

# Knowledge Sharing-Based Value Co-creation Between E-Commerce Enterprises and Logistics Service Providers

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**Abstract.** Under the new economic forms of China's "Internet +" strategy, the Internet technologies spill over into different areas in a variety of traditional industries. As a result, electronic commerce develops rapidly. With the sustainable increase of consumers shopping online, the logistics problems have become the biggest obstacle of the development of electronic commerce. We argue that one can solve the current problems in logistics and improve consumers' satisfaction by establishing a long-term relationship of value co-creation between electronic commerce enterprises and logistics service providers. In this paper, we build a game model of electronic commerce enterprises and logistics service providers based on knowledge-sharing. We analyze the cases of one-shot game and repeated game. According to model analysis, we propose strategies for electronic commerce enterprises and logistics service providers to co-create value on the basis of knowledge-sharing from two different angles, i.e., the whole supply chain's and its members' perspective. These strategies may have implications to practice.

**Keywords:** Knowledge sharing · Value co-creation · E-commerce enterprises · Logistics service providers · Game theory

## 1 Introduction

With the development of Internet technology, the convenience of e-commerce emerges gradually, and different kinds of e-commerce enterprises appear, especially those with online shopping grow rapidly, such as Jingdong Mall, Alibaba and Taobao in China. Data show that by the end of 2014, netizens in China reached 649 million, and the number of online shopping users reached 361 million, with an increase of 55.7 % [8].

In March 5th, 2015, "Internet+" was first proposed in the Chinese governmental work report. "Internet+" emphasizes the advantages of Internet and making innovations by integrating Internet technologies, such as big data, cloud computing and so on, with traditional industries [2]. For example, in electronic commerce and its logistics service, the traditional logistics distribution is focused on the transporting route, and cost, and thereby optimization of logistics is concerned with cost saving and time saving. But modern logistics distribution is more focused on service quality that is related to other aspects of customer satisfaction, such as customer preference, etc. The Internet as a tool

has multiple influences on the e-commerce and logistics, including impacts on online transactions, offline transactions and online-offline interactions. For e-commerce and logistics service providers, therefore, “Internet +” may help them solve the current problems such as high delivery cost, delayed delivery and wrong delivery in e-commerce and its logistics.

With the sustainable increase of consumers shopping online, the insufficient logistics service have become the biggest obstacle in the development of electronic commerce. For electronic commerce enterprises and logistics service providers, the biggest challenge is how to collaborate to solve the current problems in logistics and to improve consumers’ satisfaction by establishing a long-term relationship between them. Nowadays, more and more enterprises tend to be value-co-created enterprises, as a result, the electronic commerce enterprises can concentrate on solving the problem of logistics to co-create value together with the related logistics service providers. If so, they can also improve their competitiveness. However, in fact, the development of logistics lags behind that of e-commerce. Consequently, consumers are forced to accept logistics service of low level which they are not very satisfied with. The purpose of this study is to work out some solution.

This paper is organized as follows. The next section reviews the pertinent literature. Subsequently, we analyze the one-shot model and the repeated model in Sect. 3. In Sect. 4, we propose some strategies for value co-creation, while results and discussions are presented in Sect. 5.

## 2 Literature Review

In this section, we briefly review literature about knowledge sharing and value co-creation.

### 2.1 Knowledge Sharing

Knowledge sharing is a way of exchanging knowledge to increase value and effects of knowledge. Researchers have different views about knowledge sharing, and they do research from different angles. Previous research on knowledge sharing focuses on the issues of effective factors, technology realizing, and specific practice.

Some researchers attribute the difficulties of knowledge sharing to transferring implicit knowledge, trust issues of in knowledge sharing, intentions and potential threat of knowledge sharing. They summarize the factors to facilitate knowledge sharing, 16 properties in four aspects including enterprise culture, employee motivation, leadership and information technology. On this basis, they propose a fuzzy evolutionary model to determine the weights of the related property [19]. A network model is proposed based on the analysis of literature about knowledge codification and knowledge-sharing networks. The findings show that the growth of knowledge codification may lead to the damage of knowledge-sharing ties [6]. Some studies investigate the effects of two types of trust, i.e. organization-institution-based trust and interpersonal trust, on knowledge sharing by building a conceptual model. The model is tested by an empirical study of

294 Chinese IT firms [20]. Some researchers argue that conflicting incentives among managers may affect knowledge sharing which can bring potential benefits through an analysis of leasing data [11].

