

# Improve Cross - border E-commerce Logistics Risk Using SCCOM Framework and Risk Analysis

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**Abstract.** With Cross-border e-commerce has become popular recently, and the importance of cross-border logistics has been enhanced. Because foreign buyers have high demand for logistics time, strengthening the logistics is an important step 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 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. There is no complete research about cross border e-commerce logistic service risk now. Therefore, this study is based on five steps of "Supply Chain Continuous Operation Management" (SCCOM) and Fault Tree Analysis to help us analysis service risk for cross-border logistics. The main content of five steps includes 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, it 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

## 1. Introduction

In recent years, the global e-commerce retail sales grew rapidly. Cross-border e-commerce could make distance shorten between product and market. From experts forecast, retail sales might reach 3400 billion dollars. The Cross-Border Ecommerce 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, providing multi- business models innovation opportunities.

A series of advantages including cheap price, ensure genuine, multi-products etc. are more popular for cross-border consumers. However, 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.

Besides, customers and e-commerce companies have new requirements for logistics. They want faster, more accurate, and more efficient logistics across the border trade. By improving the abilities of logistic, e-commerce enterprises can accelerate the recovery of capital and increase profits.

Analysis from e-commerce professional business man, cross-border logistics involved in overseas warehousing, package, air transportation, customs clearance, domestic distribution and many other complex process will affect the entire cross-border logistics time.

Logistic is the main foreign trade expenditures. So, e-commerce companies should more take care of logistic risk, any mistake maybe cause significant losses. Cross-border e-commerce logistic risks include damage or loss of goods during transit, customs confiscation inspection, not through aviation security, risks during transportation, customs clearance and so on. Therefore, logistic risk analysis is very important for a cross-border trade. Reducing the risk of logistics can avoid a lot of unnecessary costs.

## ***2. Literature review***

### *2.1. Cross border e-commerce*

The raising of Internet accelerators cross border e-commerce and enables enterprises to develop global trade [1] [2]. International e-commerce is called cross-border e-commerce. 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 [3]. 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 [4]. 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 relying 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 [5]. Cross-border e-commerce has injected new vitality to e-commerce, but it also exist some problems of cross-border logistics and distribution system [6]. So, doing supply chain management and controlling risk are also be concerned.

### *2.2. International supply chain management*

E-commerce had developed for a long time in western countries, mainly in Europe and American like Amazon. It is nature logistics is advanced in such areas, bring it strong support. Therefore, cross-border commerce is developed faster by its environment [7]. Logistic mode in western is more mature than eastern world, like China. However, the exist research are mainly focus on the importance of E-commerce service quality and single-country delivery way of E-commerce management [8]. Though there are several thesis research in cross border E-commerce, but still few thesis focus on order management or application mode. 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 conference paper works on risk analysis of cross border E-commerce. [7] Main difficulty and problem of cross border E-commerce in China could summarize in three parts [8]. 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 [8]. The development of E-commerce is strong related to logistics, the development of logistics also needs support of E-commerce. It is complement to each other.

### *2.3. Risk analysis*

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. As we know, the purpose of risk analysis is to describe and analysis risks. And 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. And risk can be represented quantitatively in totally different ways, but usually by means of consequence of undesirable events and the frequency or probability. In order to understand a more thorough concept of the risk, we shall concentrate on a general risk model [9]. And risk is composed of three elements, vulnerability, threat and consequence [10]. Risk analysis can be classified as three types: simplified risk analysis, standard risk analysis and Model-based risk analysis. 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. Risk matrices are usually used to express the results [11]. And risk analysis includes the fault tree analysis and FMEA, which we would like to exploit. Fault tree analysis is a deductive reasoning approach used to identify failures before their occurrence, and/or as investigative tools to ascertain failures, to analyze accidents [12].

#### *2.4. Summary*

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 Supply Chain Continuous Operation Management (SCCOM) and Fault Tree Analysis method to analysis the risk. The analysis results help us develop strategies and do reliable basis for foreign trade industries.

### **3. Method**

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

#### *3.1. Understanding the SCCOM background*

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.

#### *3.2. Defining SCCOM scope and objectives*

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.

### 3.3. Operational impact analysis

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 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 of two. And we would introduce the symbols and the meaning of them applying in QFD as the table 1.

