

## MANAGING LOGISTICS RISKS IN A SUPPLY CHAIN

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### ABSTRACT

Logistics in a supply chain network has become an important operational strategy in a rapidly changing global competition environment. There are many internal and external risks involved in the logistics operations in a company which tend to create problems in satisfying customer's orders. This research is to present that risk management using an ERM framework can be applied to identifying, assessing, and controlling logistics risks. An electronic company's logistics activities were used to demonstrate how to identify risks surrounding the global logistics function and develop action plans to react against the risks.

**Key Words: Logistics, Risk, ERM Framework, Supply Chain**

### INTRODUCTION

Companies have attempted to improve their supply chain operations which involve a complex network of a set of entities, such as suppliers, their internal functional operations, and customers. Those operations, including the design of new products, procurement of raw materials, transformation into semi-finished and finished products, and delivery to the retailers or end users, are well illustrated by New and Payne (1995). The supply chain network operations are usually carried out through an overwhelming number of interactions and inter-dependencies among different entities, processes and resources. Thus, SCM (supply chain management) was recently introduced to make the end-to-end process throughout the entire supply chain network efficient in time and cost and responsive to customer orders as well.

Logistics plays the main role of connecting two entities or functions by moving materials/parts, work-in-process inventories, and finished goods. From this perspective, logistics is a very important activity in supply chain operations. There are two approaches to improving the logistics operations: performance-driven logistics improvement and risk reduction-driven logistics improvement. Most research on logistics in the literature can be categorized as the former. So, their performance indicators to enhance and monitor logistics operations include on-time delivery rate, damages during transportation, logistics costs, etc. While the activities of improving logistics performance are important, reducing risks involved in the logistics is also equally critical. Logistics risks here encompass transportation disruption, the damages of goods, the inability to access inventories, manufacturing discontinuity, and more. These risks definitely become barriers or ruination to improving logistics performance. Thus, reduction in logistics risks will in turn contribute to efficient and reliable logistics operations directly and/or indirectly.

Risks in business operations may threaten a company in many ways if the company doesn't cope with them properly and timely. A recent trend in corporate governance has been the development

of an integrated, enterprise-wide approach to assessing the business risks that can impact an organization's ability to achieve its business objectives and developing programs to manage those risks (Miccolis et al., 2001). From the needs for guiding companies to reduce their financial and nonfinancial risks, COSO (Committee of Sponsoring Organizations of the Treadway Commission, 2004) developed a framework for establishing an effective ERM (enterprise risk management), which describes key risk management principles and concepts, provides a common language, and offers direction and guidance. Since then, companies started employing ERM to investigate, analyze, and assess certain or uncertain risks involved in all activities in their business operations, and then prepare plans to manage those risks.

This research is to apply the ERM framework to identifying, assessing, and controlling risks associated with global logistics operations and present a case study with data obtained from an electronic company with global operations. The case company has a headquarters in Korea and factories in Europe, China, and Korea. This research employed the ERM processes of identifying all risks involved in the company's global logistics, assessing them based on their probabilities of occurrences and severity, and then categorizing the level of risks into key/major/minor risks.

## **ENTERPRISE RISK MANAGEMENT**

COSO (Committee of Sponsoring Organizations of the Treadway Commission, 2004) introduced a new framework of ERM which describes key risk management principles and concepts, provides a common language, and offers direction and guidance. The COSO framework shows risk management as an ongoing, enterprise-wide process that involves eight interrelated components: internal environment, objective setting, event identification, risk assessment, risk response, control activities, information and communication, and monitoring.

Australia and New Zealand endeavored to develop a risk management standard and introduced a revision series of AS/NZS 4360 Standard on Risk Management since 1995. AS/NZS 4360 has been especially successful in obtaining a wide acceptance from outside the Australasian region. The risk management's process steps listed in its 2004 edition of the Standard are:

- Step 1) Establishing a company's goals and context,
- Step 2) Identifying risks,
- Step 3) Analysing the identified risks,
- Step 4) Assessing or evaluating the risks,
- Step 5) Treating the risks,
- Step 6) Monitoring and reviewing the risks and the risk environment regularly, and
- Step 7) Continuously communicating and consulting with stakeholders.

