A Method of Detection and Analysis of Logistics Information Error on B2B Supply Chain

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Abstract: - Logistics environment is getting sophisticated but it is still hard to detect various problems regarding logistics fields and even if they are recognized, it is hard to resolve them quickly. To resolve these problems, this article explains a method of detection and analysis of logistics information error on B2B supply chain. A meaning of logistics information and logistics information error is explained first and error type is classified for a method of detection and analysis of logistics information error and then concrete scenario is presented. The analysing process of error is described by explaining of conditions which are determining each logistics information error type on the presented scenario. This method makes an individual item level analysis of causes for errors being possible.

Key-Words: - Logistics, Logistics Information, Logistics Information Error, Detection of Logistics Information Error, Analysis of Logistics Information Error, B2B Supply Chain

1 Introduction

Many logistics companies try to merge several specialized logistics information systems like a WMS(Warehouse Management System), a TMS(Transport Management System), a OMS(Order Management System) etc. for an effective SCM establishment and try to connect various business information systems link a SCM, a ERP(Enterprise Resource Planning), a BPM(Business Process Management), a CRM(Customer Relationship Management) etc. for business efficiency[1]. In addition, logistics environment is getting more sophisticated by improving automation level after adjustment for RFID technology[2]. In spite of these efforts, it is still hard to detect various problems regarding logistics fields and even if they are recognized, it is hard to resolve them quickly. Human error and no counter plan for occurrence of logistics information system error and decoupling of information among supply chain participants can be mentioned as these reasons. Human error is the case that a human produce and enter and transfer wrong information while testing products directly, which can be resolved by automating product testing[3]. But this also can be a problem if the success rate of the testing is less than 100% by automation system, and it can be a problem as well if logistics information is not processed correctly by logistics system error. Most
of all, the decoupling of information without standardized logistics environment is one of the major factors of blocking to resolve various problems on supply chain[4]. If a problem occurred on a supply chain, logistics flow will be delayed and due to this, participants will incur a loss of money and time. Therefore a study of problems on a supply chain is very important and it is urgently required.

This article is a study on a method of detection and analysis of logistics information error on B2B supply chain, which explains the meaning of logistics information and logistics information error and a method of detection and analysis of logistics information error. Logistics information error will be classified and concrete scenarios will be suggested for the method of detection and analysis. The analysing process of error will be described by explaining of conditions which are determining each logistics error type on the presented scenario.

2 Logistics Information and Logistics Information Error

2.1 Logistics Information

Logistics information means all occurring information including ordering information which means purchasing products, while products flow through a supply chain. Logistics information is started with ordering information created from purchasing products, and consists of generated product shipping information while transporting from manufacturers to distributors and from distributors to retailers on general form of B2B supply chain consisting of manufacturers, distributors and retailers.

Fig. 1 B2B Supply Chain Structure and Logistics Information.

In order to match the first information on ordering products and the last information on shipping products, ordering information and shipping information between companies should be matched all, so ordering information can be standard information. Shipping information is divided into product information and information in transport document and these are also matched to each other. Most participants on supply chain check any problem by comparing information in transport document with product information through receiving tally and shipping tally. Therefore tally is an important process to maintain consistency in logistics information.

Until manufactured products are transported from manufacturer to distributor at manufacturer and receiving products are transported from distributor to retailer at distributor and receiving products are stocked at retailer, products are processed sequentially in accordance with internal business processes like receiving, shipping, packing, picking, loading, etc. These internal business processes differ from company to company and information also has not been shared each other. Certain logistics information needed to be shared for consistency in logistics information, because logistics flows depend on business process and logistics information can be added or changed in this process. Logistics business processes like receiving and shipping performing tally, can be utilized as the unit for confirming the consistency of logistics information, therefore sharing information related to receiving, shipping, and etc., between companies is needed for supply chain visualization.

2.1.1 Logistics Information Error

The situation which logistics information does not match to each other, often occur for various reasons while products flow through supply chain. Logistics information error means that which occurs by not matching product information and information in transport document and mostly occurs in product information while transporting products rather than ordering information while ordering products. Errors generally occur in product information rather than information in transport document, but they can also occur in information in transport document rather than product information. Specific reason of product information error can be
found among loss, misdelivery, delay or missing delivery, etc. and these can be classified as errors related to business process because these types are related to product flow. On the contrary, information error in transport document can be found among human error or automating testing system error and these can be classified as errors related to tally. These days a trend for adoption of RFID technology for automating system is growing, therefore to companies RFID is adopted, errors related to tally can be considered as RFID infrastructure error.

Table 1 Type and Reasons of Logistics Information Error

<table>
<thead>
<tr>
<th>Type of Logistics Information Error</th>
<th>Reason of Logistics Information Error</th>
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<tbody>
<tr>
<td>Logistics Business Process</td>
<td>Missing delivery</td>
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<tr>
<td></td>
<td>Misdelivery</td>
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<tr>
<td></td>
<td>Loss</td>
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<td></td>
<td>Delay</td>
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<td>RFID Infrastructure Error</td>
<td>RFID Reader Error</td>
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<td></td>
<td>RFID Middleware Error</td>
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<td>EPCIS Error</td>
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<td></td>
<td>Network Error</td>
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</table>

Table 1 represents that type and reason of logistics information error. Missing delivery means that product was treated as proper delivery, but the real product remains at previous location, and misdelivery means that the real product is transported at different location, and loss means that product was treated as being shipped but it cannot be found in current business process. Loss means that product is not arrived on time with transportation delay.