Symbols of the relationship between errors and technical requirement	meaning	value
▽	Weak relationship	9
○	Medium relationship	3
◎	Strong relationship	1
Symbols of the relationship between technical requirements	meaning	value
○	Medium relationship	
◎	Strong relationship	
×	Negative relationship	
⊗	Strong negative relationship	

Table1. Symbols introduction in QFD

### 3.4. Continuous operational risk assessment

At this step, we need to identify the risk which might occurred, also risk analysis and assessment is demanded.

#### 1. Risk identification

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.

#### 2. Risk Analysis and Assessment

We make use of fault tree analysis (Figure 1 and Table 2) 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). If we take cross-border transportation service fault as top event. Then we might get some reasons of this service fault. Just like the store staff fault, transporter fault and so on. Second, 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.

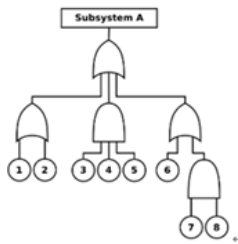


Figure 1. Fault Tree Analysis

Table 2. The symbols of Fault Tree Analysis<sup>47</sup>

Gate symbols	Description
	This symbol means AND gate and the event above is caused by one of events below, but these event is independent with each other.
	This symbol means OR gate, and the event above is caused by one of events below, but these event would not happen simultaneously.
Event symbols	Description
	This symbol means original failure event. The occurrence state is normal and the event is caused by other factors, not need to be unfolded to next level.
	This symbol means secondary failure event. The occurrence state is abnormal and the event is caused by other factors, need to be unfolded to next level.

Due to the consequence of the risk analysis, we can recognize the most dominant variables. And we can identify two or three influencing variables to make strategic plans. There is procedure at this step:

1. Elaborate alternative strategies
2. Select the best alternative strategy
3. Identify the resource requirements for the implementation of the strategic plan

Finally, we complete all the step of supply chain continuous operation management.

#### 4. Case study

##### 4.1. 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. Figure 2 is service process of convenience store delivery. And Figure 3 is service process of home delivery.

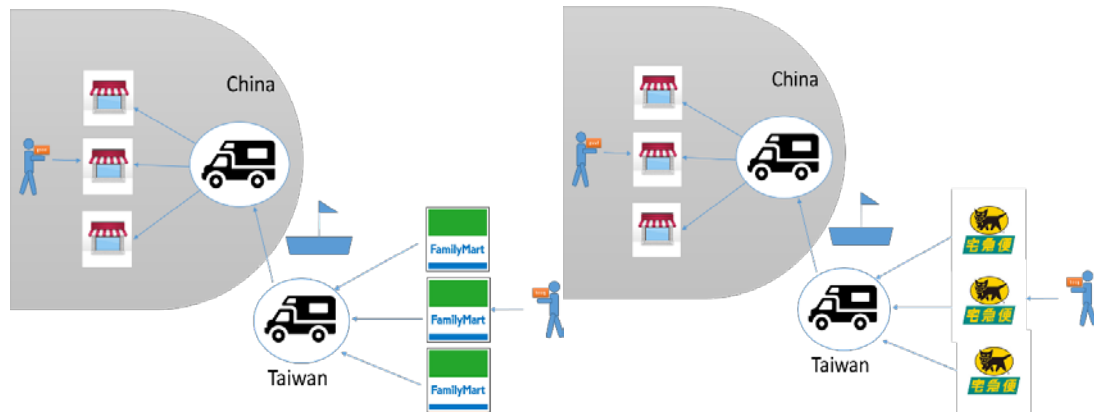


Figure 2. service process of convenience store delivery      Figure 3. service process of home delivery

#### 4.2. 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.

#### 4.3. 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 3 shows detail contents of cross border logistic service errors. Figure 4 is "Cause & Effect/Fishbone Diagram". It is method that discover the root cause of questions.

Table 3. 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
		⑭ Product not meet delivery regulations
		⑮ Wrong Package
	④ Delivery employees errors	⑯ Delay (ex: traffic jam, weather, car accident, etc.)
		⑰ Product damage
	⑤ Tally employees errors	⑱ Wrong Classification in logistic boxes

		⑱ Unboxing damage
		⑳ Product damage
	⑥ Cross border delivery errors	㉑ Delay(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

