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Research on the Pricing Model for Informatization Logistics Service Products

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Abstract: Based on expounding the connotation of informatization of logistics service products and comparative analysis of pricing methods of information products and traditional logistics service products, Complied with the principle of revenue sharing, this study constructed the pricing model of information logistics service products in two-level logistics service supply chain, analyzing that the pricing model has the optimal pricing strategy and the strategy is effective to enhance the coordination stability of logistics service supply chain and to encourage logistics service providers to promote information upgrading.

Key words: Informatization logistics service products, revenue sharing, pricing model

INTRODUCTION

Traditional logistics service products, such as storage, transportation and distribution, etc. mostly tend to homogenization which may lead to vicious price competition among logistics enterprises, undermine the logistics service supply chain coordination and stability, erode logistics service provider's revenue. Since, the 21st century, more and more logistics service providers began to gradually push forward the information process, injecting the meaning of information services into traditional logistics service products. Thus, not only the traditional logistics service products gradually differentiation, competitiveness gradually increased but also increased value-added service revenue of logistics service providers, the stability of logistics service supply chain has also been strengthened. However, in the early stages of advancing information technology upgrades, the higher capital investment and the lack of professional of logistics information are the main obstacle that hinders logistics service providers.

Informatization logistics service products that provided in this study is a kind of integrated logistics service products that combined the logistics information directly collected, excavated or after processing and integration that logistics service providers supply to customers after building logistics information platform and achieving logistics informatization management, such as transportation and distribution services that can inquiry goods information whenever necessary, remote inventory control, consulting services for logistics information management (He *et al*., 2009).

Informatization logistics service products include not only traditional logistics services, but also modern information services. Therefore, they combine the characteristics of information products and logistics service products. Whether it's pricing mechanism reasonable or not, essentially affects the coordination and stability between logistics service providers and product manufacturers and also affects the Level of effort that logistics service providers promote information technology to upgrade.

Information products have the characteristics of zero marginal cost, sharing transport facilitation, value attenuating rapidly (Ma and Zhang, 2007; Zhang and Tang, 2006). Based on the above characteristics of information products, a wide range of information products pricing methods were produced: Mendelson (1985) think that the pricing target of information products provider should aim to maximize the value of the network, the optimal pricing levels should be equal to the marginal delayed cost caused by network externalities; Schmalensee (1984) and other researchers probed the bundle pricing strategy when consumer's reservation utility obeyed Gaussian probability distribution; Brooks *et al*. (2000) and other researchers think that advancement in information technology makes information products accurately fit customer preferences, therefore, personalized pricing strategy can be implemented to customers.

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The existing main pricing methods of traditional logistics service products are the following categories:

- **Transaction pricing method:** is the traditional unit pricing method which is clear and comprehensible, easy to operate, but not flexible enough
- **Operating cost pricing method:** Accounting logistics services costs consumed by each operating as the basis for pricing, it is accurate, but it's implementation is very complicated
- **Cost-plus pricing method:** it can powerfully safeguard the revenue that logistics service providers can gain, but easy to cause the dispute of supply chain's collaboration
- **Standard price pricing method:** Refer counterparts' standard price to determine its own price, easily lead to price competition among counterparts (Xie and Li, 2007; Qiu and Huang, 2006; Hosanagar *et al*., 2008).

Most of these pricing methods are absorbed in how to maximize the short-term revenue of logistics service providers, but lack of incentives for logistics service providers to reduce the cost of logistics services. Considering the characteristics of informatization logistics service products, based on the principle that logistics service providers and manufacturers share the revenue, this study constructs a pricing model that can encourage logistics service providers to promote hard the informatization process, reduce logistics costs, improve the whole revenue of logistics service.