Trust plays an important role in knowledge sharing in a supply chain, so there are several studies on it. A multi-period model is constructed to examine trust in a supply chain in terms of salespersons. It shows that salespersons who share demand forecast information with retailers are always trusted in a long-term relationship [5]. An investigation of capacity decision of suppliers reveals that the cooperation of suppliers and manufacturers depends on trust. Thus, an analytical model is developed to observe behavioral regularities [10]. A study on Group Buying indicates that social interactions between sellers and consumers can bring benefits through knowledge sharing, accordingly some new strategies are developed, such as Referral Rewards programs, which are different from traditional individual-selling strategies [3].

As for the practical applications of knowledge sharing, many researchers study the issues in different areas including healthcare, education and supply chain in business. The factors influencing the improvement of supply chain are investigated by using structural equation modeling. As a result, adaptability and, openness and innovation orientation are found to be very important factors [18]. A method with two steps is proposed to solve the problem of capturing implicit knowledge and develop a semantic web platform for knowledge sharing [9]. Some researchers have explored the relationship among trust, perceived risk workplace spirituality and knowledge sharing behavior by applying confirmatory factor analysis and structural equation modelling. Their findings show that there is a strong tie between workplace spirituality and knowledge sharing, and the perceived risk is a moderator variable between trust and knowledge sharing [13].

Researchers also have studied the issue of knowledge sharing in the context of supply chain using game theory. Some propose to build knowledge sharing networks to achieve optimal investment [1], and to reduced cost.

## 2.2 Value Co-creation

Value co-creation is a new concept in recent years. The generalized value co-creation means that the interactions of consumers' participating in the links of products design, manufacturing and sales circulation can create value. Doorn et al. argue that consumers and enterprises can create value in the cooperation of collecting ideas and realizing design and this is called value co-creation [4]. Thus, value co-creation covers two kinds of situations. One is value co-creation driven by enterprises who occupy resources, and the other is driven by consumers who occupy resources. At present, most researchers study value co-creation from the aspect of empirical thought.

In past years, most studies about value co-creation are based on the collaboration between enterprises and individual consumers. But now more and more studies focus on the value co-creation among enterprises.

Current two views are value co-creation theory based on consumers' experience [12] and value co-creation theory based on service-dominant logic [17]. The former believes that value co-creation is demonstrated in the aspect of consumers' experience.

Enterprises provide consumers with a context to experience consumption. It is interactions that create value including interactions among consumers, and interactions between consumers and enterprises. While value co-creation theory based on service-dominant logic states that value co-creation is realization of consumers’ use value. In the process of value co-creation, consumers need to use their own knowledge and enterprises need to create good circumstances to facilitate value co-creation. When consumers use the products, value is co-created.

Researchers have studied the issues of value co-creation in different areas. The following are some examples. In one study, ideas are developed by linking service logic to an ecosystem perspective and the results show the challenges of the base of the pyramid environment [7]. In another study, it is proposed that the antecedents for value co-creation in health care include flexibility, responsiveness and co-innovation, and they are analyzed by using structural equation modeling. And it is tested by a survey of 225 health care professionals [15]. Some researchers verify the relationship between firms’ degree of involvement in co-creation activities and the degree of articulation of their service value attributes via principal component analysis and artificial neural networks based on online textual data [16]. Above all, there are many studies on value co-creation in different fields, but very few on value co-creation between e-commerce enterprises and logistics service providers. To fill in this gap, in the presented research we build a game model and study knowledge sharing-based value co-creation between e-commerce enterprises and logistics service providers.

### 3 The Model

There is an important link between e-commerce enterprises and logistics providers, which are key nodes in supply chain in the context of Internet economics. Knowledge sharing between them helps to prompt their value co-creation. Two situations will be discussed in the framework of game theory. Figure 1 shows the conceptual supply chain model we study.

