An Investigation of Cross-Border E-Commerce Logistics and Develop Strategies Through SCCOM Framework and Logistic Service Risk Analysis

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Abstract. Cross-border e-commerce has become popular recently, so the importance of cross-border logistics has been enhanced. Because foreign buyers have high demand for logistics time, strengthening the logistics is an important key to increase sales. Only to enhance the ability of logistics can accelerate the cycle of the entire sales chain. By accelerating the recovery of capital can also increase the company's profits. However, the cost of logistics is the largest online cost of foreign trade expenditures. Cross-border distribution service errors would cause significant losses. Logistics risk management is relevant to improve the integration of strategic flows, but the contributions to cross-border logistics risks in literature seem limited. Therefore, this study is based on five steps of "Supply Chain Continuous Operation Management" (SCCOM) to help us analysis service risk for cross-border logistics. The main content of five steps include understand the SCCOM background, define SCCOM scope and objectives, operational impact analysis, continuous operational risk assessment, and continuous operational strategy. In case study, we take "Double 11"of Taobao in Taiwan area for example. Let consumers of China buy high-quality goods in Taiwan Taobao, and then send goods from Taiwan to China as the logistics risk analysis before the phase of cross-border services. The result indicates that cross-border logistics are most affected by "information system instability" and "maritime customs clearance anomalies". We develop the strategies that aim at the two factors above and propose some ways to reduce logistics service risk. Through the analysis results of this paper, cross-border logistics industries can take it as a basis for the development strategies. By this way, industries will reduce logistics risk, increase logistics capacity and smooth, and then improve the overall profit of the foreign trade industries.

Keywords. Cross border e-commerce, International supply chain management, Risk analysis

Introduction

In recent years, the global e-commerce retail sales grew rapidly. Cross-border e-commerce could make distance shorten between product and market. Cross-border e-commerce has great significance promoted the sustainable development of the domestic economy to meet the needs of foreign consumers [1]. From experts forecast, retail sales

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might reach 3400 billion dollars. The Cross-Border E-commerce is main power of growing up, increasing price over than 27%. It represents that the global consuming market has transferred.

The rapid growth of cross-border e-commerce transaction scale not only becomes the strong momentum of import and export trade, but also lengthens the value chain of the e-commerce industries and the logistics industries. Besides, cross-border e-commerce also provides multi-business models innovation opportunities. A series of advantages include cheap price, ensure genuine, multi-products. However, the development of export cross-border e-commerce has made many problems such as shortages and logistic problems [1]. We want to find the truly factors that affect the entire cross-border logistics.

The e-commerce industries said that cross-border e-commerce tax has reformed in the New Deal. The model to compete discount is not suitable for cross-border e-commerce now. The competitions shift to supply chain and logistics abilities.

Furthermore, customers and e-commerce companies have new requirements for logistics. They want faster, more accurate and more efficient logistics across the border trade. We analyze cross-border logistics involved in overseas warehousing, package, air transportation, customs clearance, domestic distribution and many other complex processes. The information comes from the opinions of e-commerce and logistics professional business time.

Logistic is the main foreign trade expenditures. E-commerce companies should take care of logistic risk more because any mistake maybe causes significant losses. Cross-border e-commerce logistic risks include damage or loss of goods during transit, customs confiscation inspection, not through aviation security, poor communication, risks during transportation, customs clearance and so on. Therefore, logistic risk analysis plays a critical role for a cross-border trade. Reducing the risk of logistics can avoid a lot of unnecessary costs. Doing supply chain management and controlling risk are concerned. So, It is time to evaluate trends and change drivers that are reshaping the current and future business environment around global supply chains [2].

This study aims to find the root causes of affecting cross border e-commerce logistic smooth. By improving these root causes, we can reduce the loss of time and cost. In other words, strengthening the abilities of logistic, e-commerce enterprises can accelerate the recovery of capital and increase profits.