CONCEPTUAL MODEL OF TWO-LEVEL LOGISTICS SERVCE SUPPLY CHAIN BASED ON REVENUE SHARING PRIINCIPLE

Revenue sharing contract is one of the traditional coordination contracts of supply chain that gain remarkable results. By coordinating the interests of the parties involved in one supply chain, the contract made each member enterprise within the scope of the supply chain system communicate and cooperate with each other and achieve to maximize overall system efficiency and the benefits of member companies.

Firstly, this study constructed an two-level logistics service supply chain composed by an independent logistics service provider and an independent manufacturer and then introduced the revenue sharing contract into logistics service supply chain, researched the pricing problem of informatization logistics service products (Xu *et al*., 2010; Vakali and Pallis, 2003).

In this two-level logistics service supply chain, in order to maximize the revenue of supply chain, after coordination logistics service provider and manufacturer formulated the following revenue sharing contract: logistics service provider constructed by itself or leased logistics service information platform and provide high quality informatization logistics services to the manufacturer at a lower price "w". Because of getting high quality informatization logistics services at a lower price, manufacturer can provide products to downstream customers at the more competitive product price "p" which can obtain higher product sales and earnings. After selling the products, manufacturer and logistics service provider split revenue in a certain proportion. Manufacturer's proportion was $\varphi(0<\varphi<1)$, logistics service provider's proportion was $1-\varphi$. The conceptual model was shown in Fig. 1. In the logistics service supply chain, in order to provide high quality information logistics services, logistics service provider paid a fee for constructing by itself or leasing logistics service information platform. It was assumed that the unit cost of the activity was c_i.

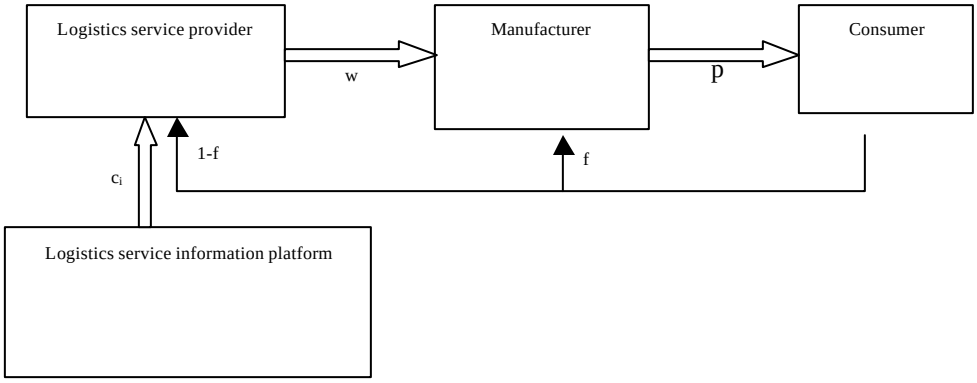

Fig. 1: Conceptual model of two-level logistics service supply chain based on revenue sharing principle

PRICING MODEL FOR INFORMATIZATION LOGISTICS SERVICE PRODUCTS

The assumptions of informatization logistics service products pricing model as follows: in a sales cycle "T", assuming when the manufacturer selling price was "p" at per unit of products, the customer demand for the product is a random function D(p) related with its market price. In the interval [0, +∞], F(x, p) was the distribution function of D(p), f(x, p) was the density function of D(p) and meet the function:

$$\frac{\partial F(x,p)}{\partial p} > 0$$

scilicet, the market demand for products will decrease when the price of the products was increase. In the sales cycle "T", the capacity of manufacturers was q_i, $q_i = \{q_1, q_2, \ldots, q_n\}$, they were a series of discrete values of numbers which corresponds to a fixed cost inputs c_{m0}.

The variable costs to manufacture per unit product were c_m. Simultaneously manufacture paid per unit informatization logistics service fee "w" to logistics service provider. The fixed cost of logistics service provider was c_{l0} and it's per unit variable cost was c_l. When we analyze the problems of supply chain contract coordination in the traditional market and pricing of tangible products, inventory plays an important role, so we usually consider the conditions when the products are out of stock and when there are surplus products in the end of period. However, in the supply chain of logistics service while logistics service products were manufacturing, they were consuming at the same time. Thus the supply chain of logistics services had not product inventory and the residual value in the end of period. It was not necessary to consider the conditions in this study.