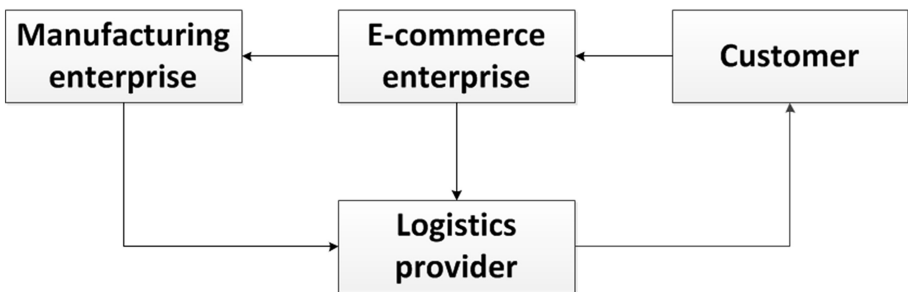


Fig. 1. The conceptual model

Before customers’ ordering, e-commerce enterprises offer forecast about customers’ ordering, then logistics providers will allocate the logistics capacity for customers.

When customers finish their ordering, logistics providers offer distribution service to customers. We assume that there is one e-commerce enterprise and one logistics provider. And the e-commerce enterprise wants to know about the logistics capacity of the logistics provider before signaling forecast.

### 3.1 One-Shot Game

Inspired by the model proposed in reference [14], we consider a different context with knowledge sharing between e-commerce enterprise and logistics provider. In this paper, knowledge sharing represents the exchange of information, such as forecast of consumers’ orders and consumers’ preference, and preference of logistics providers and preference of packaging. We assume that  $X$  is nonnegative normal random variable,  $X \sim N(\mu, \sigma^2)$ , and the market demand of customers is a scaled random variable  $\omega \cdot X$ . Here  $\omega$  is the demand-size parameter,  $\omega \in R^+$ , it has two possible situations “high” and “low”, thus we have  $\omega_i$ , with  $i = \{h, l\}$ , with the probabilities of “high” and “low” respectively as  $P(\omega_l) = \alpha$ ,  $P(\omega_h) = 1 - \alpha$ ,  $\alpha \in (0, 1)$ .

We denote  $c$  as the unit service capacity cost of logistics provider. With knowledge sharing, the logistics provider can get the forecast of consumers’ orders offered by the e-commerce enterprise to allocate service capacity. The logistics provider charges the e-commerce enterprise a price of  $a$  for each unit allocated and the e-commerce enterprise earns  $b$  for each unit. If the service capacity can’t satisfy consumers’ real demands, the e-commerce enterprise will pay for a unit service capacity of  $d$ . If the service capacity exceed consumers’ real demands, there will be an extra cost of  $e$ . Define  $Q$  as the service capacity that logistics provider allocated. For notational convenience, define  $f(x) = \max(x, 0)$ , and

$$\pi_1(\omega_i, Q) = a \min(Q, D_i) - e \cdot f(Q - D_i) - cQ \tag{1}$$

$$\pi_2(\omega_i, Q) = (b - a) \min(Q, D_i) - d \cdot f(D_i - Q) \tag{2}$$

When the game begins, there is a random demand state of  $\omega(\omega_h$  or  $\omega_l)$ , which can be observed by the e-commerce enterprise. Then the e-commerce enterprise will send a forecast  $K(K = H$  or  $K = L)$  to the logistics provider and the strategy of the logistics provider is to trust or not. For example, when a forecast of  $H$  is sent, and if logistics provider’s strategy is to trust, service capacity  $Q_h$  will be allocated to make the expected profit maximum:

$$Q_h = \arg \max_Q E[\pi_1(\omega_h, Q)] \tag{3}$$

Of course, if the logistics provider doesn’t trust the e-commerce enterprise, service capacity  $Q_0$  will be allocated:

$$Q_0 = \arg \max_Q \{(1 - \alpha)E[\pi_1(\omega_h, Q)] + \alpha E[\pi_1(\omega_l, Q)]\} \tag{4}$$