1. Literature review

International e-commerce is called cross-border e-commerce. The raising of Internet accelerates cross border e-commerce and enables enterprises to develop global trade [3] [4]. Merchants use the internet technology to build e-commerce platform for trading and payment, and distributing goods by cross-border logistics. Customers can buy commodities from online and the merchants are located in other countries and jurisdictions [5]. Cross border e-commerce becomes an important trading patterns now. It not only breaks the barriers between countries and causes great changes of global trade but also enhances many new e-commerce business models [6]. Cross border e-commerce has three characteristics including all day, all directions and zero distance. It has changed the original e-commerce trade and rebuilt the supply chain of international trade. The rapid development of cross-border e-commerce relies on internet and international logistics provides new channels for enterprises' overseas marketing. It has

broken through the original thought of "business district" and increased the profit margin of foreign trade [7]. Cross-border e-commerce has injected new vitality to e-commerce, but it also exist some problems of cross-border logistics and distribution system [8]. So, management and controlling risk are also be concerned.

E-commerce had developed for a long time in western countries, mainly in Europe and American like Amazon. Cross-border commerce is developed faster by its environment [9]. Logistic mode in western is more mature than eastern world. We find that the exist research are mainly focus on the importance of E-commerce service quality and single-country delivery way of E-commerce management [10]. The Internet let present enterprises to make profit by their merchandise via cross border E-commerce. However, present works not focus about the logistics service risk for cross-border logistics. Therefore, this paper works on risk analysis of cross border E-commerce [9]. Main difficulty and problem of cross border E-commerce in China could summarize in three parts [10]. First, policy support of cross border E-commerce in China is in absence. Second, present development speed of international logistics is not match to giant E-commerce need in China. Third, the fundamental facility need upgrade much. The era of cross border E-commerce is relative short in China, but the development speed is super-fast. Total amount of double 11 increases every year, amazes global E-commerce manager [10]. The following approaches can help in the identification of potential supply chain risks: supply chain mapping, checklists, event tree analysis, fault tree analysis, failure mode and effect, etc.

Risk analysis can be defined in a number of ways, depending on how risk analysis relates to other concepts. Risk analysis can be described as risk communication, risk characterization, risk assessment, risk management, and policy relating to risk, to public- and private-sector organizations, in the context of risks of concern to individuals, and to society at a local, regional, national, or global level. We are concern about the risks in cross-border logistics like risks of damage or loss of goods during transit, customs confiscation inspection, not through aviation security and so on. Risk can be represented quantitatively in totally different ways, but usually due to consequence of undesirable events and the frequency or probability. In order to understand more thorough concept of the risk, we shall concentrate on a general risk model [11]. Risk is composed of three elements, vulnerability, threat and consequence [12]. Risk analysis can also be classified as three types: simplified risk analysis, standard risk analysis and Model-based risk analysis [13]. We focus on standard risk analysis. It could be defined as a more formalized procedure in which recognized risk analysis methods are used, such as Hazard and Operability study (HAZOP), coarse risk analysis and so on. There are several ways about risk analysis. For example, risk matrices are usually used to express the results [14]. The fault tree is a common method to find the problem [15]. Fault tree analysis is a deductive reasoning approach used to identify failures before their occurrence and as investigative tools to ascertain failures, to analyze accidents [16]. The FMEA is a powerful design tool that provides a mean to compare, from a risk point of view, alternative logistic service system [17]. Quality function deployment (QFD) is used as a powerful tool for improving product design and quality, and procuring a customer-driven quality system [18].

Although the cross border e-commerce is prevailing now, lots of risks exist in logistic service process. There are rarely investigations in this domain, so this research wants to analysis the logistic service risk of cross border e-commerce. We combine several methods to develop Supply Chain Continuous Operation Management (SCCOM) framework, which help us develop strategies for foreign trade industries.

2. Method

We would like to utilize Supply Chain Continuous Operation Management (SCCOM) to analyze this issue. According to the five steps of Supply Chain Continuous Operation Management (SCCOM) includes understanding the SCCOM background, defining SCCOM scope and objectives, operational impact analysis, continuous operational risk assessment, and continuous operational strategy. Taobao double eleven festival update the single-day transaction amount record every year. In Taiwan area, we let China customer buy product in Taiwan and sending to China properly. We do the risk analysis in cross-border E-commerce, especially in logistics. Based on the definition of SCCOM, we analyze logistics service risk for logistics transit mode.