Pathak (2004) presented a conceptual risk framework for internal auditing in e-commerce which is similar to AS/NZS 4360:2004 Standard on Risk Management. He suggested that prior to the installation or shifting over to e-commerce, an organization should ascertain the level of risk exposure on two counts: the number of people involved and the value of the transaction (payment or contract) because the more parties involved, the greater the risk; similarly, a higher value transaction will generate greater risk. When a company allows international trading on its e-commerce, the number and location of parties that can attempt to access the systems create

new challenges related to protecting critical applications and activities. So, companies with more sites of logistics origins and destinations, especially overseas, would face more risks in their logistics activities. Therefore, they should devise more effective and responsive risk management system for their logistics operations which allows for smooth movement of materials/semi-assemblies/finished goods to fulfill customer orders successfully.

## LOGISTICS AND ITS PROCESSES

Effective supply chain management which manufacturers recently strived for could enable the velocity of logistics to speed up along with more on-time delivery to customers. As results, Customers are expecting faster and more frequent deliveries without increase in logistics costs. And manufacturers in turn lean on their suppliers for “just-in-time” shipments of parts to the assembly line with similar demands that their customers imposed to them. Even though the role of logistics is to manage the flow of goods, information and other resources between the point of origin and the point of consumption, it involves many activities and participants to fulfill its function in a supply chain; the activities include transportation, inventory management, warehousing, material-handling, packaging, and logistics-related information management, and the participants in logistics are truck drivers, 3PLs, manufacturing, marketing, warehousing personnel, and so on. Figure 1 shows the flows of materials/subassemblies/finished goods and some logistics participants in a supply chain.

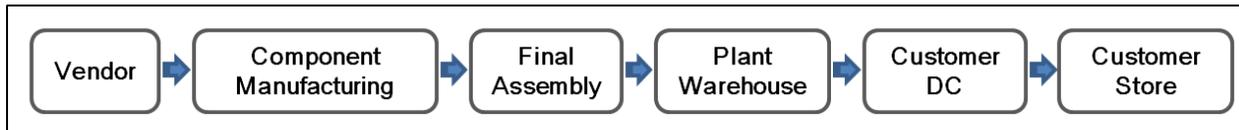


Figure 1. Flows of Materials/Subassemblies/Finished Goods in a Supply Chain.

Logistics whose processes are illustrated in Figure 2 is a multidimensional value-adding function including production, location, time and control of elements of the supply chain. It involves a wide set of activities dedicated to the transformation and distribution of goods, from raw materials to final product distribution as well as the related information flows. Thus, there are three main processes in the logistics: physical distribution, materials management, and logistics information management. Physical distribution ranges activities involved in inbound material movement and outbound finished goods transportation as well as movement of materials and goods within manufacturing facilities. Thus, it compasses all the functions of movement and handling of materials, work-in-process inventories, and goods. Materials management considers all the activities related in the manufacturing of goods in all their stages of production along a supply chain. Thus, it includes production planning, demand forecasting, and purchasing and inventory management, packaging (for transport and retailing) and, ultimately, recycling discarded materials and goods. Almost all logistics service providers nowadays provide customers with information about their service, including anticipated departure and arrival times, location tracking, inventory status, warehouse in/out times, etc. Since most customers are also expecting or requiring the logistics service providers to supply such information online and/or by e-mails.