Denote  $d_r$  as the realized demand of consumers, and  $o$  as the orders that the e-commerce enterprise tells the logistics provider to distribute. In the cooperative and truthful knowledge-sharing situation, the expected profit of the logistics provider and that of the e-commerce enterprise respectively are:

$$\begin{aligned} \pi_1^* &= (1 - \alpha)E[\pi_1(\omega_h, Q_h)] + \alpha E[\pi_1(\omega_l, Q_l)] \\ \pi_2^* &= (1 - \alpha)E[\pi_2(\omega_h, Q_h)] + \alpha E[\pi_2(\omega_h, Q_h)] \end{aligned} \tag{5}$$

However, in the noncooperative situation, the expected profit of them respectively is:

$$\begin{aligned} \pi_1^0 &= (1 - \alpha)E[\pi_1(\omega_h, Q_0)] + \alpha E[\pi_1(\omega_l, Q_0)] \\ \pi_2^0 &= (1 - \alpha)E[\pi_2(\omega_h, Q_0)] + \alpha E[\pi_2(\omega_h, Q_0)] \end{aligned} \tag{6}$$

We can imagine that when the e-commerce enterprise’s forecast of consumer’s demand is low, he or she is likely to send  $H$  to the logistics provider to assure sufficient service capacity can be allocated to him. If this happens, it may cause that the logistics provider can’t distinguish the real incentive, and his/her best strategy is to ignore e-commerce enterprise’s forecast information. So there is an equilibrium of non-truthful knowledge-sharing.

**PROPOSITION 1.** It occurs as a noncooperative case in the equilibrium of the one-shot game. The logistics provider allocates service capacity  $Q_0$  with ignoring the forecast of the e-commerce enterprise.

Above all, it is necessary to study the case of repeated game to seek a best strategy for both the logistics provider and the e-commerce enterprise when having truthful knowledge-sharing.

### 3.2 Repeated Game

In fact, there is always a long-term supply chain relationship between the logistics provider and the e-commerce enterprise. The repeated game is composed of several stage games. At each time  $t$  ( $t = 1, 2, \dots, \infty$ ), a stage game is played which is same to the one-shot game. As the time goes to  $t + 1$ , the game renews. We denote  $K^t = (K_1, \dots, K_{t-1})$  as the forecast,  $o^t = (o_1, \dots, o_{t-1})$  as the distributed orders,  $Q^t = \{Q_1, \dots, Q_{t-1}\}$  as the service capacity allocated, and  $h^t = K^t \times o^t \times Q^t$  as the public knowledge at time  $t$ . And the private knowledge  $h_{private}^t = (\omega_1, \dots, \omega_{t-1}) \times (d_1, \dots, d_{t-1})$  can be only observed by the e-commerce enterprise.

In the repeated game, a Pareto-efficient outcome can emerge as an equilibrium by using a review strategy. The process of the review strategy is as follows:

- (1) Divide time into several review phases. In every phase, the logistics provider marks  $G_t$  as the e-commerce enterprise’s score and sets a credibility threshold for the e-commerce enterprise. After finishing the distributed orders  $o_t$ , the logistics provider checks the reliability of the e-commerce enterprise.

- (2) If the e-commerce enterprise passes the check, his score updates:  $G_t = G_{t-1} + 1$ . If he cheats repeatedly, it is necessary to check low-forecast. It is likely that the e-commerce enterprise is at the risk of suspect forges low-forecast information.
- (3) At the end of each period, the logistics provider checks the incentive of the e-commerce enterprise for truthful knowledge sharing. If the e-commerce enterprise has truthful knowledge sharing, the review phase continues and the game renews. If not, it stops and it comes to the punished phase.
- (4) The logistics provider always trusts the e-commerce during the review phase. Once he/she doesn't allocate the system-optimal service capacity, the e-commerce enterprise can punish him by stopping the truthful knowledge sharing until he allocates the system-optimal service capacity.

**PROPOSITION 2.** A Pareto-dominant outcome can emerge as an equilibrium in the repeated game and the logistics provider and the e-commerce enterprise will realize the truthful knowledge sharing between them.

In the long run, the review strategy can help with the truthful knowledge sharing.