You must understand the relationship of logistic system and supply chain management, and the potential impact. The purpose of supply chain management and influence of interruption, preference of risk decision maker, related regulation, expectation of customer and manager also played an important role in SCCOM. In Taobao case, customer in China could choose two system deliver their product to Taiwan, cross border home delivery logistic and cross-border convenience store delivery logistic. Based on the delivery destination, cross border home delivery service will send to China customer through delivery companies like Hsinchu corperation and T-cat corperation. It is quite similar between cross-border convenience store delivery logistic and cross-border home delivery logistic. Main difference depend on different supply chain member.

In this step, you must define the scope of your analysis. For example, main product activity, export airport or port, accepted operation and service level. We evaluate the potential factor of service system fragility, the case will go on with Taiwan seller in Taobao. The seller may send their product to China local port by convenience store. In this situation, the way from Taiwan to China might face much service mistake, for example, missing and destroy in delivery process. That will lead to logistic service mistake. Therefore, we have to define the potential factor and analyze it in next part.

We can reach two goals by operational impact analysis. First, it identifies the impact on industry supply chain activities. Second, it confirms the maximum time of tolerable interrupt service. In supply chain of logistic service, the most important performance is that achieve the service requirement from customers. We interview experts to know the realistic situation of cross border logistic step by step. By their practical experience share in detail, we can collect some error service contents of cross border logistic. And then we will do further classification and analysis by the information. We apply QFD and Cause & Effect/Fishbone Diagram to find the technical requirement needed that impacts distribution logistics service system by integrating experts' viewpoints and error service contents. After that, we design the questionnaire to measure the weights of these technical requirements. Final, we get the most important requirement.

At this step, we need to identify the risk which might occurred, also risk analysis and assessment is demanded.
Ask the relevant department experts, stakeholders according to brainstorming, literature review conclusion to identify all possible risk factors, then define the risk factors severity of the impact of the possibility.

We make use of fault tree analysis and FMEA. The first step is to look for all events that cause the top of the direct cause. The second step was to find each of the above direct reasons for all the direct causes, sequentially, until the most direct cause of

the most basic (bottom event). Then we might get some reasons of this service fault. Just like the store staff fault, transporter fault and so on. We find some events cause this fault, as loss of storage of goods, goods missing in the store and not leaving, etc. Then we can put in the figure and identify what kind of event it is then make decisions. FMEA (failure mode and effective analysis) is a step-by-step approach for collecting knowledge about possible points of failure in a design, manufacturing process, product or service. The main purpose of FMEA focus on three parts, the weakness of this system, the worst case if something wrong happened, how to prevent the bad situation. In our work, we analysis the failure mode in eight part, and evaluate the failure effect, failure reason, exist control policy. Depend on expert's opinion, we give it weights in S(severity), O(occurrence) and D(Detection). The RPN value is calculated by SOD value. All these symbols have totally different meanings and are able to be divided into two types: event symbols and gate symbols simply as Table we describe distinctly. Due to the consequence of the risk analysis, we can recognize the most dominant variables. We can develop continuous operational strategies and complete all the step of supply chain continuous operation management.

3. Case study

3.1. Understanding "Double 11" of Taobao logistics background

Taobao gives a platform for Taiwan's online sellers and serve customers to buy goods from Taiwan. Then goods are transported from Taiwan to anywhere in China according to logistics distribution system and the services could be separated into two ways: cross-border home delivery service and cross-border convenience store service. The service of delivery from Taiwan FamilyMart store and pick-up from the Shanghai delivery store, the sender in Taiwan could send goods to FamilyMart store, then the goods going are transported by shipping to China. After about 10 working days, the person who ordered can pick up the goods from delivery store. The supply chain members who responsible for this cross-border logistics service also need to integrate the information of logistics of Taiwan and China.

