

An Application of ERM to Risk Management in the Logistics: A Case

† Taeho Park, Seungmin Lim*, Jae-Bong Kim**

† San Jose State University, CA, U.S.A.

* LG Display, Korea

**Korea Maritime University, Korea

Abstract : Logistics in a supply chain network has become an important operational strategy in a competitive market. A number of internal and external risks involved in the logistics operations in a company tend to create problems in fulfilling customer orders. This research presents how ERM (enterprise risk management) can be used to identify, assess, and control logistics risks. An electronic company's logistics activities were used as an industry case to demonstrate a way to identify and assess risks surrounding global logistics function. This paper has further presented action plans to mitigate the impact of the risks that occur.

Key words : Logistics, Supply Chain, ERM Framework, Logistics Risk Management, Risk Processes

1. 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 in Figure 1 (New and Payne, 1995). Supply chain network operations are usually carried out through an overwhelming number of interactions and inter-dependencies among different entities, processes and resources. 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.

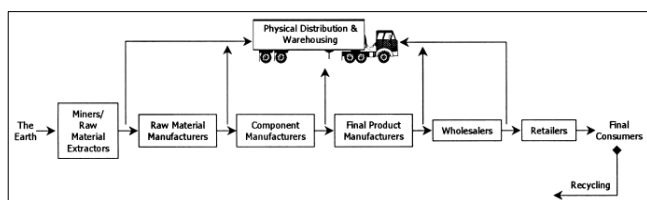


Fig. 1 Activities and Firms in a Supply Chain. (Source: New and Payne, 1995)

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 equally critical. Here, logistics risks encompass transportation disruption, damages of goods, inventory shortages, hijacks, and more. These risks definitely become barriers to performing logistics on time. 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. Corporate governance has recently developed an integrated, enterprise-wide approach to assessing business risks that can impact an organization's ability to achieve its business objectives and implementing programs to manage those risks (Miccolis et al., 2001). COSO (Committee of Sponsoring Organizations of the Treadway Commission, 2004) developed a framework for establishing an effective

† taeho.park@sjsu.edu 408-924-3561

* simon1@lgdisplay.com 010)7764-1967

** Corresponding author, kjb@hhu.ac.kr 051)410-4406

ERM (enterprise risk management) to guide companies to reduce their financial and non-financial risks. It 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 company is headquartered in Korea and has factories in Europe, China, and Korea. This research employs 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.

2. 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 illustrated in Figure 2 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.

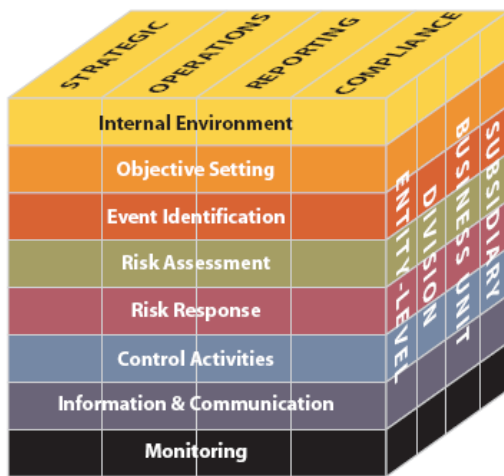


Fig. 2 The COSO enterprise risk management framework (COSO, 2004).

Australia and New Zealand developed a risk management standard and introduced a revision series of AS/NZS 4360 Standard on Risk Management since 1995. Its 2004 edition of the Standard is shown in Figure 3. AS/NZS 4360 has been successful especially in obtaining a wide acceptance from outside Australia. The risk management's process steps are:

- Step 1) Establishing a company's goals and context,
- Step 2) Identifying risks,
- Step 3) Analyzing 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.

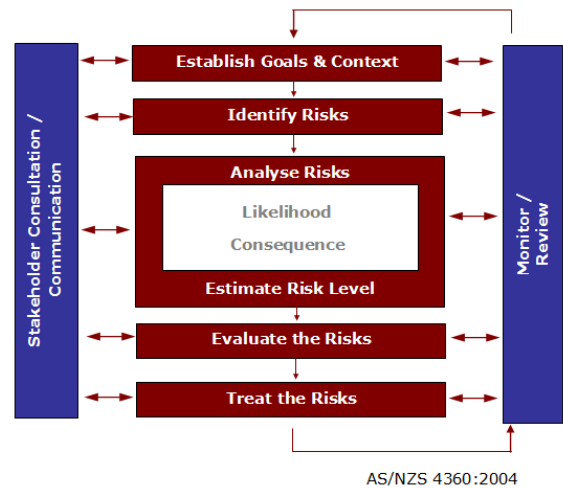


Fig. 3. 2004 Edition of AS/NZS 4360 Standard on Risk Management (Standards Australia/Standards New Zealand, 2004).

Pathak (2004) presented a conceptual risk framework for internal auditing in e-commerce. It is similar to AS/NZS 4360:2004 Standard on Risk Management, as shown in Figure 4. 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). The more the number of parties involved, the greater the risk. Similarly, a higher value transaction may generate a greater risk. When a company attempts to have international trading on its e-commerce, the number and location of parties that can access its system will create new challenges for the protection of global e-commerce 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.