## 4 Strategies for Value Co-creation

### 4.1 The Whole Supply Chain Perspective

Based on the above game model analysis, three strategies could be used to improve value co-creation from the perspective of the whole supply chain.

Firstly, to build an effective knowledge sharing mechanism between the e-commerce enterprise and the logistics provider, the whole supply chain should take some incentive measures to promote the truthful knowledge sharing, such as decreasing logistics fees for the e-commerce enterprises. If so, in the long cooperation, the review phase will be shorten. And then value will be co-created in various aspects, including reputation, efficiency and precise grasp of consumers' demand and so on.

Secondly, to facilitate value co-creation, an integrated information system platform should be built for the whole supply chain. In the real world, parties of supply chain have difficulties to coordinate information. For example, the e-commerce enterprises may not know the accurate logistics information while the logistics providers may not provide in time delivery to consumers. This may cause consumers' complaints and brings bad effects on the performance of both the e-commerce enterprise and the logistics provider. To solve this problem, the supply chain members can cooperate to build an integrated information system to increase the information transparency. For example, GPS can be used for package positioning to help the consumer know the package's state and update information in the system in time. Moreover, one can make surveys with consumers about logistics service through the system to find out problems and to improve the logistics service. Consumers can get good experience through the integrated system, and the enterprises can gain good word of mouth from consumers. So value could be co-created in different aspects, including explicit profits, implicit reputation, and consumers' experience.

Thirdly, build the proper competition mechanism. In fact, one e-commerce enterprise always cooperates with several logistics providers and one logistics provider also

cooperates with several e-commerce enterprises. Our model in this paper ignores the competition between them. Parties of supply chain will try to improve their competition through the competition mechanism which can help to realize supply chain optimization and create value including branding and good competition.

#### **4.2 The Supply Chain Members' Perspective**

Firstly, e-commerce enterprises need to offer knowledge about consumers such as forecast of orders and individual preference. It is important for e-commerce enterprises to know consumers' information to provide personalized service. In terms of logistics, the consumers who are in badly need of specific products, may have a high demand against logistics speed; the consumers who prefer box-packed than bag-packed delivery may choose to purchase some bulky goods. Moreover, if consumers purchase birthday presents to their friends, they may need cards and beautiful packaging. If the e-commerce enterprises know these consumer information well and make improvements in their service, they will gain consumers' intention of repeated visits to the website and their repeated purchases.

Secondly, logistics providers need to maintain good cooperation with e-commerce enterprises to realize value co-creation. A motivation mechanism for e-commerce enterprises' truthful knowledge sharing may help a lot. Then a specialized knowledge base can be built to enhance the management of consumers' relationship. The knowledge base should cover individual preference, feedback information, demands of logistics or packaging from consumers. When the knowledge accumulates to a certain degree, one can use big data technology to analyze it.

### **5 Discussion and Conclusion**

In this paper, we have built and studied the game model of one logistics provider and one e-commerce enterprise with knowledge-sharing between them. The findings show that a review strategy can help to realize the optimal equilibrium of the system and improve the truthful knowledge sharing between the two parties. Accordingly, we have proposed strategies for electronic commerce enterprises and logistics service providers to co-create value. This study contributes to the understanding of knowledge sharing and its impacts in supply chains.

This research provides the following managerial implications. First, our results demonstrate that a review strategy can be effective in knowledge sharing and value co-creation between e-commerce enterprises and logistics service providers. Therefore, review strategy can be applied in practice to solve the logistics problems. Second, the idea of co-creating value through knowledge sharing in the field of e-commerce has managerial insights to practitioners. Finally, the strategies for value co-creation provide managerial guidelines for both e-commerce enterprises and logistics service providers.

Throughout our work, there are some limitations in this study. First, we just consider one logistics provider and one e-commerce enterprise in our model. Obviously it is not what it is in real world. Second, no case study is addressed to test the model and



strategies. Finally, as for value co-creation, we have just proposed some general strategies but no survey-based quantitative analysis.

In future research, one may consider to do the case study and experimental study on a specific e-commerce platform, such as Jingdong Mall. Also one can extend the game model by taking multiple enterprises into account.

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