The logistics service process designed can divide into seven processes, sequentially, "Sender sends items from country A", "Logistics goods collection in country A", "Tally and labeling in country A", "cross-border cargo collection and transportation operations", "Tally and labeling in country B", "Distribution operation in country B", "Pick-up in country B". 4.2 would explain details of this process. There are two different logistic service process. Figure 1 is service process of convenience store delivery. It consolidates cargo service by Taiwan's convenience store. And Figure 2 is service process of home delivery. It consolidates cargo service by home delivery logistic of Taiwan.

3.2. Defining SCCOM scope and objectives on cross border logistic service

We evaluate the potential factor of service system fragility, the case will go on with Taiwan seller in Taobao. The seller may send their product to China local port by convenience. We collect the opinion of much experts to understand the structure of E-commerce industry, operation mode and logistic service process. We summarize the main reason in seven parts and it will presented as follows:

1. Seller sending: The seller packaged the product and go for sending at delivery multiple store or convenience store, and delivery fee is necessary.
2. Logistic process in Taiwan: The delivery corporation gather the product and check the detail and total amount of the goods. Once the checking is proceed, goods will leave the gathering place.
3. Labeling work in Taiwan: When all goods arrived to the logistic corporation, check the amount first, then labeling it. Then sealing it if no error is happened.
4. Cross-border logistic work: All goods will send to the port, separate by grade and x-ray checking is necessary. Then put the goods to the China-end logistic center.
5. Labeling work in China: When all goods arrived to the China logistic corporation, check the amount first, then labeling it, classifying it by destination.
6. Delivery process in China: The goods will send to local logistic center, buyer's place or convenience store. Message and your ID is necessary for getting your goods. Any receipt will keep in case product problem and tracking.
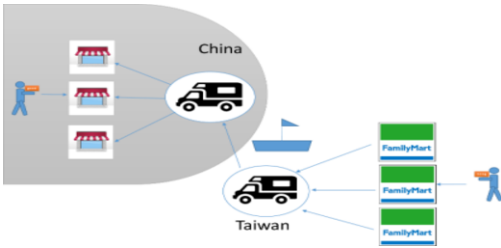

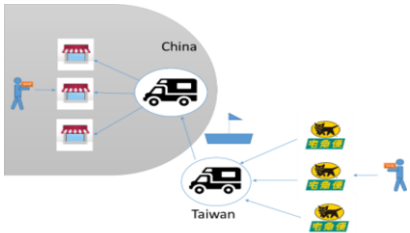**Figure 1.** Service process of convenience store delivery

Figure 2. Service process of home delivery

3.3. Operational impact analysis on cross border logistic service

Cross border logistic service supply chain exists lots of risk. Through experts' opinion and literature collections, we generalize the content of cross border logistic service faults. We classify service faults into two types, "information flow error" and "logistic error". Table 1 shows detail contents of cross border logistic service errors. Figure 3 is "Cause & Effect/Fishbone Diagram". It is method that discover the root cause of questions.

Table 1. Cross border logistic service errors.

Types	Service error content	Service error reason
○,1 **Logistic**	○,3 Store employees errors	○,11 Input wrong information
		○,12 Product missing
		○,13 Delivery sheet missing
		○,14Product not meet delivery regulations
		○,15 Wrong Package
	○,4 Delivery employees errors	○,16 Delay (ex: traffic jam, weather, car accident, etc.)