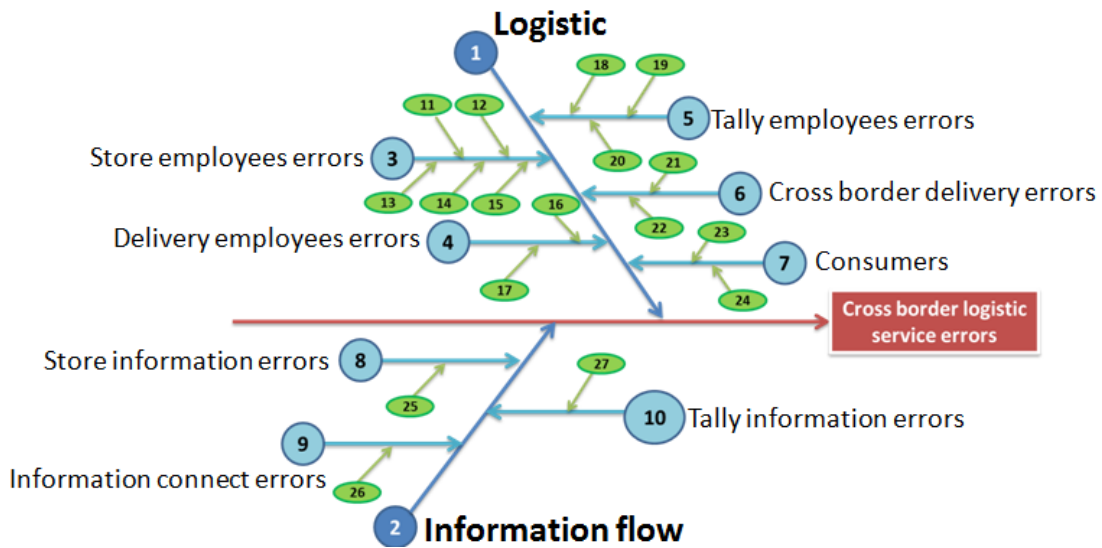


Figure 4. Cause & Effect/Fishbone Diagram

Then we apply Quality Function Deployment as Figure 5 to transfer the cross-border logistics border into technical engineering requirement. 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.