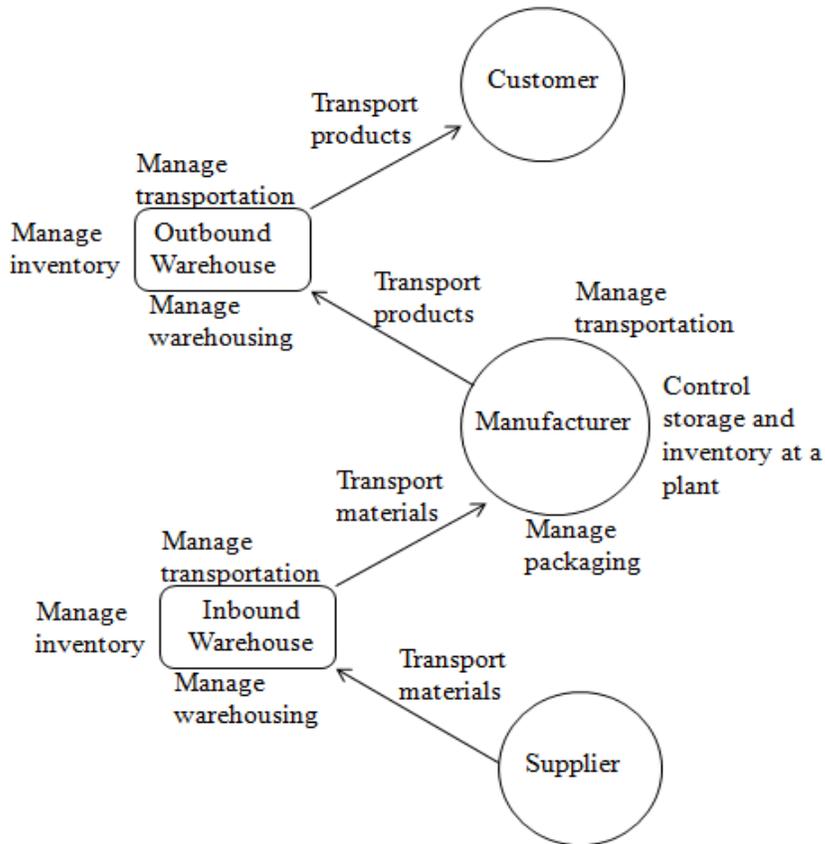


Figure 2. Logistics Processes.

Over the last two decades, logistics world has been changed a lot. The first notable change was that companies outsource their logistics functions to 3PLs, i.e., logistics service providers, so that 3PLs have become important players in a supply chain. The next one is that the total length of logistics in a supply chain becomes longer than ever due to globalization of manufacturer's production activities. Thus, the operations of logistics have got more complex and more prone to disruptions. The third one is that information technology got involved in providing visibility of logistics activities, such as movement of materials and finished goods, inventories in warehouses as well as in a supply chain pipeline, location of goods in a warehouse, etc. Even though the visibility of logistics obtained through information technology could enable companies to make more right decisions on logistics activities and reduce or eliminate some logistics risks, however, there still remain many risks in logistics, such as delay of parts availability and delivery, changes in the production schedule of products, unavailability of containers or trucks, etc., which could be caused by suppliers, 3PLs, and a manufacturer, itself.

### **AN APPLICATION OF THE ERM PROCESSES TO LOGISTICS RISK MANAGEMENT**

AIRMIC (2002) presented a risk management process consisting of four phases: (1) risk assessment (which can be broken down into risk analysis and risk evaluation); (2) risk reporting and decision; (3) risk treatment; and (4) risk monitoring. The process can be extended to 6 phases: identify, measure, assess, mitigate, control, and to continuously monitor risks.

(1) Phase 1 - Identify risks

All risks surrounding the logistics operations should be thoroughly identified. To this end, all employees should participate in identifying any risks involved in their day-by-day operations and in the environment associated with their operations and company business. In certain cases, a cross functional team of subject matter experts should be formed to brainstorm and define the risks.

(2) Phase 2 – Measure the identified risks

Once potential or/and existing risks are identified, the metrics for measuring the risks should be determined first. Then the risks should be measured in terms of their impact on the business and its possibility of occurrence.

(3) Phase 3 - Assess risks

The risks should be assessed using some scientific analysis techniques (e.g., Decision Tree, Controlled Interval and Memory Technique, Monte Carlo Simulation, Sensitivity Analysis, Probability-Impact Grid Analysis, Mapping Technique, Game Theory, etc.) and past data in a company, or relevant references from the same or different industry. Then, it should be checked whether the risks are within an acceptable level or not. In addition, since there may be more than one risk identified at a certain time, the priority of the risks should be determined based on urgency, impact, frequency, and time and budget required. For this purpose, risks can be categorized into minor/major/key risks, and a risk map can be used to illustrate the importance of risks.

(4) Phase 4 – Mitigate risks

Companies should hedge risks through action plans in the order of the priority of the risks. At this phase, appropriate budget and manpower to moderate the risks are needed. Approval steps and procedures for the budget and manpower should be determined at the time when the logistics risk management is developed.

(5) Phase 5 – Control risks

By establishing policies and procedures (e.g., action plans) for handling the risks, companies should ensure that the risk responses are effectively carried out. Companies should also construct an efficient and effective information and communication channel. Training and people development programs are another important part of valuable control.

(6) Phase 6 – Monitor risks

All activities related to the logistics risks should be monitored: Modifications and improvements should also be made when necessary.

## **CASE STUDY**

The first five phases of risk management processes discussed in Section IV were applied to a Korean company's logistics operations. The Korean company is called "Company X" in this paper. Company X produces electronic goods at factories in several countries and then delivers them to their customers by 3PLs whom they have logistics service contracts with. Thus, the role of 3PLs for their logistics function is very critical for successful supply chain operations.