| Types	Service error content	Service error reason
		○,17 Product damage
	○,5 Tally employees errors	○,18 Wrong Classification in logistic boxes
		○,19 Unboxing damage
		○,20 Product damage
	○,6 Cross border delivery errors	○,21Delay(ex: weather, vehicle, custom)
		○,22 Product damage
	○,7 Consumers	○,23 Wrong pick-up
		○,24 Leave wrong Information
○,2 Information flow	○,8 Store information errors	○,25 Consumers information loss
	○,9 Information connect errors	○,26 Out of synchronization
	○,10 Tally information errors	○,27 Wrong classification of foreign products and domestic products
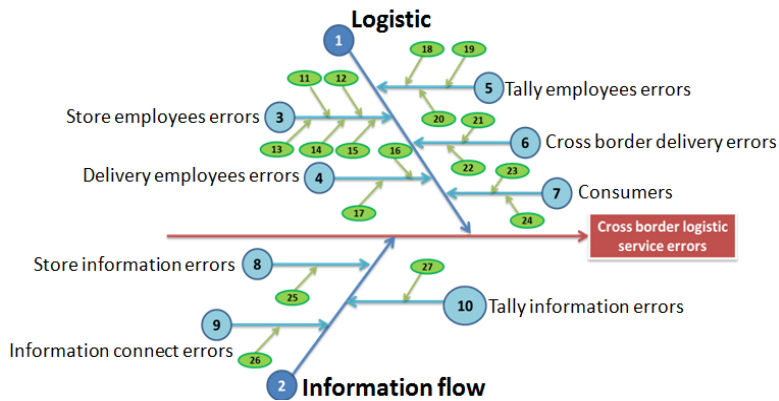
Figure 3. Cause & Effect/Fishbone Diagram

QFD emphasizes multifunctional teams required for integrating all corporate functions to be responsive to the customer's requirements so that product planning, product design, process planning, and production planning provide a coherent response to CNs [16]. But in our research, we apply Quality Function Deployment as Figure 4 to transfer the cross-border logistics border into technical engineering requirement. The customer requirements are from Service error content (Table 1).The symbols meaning and the weights applying in QFD. According to the QFD diagram, we find there are two technical requirements which have high weight value. "Avoiding logistic error" ability and "information synchronization", their value are respectively to be 106 and 71. And the value is coming from multiple technical requirement and the expert importance of every errors, then add together to be the weight value. It's much higher than the others. From these two, we can develop some strategies at 4.5- Continuous operational strategy on cross border logistic service.
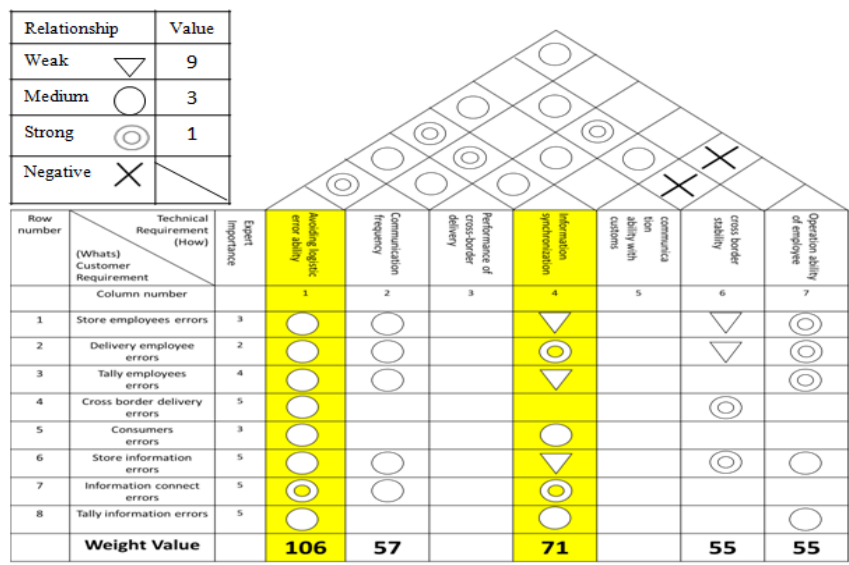
Relationship		Value
Weak	▽	9
Medium	○	3
Strong	◎	1
Negative	✕	

Row number	(Whats) Customer Requirement	Expert Importance	Avoiding logistic error ability	Communication frequency	Performance of cross-border delivery	Information synchronization	communication ability with customs	cross border stability	Operation ability of employee
Column number			1	2	3	4	5	6	7
1	Store employees errors	3	○	○		▽		▽	◎
2	Delivery employee errors	2	○	○		◎		▽	◎
3	Tally employees errors	4	○	○		▽			◎
4	Cross border delivery errors	5	○					◎	
5	Consumers errors	3	○			○			
6	Store information errors	5	○	○		▽		◎	○
7	Information connect errors	5	◎	○		◎			
8	Tally information errors	5	○			○			○
Weight Value			**106**	**57**		**71**		**55**	**55**