Logistics information error by RFID infrastructure error can be classified into RFID reader, RFID middleware, EPCIS and Network Error. More specifically, RFID reader errors are device status error, antenna error, out of memory, memory input/output error, tag Kill/Lock Erase failure, channel status error, etc. and RFID middleware errors are collection error from RFID reader, processing error in collecting data, error in transmitting a report, etc. and EPCIS errors are error in EPCIS event collection, searching error, repository error, web service error, etc.[5]. Network errors occur due to blocking network between RFID reader and RFID middleware, and between RFID middleware and EPCIS.

3 A Method of Detection and Analysis of Logistics Information Error

In this article, detection of logistics information error means that product information and information in transport document are different, and analysis of logistics information error means that which are determining error type by analyzing reasons of the logistics information error. For detection and analysis of logistics information error, a standardized method utilizing RFID technology and EPCIS architecture is used in consideration of technology direction and compatibility, and it is supposed that logistics business process information and RFID infrastructure information can be provided, and the detailed error information can be provided when error occurs, and it was defined that detection of logistics information error can be performed only in receiving and shipping process though RFID tag information can be collected from various logistics business process. Logistics business process information and RFID infrastructure information can be provided by modeling and connecting with BPM[6].

In these conditions, logistics information error can be detected simply by comparing ordering information in WMS with RFID tag information representing quantities of products if they do not match to each other. RFID tag information is included in EPCIS event information therefore it is possible to compare quantities of products by retrieving EPCIS event information and confirming names and quantities of products on receiving and shipping process[7]. But this method cannot determine exactly which product has logistics information error if quantities of products with same codes are not matched each other. It is possible to detect item level logistics information error by comparing EPCIS events with EPC list, but if the EPC list cannot be provided, it is possible to detect item level logistics information by supposing EPC list from the first EPCIS events to a proper EPC list.

Scenarios which are to analyze reason of detected logistics information error, can be divided into three different scenarios like this.
Fig. 2 Scenarios for Detection and Analysis of Logistics Information Error

Figure 2-a is the case which performs detection of logistics information error on shipping process at manufacturer, since there is no receiving information so the logistics information error type cannot belong to these errors like misdelivery, missing delivery and delay, but the error type can be one of failure in obtaining product information caused by RFID infrastructure error, or loss of product before shipment, though an error occurs on shipping process. If the error occurs by failing in obtaining product information caused by RFID infrastructure error, the error type can be determined by inquiring into provided error information whether RFID devices related to shipping process have errors or not. If the error information is not related to RFID infrastructure, the error type can be regarded as recognition error by damaged tag because the probability of loss is low. Figure 2-b is the case which performs detection of logistics information error on receiving process at distributor, and error type can be determined by shipping information from manufacturer if error occurs. At first, if there is no shipping information related to products which have error, within shipping information from manufacturer, the type can be regarded as missing delivery. But if there is shipping information, the type can be determined by inquiring into EPCIS events for other logistics center whether the product is delivered to a wrong place or not. If the product information is not be found in EPCIS events for other logistics center, like figure 2-a, the error type can be one of RFID infrastructure error, or loss of product before shipment, or error by damaged tag. Figure 2-c is the case which performs detection of logistics information error on shipping process at distributors, and this case is the same as figure 2-a except for existence of receiving information. If error occurs and there is no receiving information related to products which have error, the error analysis result is the same as figure 2-b and if there is receiving information, this case is the same as figure 2-a. In addition, the case which performs detection of logistics information error on receiving process at retailer, is the same as figure 2-b, and even if a number of distributors is increased, scenario is always belongs among three scenarios. Through this method of detection and analysis of logistics information error, logistics information error type can be determined and item level logistics information error detection is possible. The next figure shows a flowchart for the procedure.
4 Conclusion

This article explains a method of detection and analysis of logistics information error using standardized method utilizing RFID technology and EPCIS architecture. Though all the problems can not resolved through this method, this method can not only provide more detailed logistics error information to a supply chain manager but also give help prepare countermeasure for error recovery, since item level analysis of logistics information error is possible when error occurs.

Though further discussion is needed about whether suggested scenarios and error types are correct selection or not, this is meaningful as an effort to resolve problems which can occur on a supply chain and if it is possible to apply to logistics fields through implementation, it seems that more specific and concrete countermeasure can be suggested. Though this method requires information sharing among supply chain participants, and it does not seems to be resolved realistically. Since this can be resolved if a standardized logistics information sharing can be established to the extent that every supply chain participant can get public benefits, such research must proceed and the research on more complicated B2B supply chain including import and export process, also must be added.

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