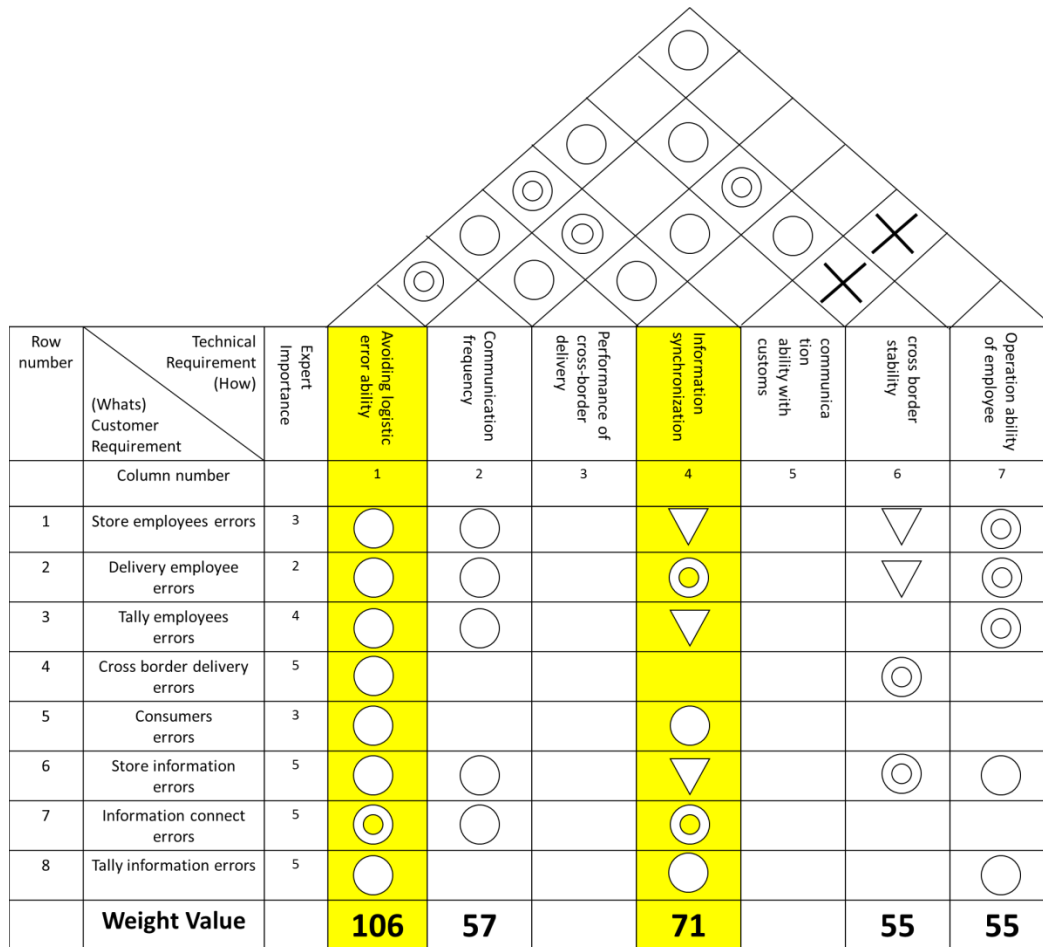


Figure 5. Quality Function Deployment

4.4. Continuous operational risk assessment on cross border logistic service

In this step, we use FMEA as Table 4 to implement logistic risk analysis. By the FMEA mode analysis, once the value is high means it is the weakness in this system. 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 4. Risk Priority Numbers

Item	Failure		Severity	Cause	Occurrence	Detection		Action	
	Failure mode	Failure effect				Exist Control policy	Detection	RPN	Advise
Logistic	Store employees errors	Input wrong information	5	Product missing, Delivery sheet missing	5	Process regulation	4	100	More employee training
	Delivery	Delivery	6	Product damage	3	Delivery corporation	4	72	More



	employees errors	Delay				regulation			driver training
	Tally employees errors	Wrong Classification	7	Unboxing damage, Product damage	2	Delivery corporation regulation	6	72	Double checking
	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
	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 6 to identify that the fundamental factors caused cross border logistic service errors. This analysis is accordance with Table 3 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. So it makes this part more competed and powerful. Then we could refer this diagram to purpose the strategy at 4.5.

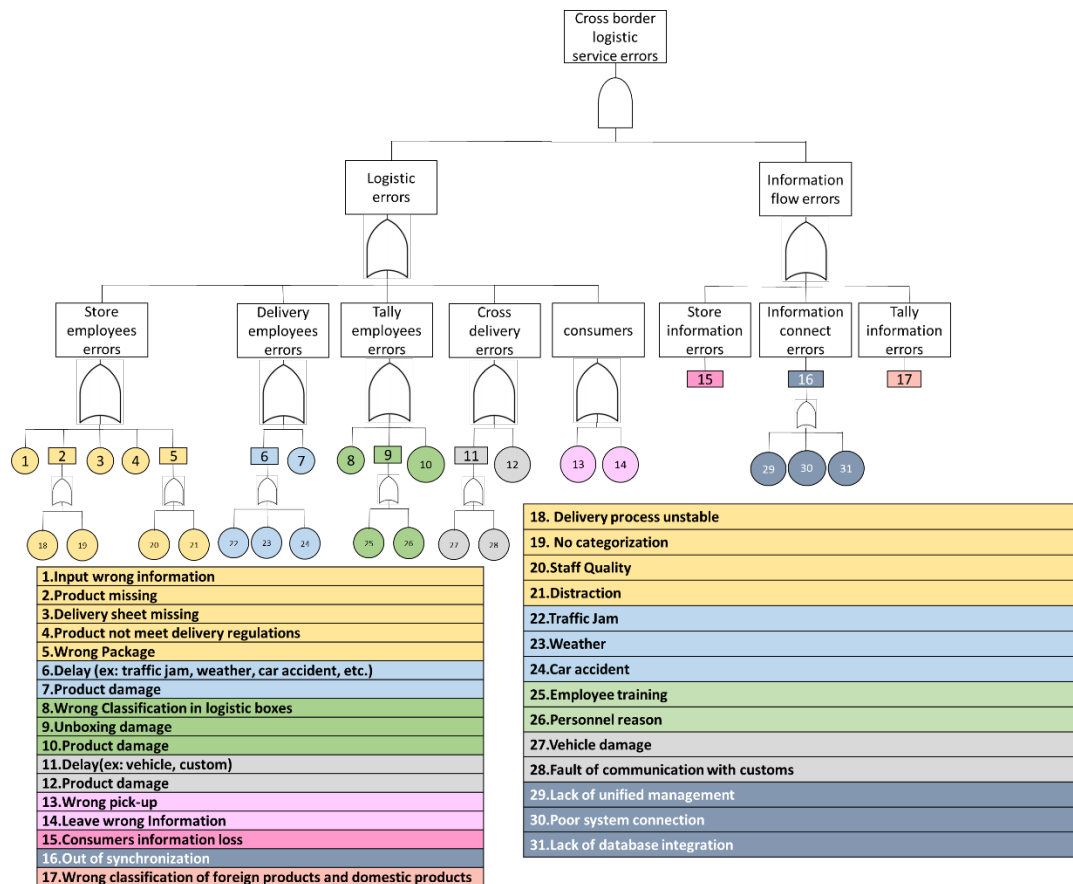


Figure 6, Fault Tree Analysis on cross border logistic service

#### 4.5. 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.

#### 5. 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 decrease rate of time is about 4.386%. And the cost is decrease from 290 to 268. The decrease rate of time is about 7.587%. Figure 7 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.