Figure 4. Quality Function Deployment

3.4. Continuous operational risk assessment on cross border logistic service

In this step, we use FMEA as Table 2 to implement logistic risk analysis. The FMEA is a formalized but subjective analysis for the systematic identification of possible Root Causes and Failure Modes and the estimation of their relative risks [15]. By the FMEA mode analysis, once the value is high means it is the weakness in this system. The SOD in Table 2 represent severity, occurrence and detection respectively. The logistic corporation have to manage the policy to conquer the factor. In this case, we found the highest value in FMEA mode is cross border delivery errors and information connection errors. Therefore, we manage the policy strategy in following part in communication frequency and information out of synchronization.

Table 2. Risk Priority Numbers.

	Failure			Cause		Detection		Action	
Item	Failure mode	Failure effect	S	Failure reason	O	Exist Control policy	D	RPN	Advise
Logistic	Store employees errors	Input wrong information	5	Product missing, Delivery sheet missing	5	Process regulation	4	100	More employee training
	Delivery employees errors	Delivery Delay	6	Product damage	3	Delivery corporation regulation	4	72	More driver training
	Tally employees errors	Wrong Classification	7	Unboxing damage, Product damage	2	Delivery corporation regulation	6	72	Double checking

	Cross border delivery errors	Delivery Delay	8	Product damage	5	Related law between countries	3	120	Strict standard at custom
	consumers	Carefulness	6	Wrong pick-up, Leave wrong Information	4	Receipt keeping	4	96	Sign and checking in receipt
Information flow	Store information errors	Data loss	5	Consumers information loss	4	Computer management	4	80	Database back up
	Information connect errors	Data link failure or loss	6	Out of synchronization	6	Computer management	4	144	Database back up
	Tally information errors	Wrong packaging or missing	7	Wrong classification of foreign products and domestic products	3	Logistic system	4	84	Strict training

Then, we use Fault Tree Analysis as Figure 5 to identify that the fundamental factors caused cross border logistic service errors. This analysis extends from Table 1 at 4.3. We employ some symbols as we introduce at 3.4 from the fault tree analysis. The purpose of using this diagram is to realize the relationship between an event to another and the most influential factors clearly. By Fault Tree Analysis, we can find the root causes of cross border logistic trade. So it makes this part more competed and powerful. Then we could refer this diagram to purpose the strategy at 4.5.
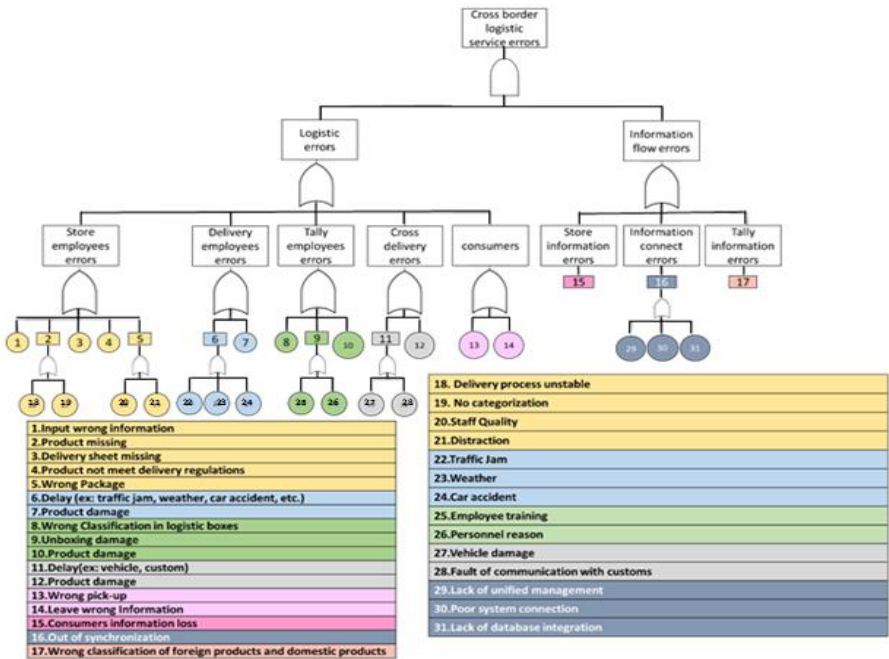

