C firms in China, such as No.5, Salala, and Hoyoyo, are not manufacturers, but drop-shippers. In other words, these B2C firms sell product over the Internet, but do not ship the product, instead DCs or suppliers ship the product, (2) the existence of third checking sites (3CS) in e-markets of China. 3CS companies are either small retail stores that sell similar products and are capable of offering a professional check for the B2C firm or professional firms that offer checking services for many different products. A 3CS does not hold any inventory for the B2C firm. In order to be qualified to return his unsatisfied product, a customer must take the product to a 3CS. The 3CS checks to make sure the product is intact and can still be sold as brand new. In the case of a professional 3CS firm, the main cost incurred is a rent fee.

Motivated by the above unique characteristics of the electronic markets of China and the surveys about returns policies, in this paper we propose a new location-inventory policy for drop shipper B2C firms in China. The returns logistics in this paper considers the direct reuse of returned products, which means products returned to a suitable DC may be used to satisfy other demand, if possible.

The operation of product order and returns for this kind of B2C firm is as follows: After a customer places an order online, the B2C firm transfers the order information to a nearby DC, which in turn either delivers the product to the customer, if the inventory is on hand, or places a backorder on the product. The customer, if unsatisfied with the product, can, within a specified time after receiving the product, take the product to a third checking site (3CS). If the product passes the 3CS check, the customer is given a label that verifies the 3CS check. The customer then takes the product back and contacts the DC to pick it up. Once the product is returned to the DC, the customer receives a full refund.

The purpose of this paper is to present a new joint location-inventory policy catering to Chinese drop shipper B2C firms when product return is considered, which is modeled as a bi-level programming problem. The remainder of the paper is organized as follows: We briefly review some relevant literature in Section 2. Section 3 presents the model framework and basic assumptions adopted in the paper; a new policy is outlined in Section 4. More

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