Research on B2C E-commerce Reverse Logistics System Based on SD Model

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Abstract. Reverse logistics is important in the link of electronic commerce development, it orients terminal consumers of supply chain, represents electronic commerce's reputation and image, and for the enterprise to service ability proposes greater challenges, putting forward higher requirements to cooperating logistics service providers, too. Return reverse logistics has a direct impact on the competitiveness of the electricity supplier. The essay is written from the view of the return reverse logistics complex system, using the system dynamics Vensim software to build the simulation model, the lynx e-commerce platform of enterprise data simulation analysis. The analysis shows that the simulation results are in good agreement with the actual data. the use of System dynamics analysis method in the B2C return reverse logistics, providing a new system analysis method to guide the business of the enterprise return reverse logistics system analysis, and according to the results of the analysis to optimize the allocation of internal resources of enterprises to adjust and enhance the competitiveness of enterprises.

Introduction

E-commerce originated in the 1990s, with the rapid spread of the Internet and the emergence of mobile Internet in just over two decades, and it seized opportunities for rapid development. According to the ministry of commerce said: in 2014, the domestic consumer market, the realization of social total retail sales of consumer goods totaled 26.2 trillion yuan, including electronic business turnover of around 13 trillion yuan (including B2B, B2C and online retail), up 25% from a year earlier \cite{1} . That means that e-commerce has taken up half of consumer retail, and there's still a lot of rising space.

By studying the reverse logistics system of B2C e-commerce, this paper tries to discuss the complex feedback relationship in this system and to figure out the key factors that influence the customer satisfaction and e-commerce competitiveness. Simulation analysis was carried out on the reverse logistics system for the electric business enterprise to provide the new thought of reverse logistics analysis in order to improve customer satisfaction, business competitiveness, and reduce the positive development of e-commerce under B2C e-commerce, while reducing unnecessary waste of social resources.

The Overview of the B2C Reverse Logistics System

The study found that the return of reverse logistics and the traditional return reverse logistics is just two contrary process, based on the B2C e-commerce return reverse logistics under the process of combing, sort out the return reverse logistics system of the return process, the specific process as shown in Figure 1.
The return reverse logistics under B2C e-commerce is by consumers, the electric business enterprise, the third party logistics service provider jointly dominated a process [2]. First of all, consumers of electricity products, consumers online submit an application for return. Second, electricity after the review of the service return customers request, after review by after-sales will notify customers choose to return or inform logistics partners the door handle return single. Then, the return of the goods sent to electricity through the reverse logistics network specified return product test center for centralized detection, return test center for the damaged goods to define and responsibility identification, and other operations and will review the information sent to the after-sales service [3]. Finally, the after-sales service according to the return of the testing center inspection report online refund account designated by the consumers. At this point, the full return reverse logistics all over, the transmission of online information, capital and the combination of offline logistics.

**Figure 1. B2C e-business return process.**

**Figure 2. B2C e-commerce return reverse logistics system causal feedback figure.**

**The Construction of Reverse Logistics System Based on SD**

**SD model based on customer satisfaction**

Through the analysis of the B2C e-commerce return reverse logistics process, found that consumers in return because of reverse logistics system, electric business, the third party logistics three main and auxiliary variables are the result of mutual influence.

The emergence of e-commerce return reverse logistics is the most direct factors of consumer satisfaction. That is, when consumers receive the goods below expectations expectation satisfaction appeared deviation, when excessive deviation also creates a return reverse logistics [4]. Common customer satisfaction by many factors, such as product quality and efficiency of logistics, after-sales service, such as processing speed, these factors also directly affect the competitiveness of e-commerce enterprises. The emergence of returns and may be the reason for the forward logistics, such as logistics service provider of violence sorting for the damaged cargo, logistics delivery time delay lead to consumers receive the goods when the product has lost its limitation, etc.

According to the above analysis of each subsystem, it is concluded that the system of cause and effect diagram, and can be based on the B2C e-commerce return reverse logistics system dynamic causality diagram, as shown in figure 2.