Figure 5. Fault Tree Analysis on cross border logistic service

3.5. Continuous operational strategy on cross border logistic service

From the previous QFD and FMEA, the first and second important technical requirements of the enterprise go to 'Avoid logistics errors ability' and 'Information synchronization.' First, Information synchronization means we have to set a stable system. Information system connects all related data between supply chain members, so it plays a crucial role in logistic system. To unified information system, we have to formulate a serious regulation. Then push all staff follow the regulation, education on such lesson. Also, tight standard on any system mistake, once something wrong happened, we think that enterprise could implement total quality management to manage efficiently. Second, avoid logistics errors ability is absolutely essential according to QFD. And we know cross border delivery might be key point in this technical requirement. So we conclude the frequency of weekly meeting in cross border supply chain is important, once there is bottleneck or emergency situation, the meeting will become frequent. During the meeting, we might have week review and prospect, then the manager review some fault in this week, then discuss what to do next week. Not only it could apply in this requirement, but also could use in lots of aspects.

4. Verification

We use INCOME to simulate the process we expected. There are two processes: as-is model and to-be model. The two processes are the same. We suppose that if the enterprise avoids the risk caused by "out of synchronization" and "cross border delivery", then the cost of transportation might decrease. Then we compare as-is model with to-be model, we could see that the time of this logistics process decrease from 604892 seconds to 578972 seconds. The decease rate of time is about 4.386%. And the cost is decrease from 290 to 268. The decease rate of time is about 7.587%. Figure 6 shows the result of comparison As-Is & To- Be. After analyzing, we identify the risk, then we apply INCOME to simulate that if the enterprise involved in this logistics process avoid these risk, then the cost and time will decrease certainly.

As- Is Activities	C...	Execution...	Resource...	Value Add...	Times (Sec...
manage order	1	10	0	0	10
Details of the goods (EDI)	1	2	0	0	2
examinate success 1	1	1	0	0	86,400
Seizure	0	0	0	0	0
pick up	1	0	0	0	3
transport by ship	1	100	0	0	345,600
examinate success 2	1	1	0	0	1
seizure 2	0	0	0	0	0
Domestic transport (Taiwan)	5	78	0	0	86,438
Domestic Transport (China)	5	98	0	0	86,438
Sum	**16**	**290**	**0**	**0**	**604,892**

To- Be Activities	C...	Execution...	Resource...	Value Add...	Times (Sec...
manage order	1	10	0	0	10
Details of the goods (EDI)	1	2	0	0	2
examinate success 1	1	1	0	0	86,400
Seizure	0	0	0	0	0
pick up	1	0	0	0	3
transport by ship	1	90	0	0	345,600
examinate success 2	1	1	0	0	1
seizure 2	0	0	0	0	0
Domestic transport (Taiwan)	5	73	0	0	69,158
Domestic Transport (China)	5	91	0	0	77,798
Sum	**16**	**268**	**0**	**0**	**578,972**

Figure 6. The result of comparison As-Is & To- Be.