Modeling and analysis: Assumed that when the manufacturer's production capacity is q_i, the expectation of the product sales (Swaminathan and Tayur, 2003) expresses as follows:

$$\begin{aligned} s(q_i,p) &= E\{\min[q_i, D(p)\} \\ &= \int_0^{\infty} \min(q_i, x) f(x,p)dx \\ &= \int_0^{q_i} \overline{F}(x)dx \end{aligned} \tag{1}$$

Therefore, the function of manufacturer's expected profit was:

$$\begin{aligned} E\prod\nolimits_m(q_i,p) &= \varphi p S(q_i,p) - wS(q_i,p) \\ &-c_m S(q_i,p) - c_{m0} \\ &= \varphi p \int_0^{q_i} \overline{F}(x)dx - (w + c_m) \\ &\int_0^{q_i} \overline{F}(x)dx - c_{m0} \end{aligned} \tag{2}$$

The function of logistics service provider's expected profit was:

$$\begin{aligned} E\prod\nolimits_l(q_i,p) &= (1-\varphi)pS(q_i,p) \\ &+\tau(N, S(q_i,p)) + wS(q_i,p) \\ &-c_l S(q_i,p) - c_{l0} - c_l S(q_i,p) \\ &= (1-\varphi)p\int_0^{q_i} \overline{F}(x)dx + \tau(N, \\ &\int_0^{q_i} \overline{F}(x)dx) + (w - c_l) \\ &\int_0^{q_i} \overline{F}(x)dx - c_{l0} \\ &-c_l \int_0^{q_i} \overline{F}(x)dx \end{aligned} \tag{3}$$

In the Eq. 3: $wS(q_i, p)$ was the normal income of logistics service provider without using the information service platform. When logistics service provider used use N information service platform interfaces to provide instant interaction Information logistics Services for manufacture and downstream customers, it obtained additional income $\tau(N, S(q_i, p))$. According to Palliser's (Levin *et al*., 2009) research, we know:

$$\frac{\partial \tau(N, S(q_i,p))}{\partial N} > 0$$

$$\frac{\partial \tau(N, S(q_i,p))}{\partial S(q_i,p))} \geq 0$$

$$\frac{\partial^2 \tau(N, S(q_i,p))}{\partial S(q_i,p))^2} \leq 0$$

$c_l S(q_i, p)$ was the logistics service provider's cost of using information service platform, we calculated $c_l S(q_i, p)$ according to sales of product.

Then, in the condition of integrated decision-making, the overall expected profit function of logistics service supply chain was:

$$\begin{aligned} E\prod(q_i,p) &= pS(q_i,p) \\ &+\tau(N, S(q_i,p) - (c_m + c_l)S(q_i,p) \\ &-(c_{m0} + c_{l0}) - c_l S(q_i,p) \\ &= p\int_0^{q_i} \overline{F}(x)dx + \tau(N, \int_0^{q_i} \overline{F}(x)dx) \\ &-(c_m + c_l)\int_0^{q_i} \overline{F}(x)dx - c_l \int_0^{q_i} \overline{F}(x)dx \end{aligned} \tag{4}$$

Calculated and analyzed as follows.