**Construction of system flow chart**

Based on system dynamics modeling theory, and through the B2C electronic commerce reverse logistics subsystems causality analysis, after that the causal relationship between each subsystem, the key is within the system, such as the determination of state variable and rate variable and information transfer process, which including the determination of auxiliary variables and constants related to important variables and the relationship between the variables [5]. We return reverse logistics through the establishment of B2C e-commerce system dynamics simulation flow chart to reflect the dynamic changes of the internal, the relationship between flow diagram as shown in figure 3.
According to the flow chart of system dynamics model and causality diagram, a further analysis of logic relation and interaction between system variables, and according to the prompt VensimPLE software, mathematical formula, the relationship between the variables in the system can be converted to establish relevant system of equations, convenient for quantitative analysis of computer simulation. The meaning of the main variable and the unit description and model of the key mathematical logic relationship is as follows:

Table 1. Customer Satisfacton Correlation.

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Variable</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>X: Customer satisfaction</td>
<td>a</td>
<td>Blind consumption</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>The delivery Percent of pass</td>
</tr>
<tr>
<td></td>
<td>c</td>
<td>Forward logistics efficiency</td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>Consumer expectations</td>
</tr>
<tr>
<td></td>
<td>e</td>
<td>Goods in transit backlog rate</td>
</tr>
<tr>
<td>Y: Electric business competitiveness</td>
<td>f</td>
<td>Returns the response rate</td>
</tr>
<tr>
<td></td>
<td>g</td>
<td>Return of the detection efficiency</td>
</tr>
<tr>
<td>Z: Line up to return the amount</td>
<td>h</td>
<td>Consumers return frequency</td>
</tr>
<tr>
<td></td>
<td>i</td>
<td>Order processing speed</td>
</tr>
<tr>
<td></td>
<td>j</td>
<td>Reverse logistics efficiency</td>
</tr>
<tr>
<td>M: Reverse through put</td>
<td>k</td>
<td>Logistic service ability of cooperation</td>
</tr>
<tr>
<td></td>
<td>l</td>
<td>Advertising</td>
</tr>
<tr>
<td>N: Return inventory</td>
<td>m</td>
<td>Return of the detection efficiency</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>Secondary sales conversion rate</td>
</tr>
<tr>
<td></td>
<td>o</td>
<td>Goods in transit backlog rate</td>
</tr>
</tbody>
</table>

\[
X = \text{INTER}((\text{INFLOW1} - \text{OUTFLOW1}),100) \quad (1)
\]
\[
\text{INFLOW1} = (1 - a) * b * c \quad (2)
\]
\[
\text{OUTFLOW1} = (d - b) * a \quad (3)
\]
\[
\text{Y} = \text{INTEG}((\text{INFLOW2} - \text{OUTFLOW2}),100) \quad (4)
\]
\[
\text{INFLOW2} = X * (1 - e) \quad (5)
\]
\[
\text{OUTFLOW2} = (1 - f) * (1 - g) \quad (6)
\]
\[
Z = \text{INTEG}((h - f), 0) \quad (7)
\]
\[
h = (100 - X)/100 \quad (8)
\]
\[
f = \text{IF THEN ELSE} (Z \geq 10, \text{SIN} (Z), (\text{IF THEN ELSE} (Z \geq 0, 1, 0))) \quad (9)
\]
The default system per unit time is retreated inside the single largest capacity of 10 pieces, at this
time the return of the efficiency of 1; When the return amount per unit time is higher than 10 pieces,
electricity after due to handle multiple single back at the same time, the return processing efficiency
will be regular fluctuations, so the processing efficiency to choose first-choice wave function.

\[
M = \text{INTEG} (i - j, 0) \\
i = \text{IF THEN ELSE} (Z <= 5, 0.2 * k, \text{SIN} (Z)) \\
j = \text{IF THEN ELSE} (M >= 20, 0.1 * k, 0.2 * k) \\
N = \text{INTEG} (m - n, 0) \\
m = \text{IF THEN ELSE} (M <= 20, 1, \text{SIN} (M))
\]

Different products secondary sales conversion rate difference is bigger, often determined by the
electrical contractor.