Figure 7 below is the process of this cross-border logistics. Figure 8 is drill down of domestic transportation (Taiwan) and (China).
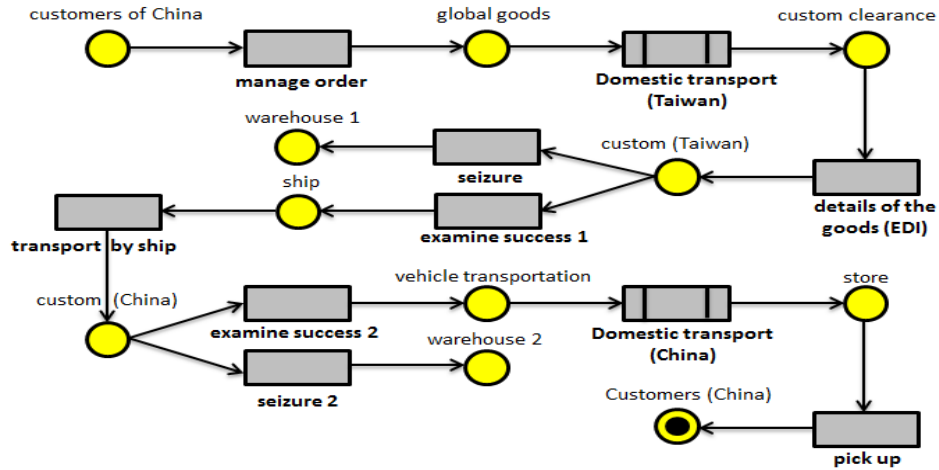

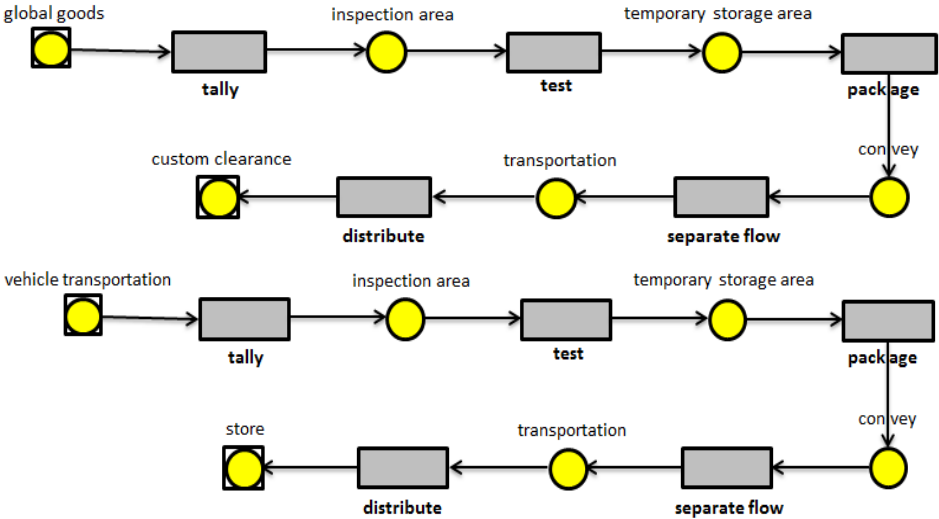
Figure 7. the whole process of cross-border logistics.

Figure 8. The drill down of domestic transportation (Taiwan) and (China).

5. Conclusion

In our work, the research is based on the rapid growth of cross-border e-commerce transaction, we complete research about cross border e-commerce logistic service risk. In Taobao case, we successfully use five steps of "Supply Chain Continuous Operation Management" (SCCOM), FMEA and Fault Tree Analysis to help us analysis service risk for cross-border logistics. In section 3, we introduce the method we proposed in this paper, SCCOM, QFD, FMEA and fault tree analysis. In section 4, the scope of SCCOM is defined and operational analyzes on cross border logistic service are

presented in this paragraph. We interviewed several experts in logistic and finished our questionnaire, it is the background of our work. Depend on the survey, it has been transfer into QFD and FMEA, we found several factors play a crucial rule in logistic system. By risk analysis in our work, 'Communication frequency' and 'Information out of synchronization' is the main reason to make the system unstable. We develop the strategies that aim at the two factors above and propose some ways to reduce logistics service risk. Also we propose the strategy against the weakness. Also we apply fault tree analysis to find the primary risk to deal with from all risk factors. Through the analysis results of this paper, cross-border logistics industries can take it as a basis for the development strategies. Furthermore, by this way, it will reduce logistics risk, increase logistics capacity and smooth, and then improve the overall profit of the foreign trade industries. In further work, we will do application of our analysis in real case. If our analysis is proved helpful to real logistic company, the era of cross border logistic will prosperous faster in near future.

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