Considering the parameters of revenue sharing contract, When, $\Pi_l(q_i, p) = (1-\phi)\Pi(q_i, p)$, $\Pi_m(q_i, p) = \phi\Pi(q_i, p)$ the entire supply chain achieved coordination that is, when the income of entire supply chain was maximized, the income of manufacturer and logistics service provider were also maximized at the same time; then solving w, φ, they were:

$$\varphi = 1 - \frac{c_{l0}}{c_{l0} + c_{m0}} \quad (5)$$

$$w = \varphi\tau(N, S(q_i, p) - \varphi c_i S(q_i, p) + (1-\varphi)(c_l + c_m)/Q - c_l \quad (6)$$

If:

$$\frac{\partial\Pi(q_i, p)}{\partial P} > 0$$

$$\frac{\partial^2\Pi(q_i, p)}{\partial P^2} < 0$$

then $\Pi(q_i, p)$ was a concave function related to "p", there was a reasonable price p* that could make the income of supply chain maximize. Therefore, when we knew the specific expression of each function, we could solve the specific expression of p*. When all the conditions were satisfied, there would be the optimal price of product in the logistics service supply chain.

From the above calculation, analysis, we can draw the following conclusions:

In the two-level logistics service supply chain constructed in this study, supply chain coordination and pricing strategy of Informatization logistics services product based on revenue sharing contract could make the entire income of supply chain maximize and at the same time make the income of logistics service provider and manufacturer maximize and enhance the stability of supply chain collaboration. According to (1) we knew that when obeying revenue sharing contract and the parameter w, φ meeting the Eq. 5-6, there was an optimal price p* that could make the income of both logistics service provider and manufacturer also maximize at the same time. According to the function:

$$\varphi = 1 - \frac{c_{l0}}{c_{l0} + c_{m0}}$$

we knew that the income sharing ratio was not related to the price of logistics service products and the price of tangible products price and the quantity of sales, only related to the fixed costs of logistics service provider and manufacturer that is, related to the fixed cost corresponding to production capacity that manufacturer selected according to the demand of customers and the fixed cost of logistics service provider.

According to the function $w = \varphi\tau(N, S(q_i, p)-\varphi c_i S(q_i, p)+(1-\varphi)(c_l+c_m)/Q-c_l$, we knew that the informatization logistics service fee that manufacturer paid for logistics service provider was not only related to income sharing ratio, but also related to the number of interfaces when logistics service provider used information service platform and closely related to the pricing strategy of information service platform provider. (Plagemannm *et al.*, 2005)

CONCLUSION AND PROSPECT

In the long run transforming and upgrading traditional logistics service products used information technology not only can prevent vicious price competition between logistics service providers, enhance the competitive strength of logistics service products, but also can significantly improve the benefits of logistics service provider and logistics service supply chain. But in the early stages of informatization process, the high capital investment and the lack of professional information talents were main constraints for logistics service providers to promote informatization process. Firstly, based on revenue sharing principle, this study constructed two-level logistics service supply chain and pricing model for informatization logistics service products. After calculus and analysis we concluded:

- This pricing strategy of informatization logistics services product can make the logistics services supply chain to maximize the overall income while make the logistics service provider and manufacturer maximize their income and enhance the stability of supply chain collaboration
- The income share ratio of logistics service provider and manufacturer was not related to the price of informatization logistics services product, the price of tangible products and the quantity of sales, only related to the fixed cost of logistics service provider and manufacturer that is related to related to the fixed cost corresponding to production capacity that manufacturer selected according to the demand of customers and the fixed cost of logistics service provider

The price of informatization logistics services product not only was related to the income sharing ratio between the each part of supply chain, but also closely

contacted with the scale and the construction and operating cost of logistics service information platform. These results fully indicated that using the pricing strategy of informatization logistics services product proposed in this study, the benefits of information logistics service provider and the entire supply chain will increase after logistics service provider upgrading traditional logistics service products to informatization logistics services products. This pricing strategy will effectively motivate logistics service providers to promote informatization reform.

However, in order to facilitate research, this study only considered the case that the logistics services supply chain consisted of a single independent logistics service provider and a single manufacturer. In the reality the logistics service supply chains are much more complicated; When selecting strategy in reality, the logistics service provider may choose to maintain the traditional logistics services, informatizate part of logistics services, or informatizate the entire logistics services products to enhance competitive strength themselves according to the various amount of logistics services and the different types of logistics services. These issues need to be further researched and discussed.

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