(1) Identifying risks

At the risk identification phase, all relevant internal departments (i.e., sales, import/export support, global service, customer value fulfillment, and logistics) and 3PLs participated in

identifying risks surrounding logistics operations of Company X. 124 risks were identified through a brainstorming approach.

(2) Measuring the identified risks

Once potential or/and existing risks are identified, the metrics for measuring the risks should be determined first. Then, the probability of occurrence and impact of the risks were estimated by the participants.

(3) Assessing risks

A risk map was drawn with the probability and impact and illustrated in Figure 3. The risks are categorized into 15 key risks, 25 major risks, and 84 minor risks according to their importance measured by their occurrence probability and impact. Table 1 shows a list of 15 key risks

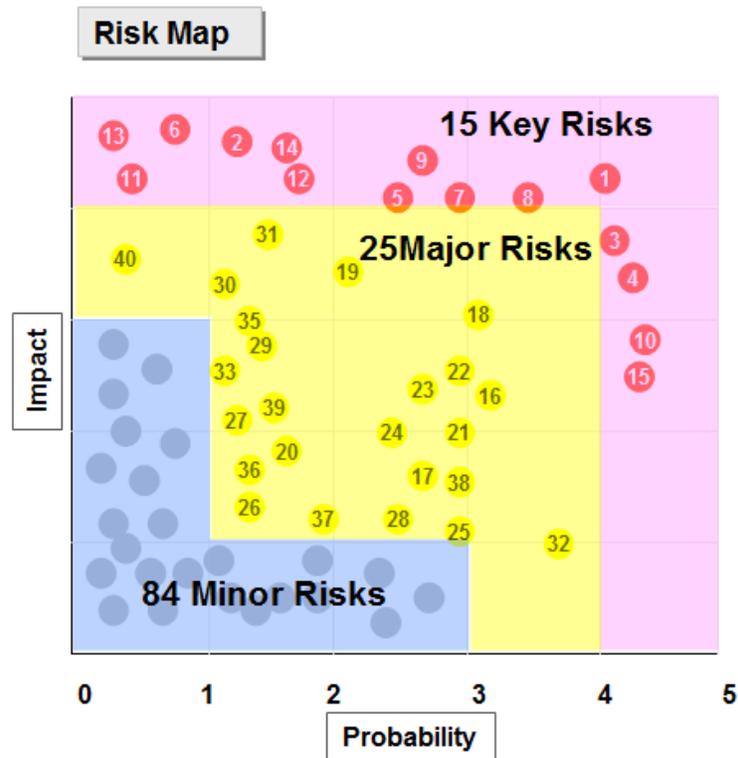


Figure 3. A Risk Map for the Logistics Operation of Company X.

(4) Mitigating risks

According to the results of logistics risks measured, Company X should focus on keeping track of its inventory more closely. Delay due to incorrect loading/delivery and use of inappropriate transportation modes may rarely happen, however, once they occur, the impact of loss will be significant. Thus, they should be closely monitored to prevent from occurrences. Precautions against damages are shown in Table 2 as an example. If damages were caused by negligence on the part of the driver, companies should give a priority to experienced drivers and have to keep the information related to drivers. Also safety training courses should be compulsory for all drivers regularly. All trucks should be tuned up before delivery and outdated ones have to be junked before an accident was happened by car problem. Furthermore, it is also critical to make KPI (key performance index) standards on damages and evaluate performance.

Table 1. A List of 15 Key Risks and their occurrence probability and Impact.

No	Key Risks	Measure	
		Probability	Impact
1	Discrepancy between actual inventory and its record in the system	4.1	4.2
2	Increase in logistics cost per unit area	1.2	4.3
3	Damages during delivery	4.1	3.7
4	Missing delivery due	4.1	3.7
5	Omission of sales	2.5	4.0
6	Inaccurate evaluation of logistics service providers (i.e., 3PLs)	0.8	4.7
7	Delay in handling damages	2.9	4.0
8	Increase in air/ocean transportation rates	3.4	4.0
9	Loss/pilferage at a warehouse	2.7	4.3
10	Untransmitted or Incorrect shipping information	4.3	2.9
11	Delay due to incorrect loading/delivery	0.4	4.1
12	Defective product packages	1.8	4.2
13	Use of inappropriate transportation modes	0.3	4.6
14	Selection of unqualified 3PLs	1.8	4.4
15	Incurring re-forwarding costs	4.2	2.6

Table 2. A list of Precautions for damages.