\[
o = M/(N + M) \\
a = \text{IF THEN ELSE} (l >= 0.75, 0.5, 1*0.6)
\]

According to the logistics enterprise classification and evaluation indicators (GB/T19680-2005),
the domestic logistics industry hierarchy: A grade AA grade AAA grade AAAAA AAAAAA level 5
levels, 5 A grade logistics enterprise is the highest level in China. Research process because of the
time, it is hard to find a different level of logistics enterprise service efficiency of related data, so in
this paper, the principle of fuzzy analytic hierarchy process (ahp) is adopted to logistics efficiency
and speed of order processing for parameter estimation, the divided into five grades, respectively
corresponding with corresponding level of logistics enterprise.

Simulation and Analysis

Simulation case data import

<table>
<thead>
<tr>
<th>Variable</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product sourcing qualified rate</td>
<td>95</td>
</tr>
<tr>
<td>Returns response efficiency</td>
<td>10(normal)</td>
</tr>
<tr>
<td>Detection efficiency</td>
<td>20(normal)</td>
</tr>
<tr>
<td>Advertising</td>
<td>RANDOM UNIFORM(0, 1,0.002 )Uniform distribution random function</td>
</tr>
<tr>
<td>Secondary sales conversion rate</td>
<td>75</td>
</tr>
<tr>
<td>Logistic cooperation level</td>
<td>4(General express)</td>
</tr>
</tbody>
</table>

Combining the above modeling analysis, the system dynamics simulation software Vensim PLE
for simulation. According to the experience of the previous e-commerce return analysis, reverse
logistics in B2C e-commerce return for an average of 3 days or so, in order to ensure the accuracy
of the simulation in this paper, the simulation time is 150 hours, for about 6 days, namely step
length is 0.5 hours. And with Tmall platform of some electronic commerce.

Simulation analysis

According to the enterprise data as simulation constant initial values of the input model, get the
following simulation results.

1) Customer satisfaction and electrical business competitiveness. When the system flow diagram
analysis we found that customer satisfaction is INFLOE1 and OUTFLOE1 time integral;INFLOW1
by blind consumption quota, qualified delivery rate and the efficiency of the forward logistics
mutual influence, as consumers spend degree affected by fluctuations in electrical business
advertising, so customer satisfaction rate of flow is also affected by fluctuation, its numerical fluctuation between 0.2 to 0.5; OUTFLOE1 by blind consumption, delivery rate and consumer expectations affect together, for the same reason consumers satisfaction outflow rate correspondingly affected by fluctuation, is less affected, its value from 0 to 0.3; But as time integral with the processing of reverse logistics, customer satisfaction is gradually enhanced, the law and wei ying [6].did return reverse logistics questionnaire is consistent.

2) Return reverse logistics and inventory. Queuing return amount due to the return of the response rate and consumer return frequency composite effect, due to the initial consumer satisfaction low return frequency surge, queuing followed in return. As the amount of time to the accumulation of a consumer line return stock is beyond the scope of electrical business normal processing ability, response rate of return volatility, at the same time as the amount of processing line return reverse logistics regularity of volatility and weak decline trend.

With the increment of queuing returns, reverse through put into a growth trend. But as time accumulation of increasing customer satisfaction and business competitiveness is in, so a time reverse through put in steady, the third day after the reverse through put gradually diminishing.

Conclusion

In the rapid development stage of China's B2C e-commerce, the problem of returning goods is becoming more and more prominent. It turns out that B2C returns to reverse logistics is influenced by an electrical merchant and a third party logistics, and it's the reverse logistics that is driven by consumers. According to the paper under the B2C e-commerce return reverse logistics system simulation case study found that when consumers choose to return, the consumer satisfaction of the electricity suppliers is low, and the electricity business lacking of consumer trust is not competitive at all. As the return response and third party logistics are handled, the consumer satisfaction is gradually recovering, and it's proportional to the processing and response rate. For the reverse logistics of returned goods, this paper suggests that when consumers initiate returns, e-commerce should formulate flexible manpower input and speed up response rate according to the quantity returned, and reduce the delay of service.

References