Figure 8 below is the process of this cross-border logistics. Figure 9 is drill down of domestic transportation (Taiwan). Figure 10 is drill down of domestic transportation (China).

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
	examine 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
	examine 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
	<b>Sum</b>	<b>16</b>	<b>290</b>	<b>0</b>	<b>0</b>	<b>604,892</b>

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
	examine 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
	examine 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
	<b>Sum</b>	<b>16</b>	<b>268</b>	<b>0</b>	<b>0</b>	<b>578,972</b>

Figure 7. The result of comparison As-Is & To- Be

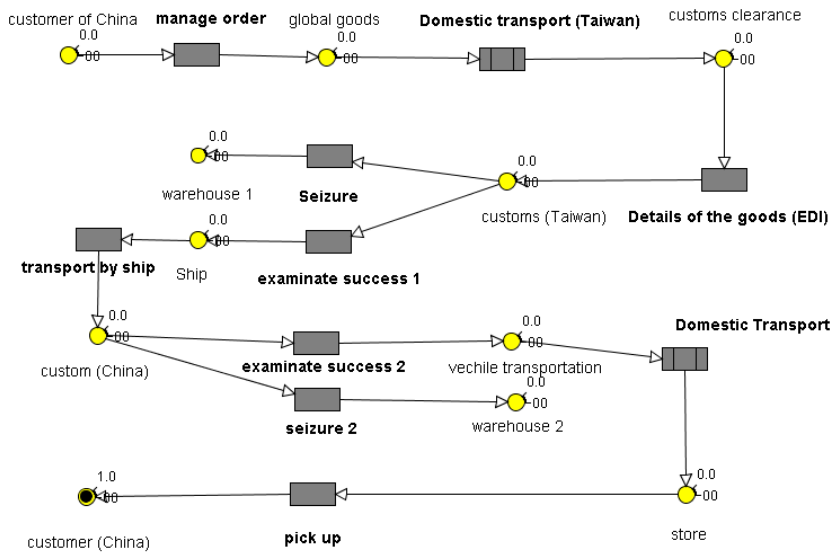


Figure 8. the whole process of cross-border logistics

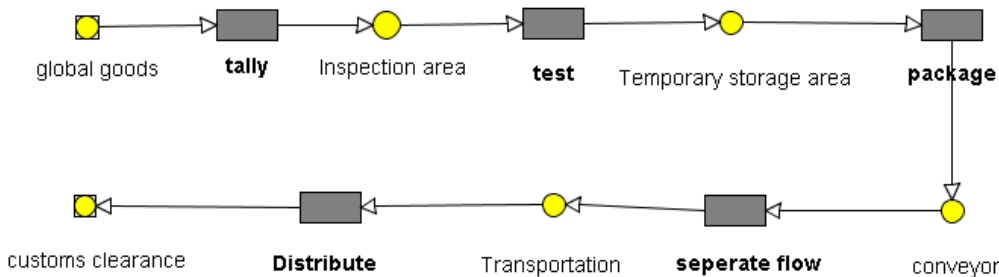


Figure 9. the drill down of domestic transportation (Taiwan)

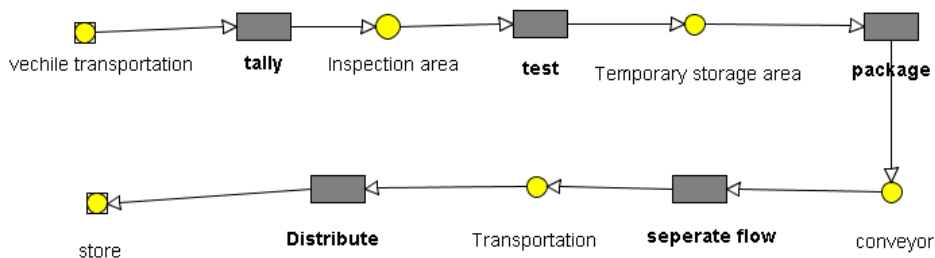


Figure 10. the drill down of domestic transportation (China)

## 6. 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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