Damages	Precautions
Were caused by negligence on the part of the driver	1) Companies should need to employ experienced staff for driving.
	2) All drivers are required to take a course in safety regularly.
Were caused by car problems	1) Every truck has to be tuned up before.
	2) Outdated trucks should be scraped.
Were caused by 3PLs	1) Companies should make KPI standard and evaluate performance on a scale.

(5) Controlling risks

By investigating risks in a supply chain, Company X faced many risks, such as discrepancy between actual inventory and its record in the system, damages during delivery, and so on. Some policies and procedures were established to control the risks. An example of an action plan for the accident during delivery is illustrated in Figure 4.

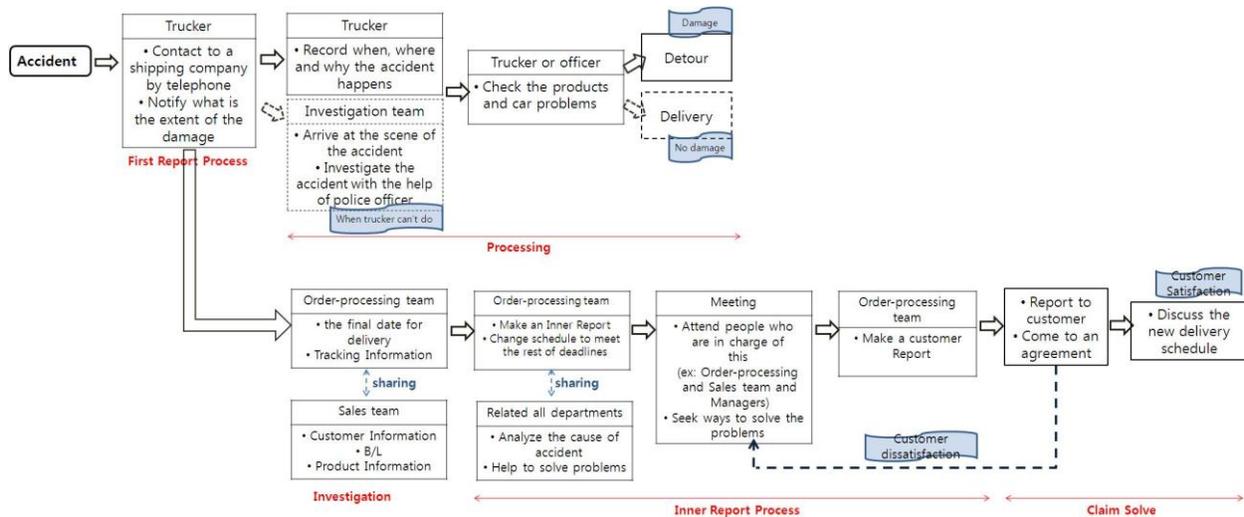


Figure 4. A Flow of Action Plans

- 1) First Report: Once an accident is occurred, a trucker should report all the circumstances in detail.
- 2) Return: When boxes containing products have some damages due to an accident, they should be sent back to a warehouse.
- 3) Delivery: When products have no damage, they should be delivered as scheduled.
- 4) Investigation: Find the direct and indirect causes of the accident and determine the responsibility of the accident.
- 5) Inner Report and Actions: Inform all relevant departments of the accident and take any necessary actions.
- 6) Customer Report: A report on the handling of the problems will be notified to customers.
- 7) Claims for Damages: File any claims necessary to recover the damages.

## CONCLUDING REMARKS

Since Companies are implementing lean supply chain systems with less inventories, shortened delivery times, and quick responses to customer orders or order changes, logistics plays more important role in sustaining high quality of supply chain operations than ever before. Logistics is, however, getting more prone to disruptions in the recent lean supply chain operations. Thus, it is necessary to identify logistics risks in advance and prevent them from occurring. To this end, an ERM framework is applied in this paper to establishing a logistics risk management process.

A logistics risk management process with six phases is used to identify, measure, assess, mitigate, control, and continuously monitor risks. To demonstrate this logistics risk management process using an ERM framework, data was collected from an electronics company in Korea. Through intensive brainstorming, 124 logistics risks were identified, and then those risks were categorized into 15 key risks, 25 major risks, and 84 minor risks based on their probability of occurrence and impact on company's operations. To demonstrate the creation of procedures to control risks, action plans for handling an accident during delivery is used as an example and described in detail. Companies should form a logistics risk management team to organize the logistics risk management activities. Since most policies and procedures for the logistics risk management

involve several departments in an organization, top management or high level management should lead or support the implementation of logistics risk management.

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