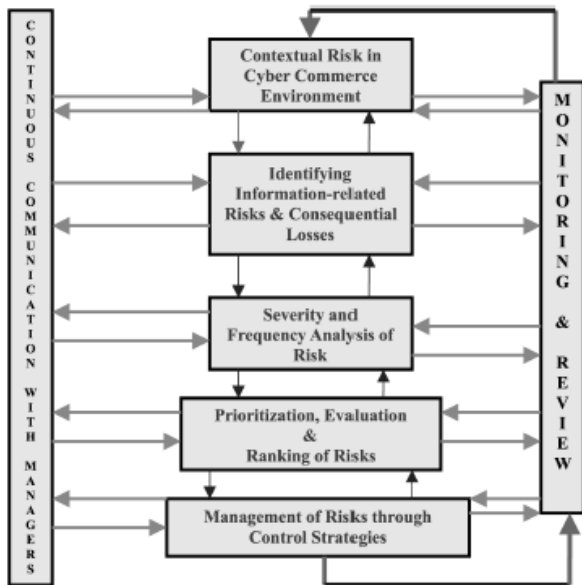


Fig. 4 A Conceptual Risk Framework for Internal Auditing in E-Commerce.

Raz and Hillson (2005) presented nine major risk management standards in the dimensions of their scope, processes, and specific emphasis: six national or international standards that were developed or adopted by standardization bodies, and three standards that were developed by professional organizations with an interest in risk management. They also evaluated commonalities and differences of the risk standards, including the issues of monitoring and controlling the effectiveness of the treatment actions for risks identified in the previous steps of their risk processes, and the definitions of risks vary among the standards in that there are risk standards which use an exclusively negative definition, equating ‘risk’ with ‘threat’, those which do not explicitly state whether consequences are positive or negative, and those defining ‘risk’ as including both threat and opportunity.

3. Logistics and Its Processes

Effective supply chain management which manufacturers have been striving for could speed up the on-time delivery

to customers. Customers too, are expecting faster and more frequent deliveries without increase in their logistics costs. Manufacturers in turn lean on their suppliers for “just-in-time” shipments of parts to the assembly line with similar demands that their customers impose on them. Even though the role of logistics is to manage the flow of goods, information and other resources between the points of origin and destination, 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 5 shows the typical flows of materials/sub-assemblies/finished goods and some logistics participants in a supply chain.

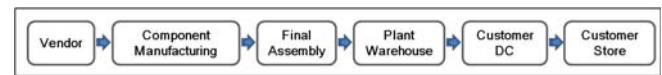


Fig. 5. Flows of Materials/Subassemblies/Finished Goods in a Supply Chain.

Figure 6 illustrates detailed logistics processes in 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 encompasses 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.

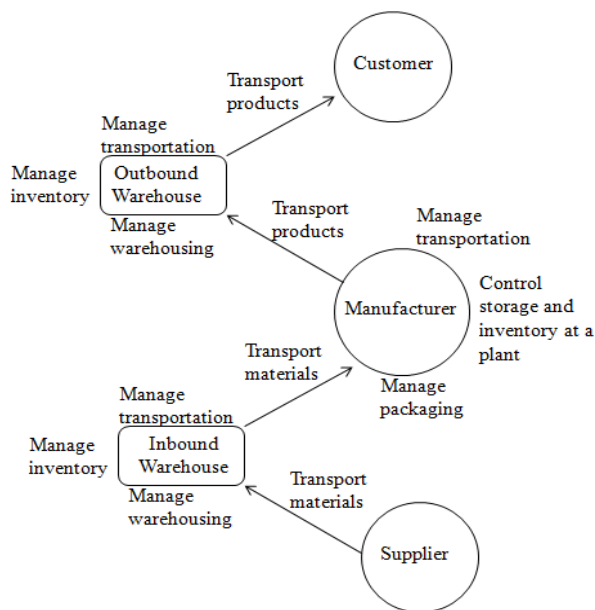


Fig. 6 Logistics Processes.

Logistics has undergone a lot of changes over the last two decades. The first notable change is that many companies outsourced their logistics functions to 3PLs, i.e., logistics service providers, making 3PLs important players in a supply chain. The second change is that the total length of logistics has become longer than ever due to globalization of production activities. Thus, the operations of logistics have got more complex and more prone to disruptions. The third change is information technology is providing visibility for 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/eliminate some logistics risks, 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. Thus, there should be a formal, company-wide management system for reducing/eliminating risks in the logistics operations. The next section will describe an application of an ERM process to manage risks in the logistics.

4. An Application of the ERM Processes for Logistics Risk Management

The AIRMIC, ALARM, IRM (AAIRM) standard (2002) presented a risk management process flow 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-to-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 and/or 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 be made when necessary.

5. Case Study

The first five phases of risk management processes discussed in the previous section were applied to a Korean company’s logistics operations. The Korean company is referred to as “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. They were asked to list all risks during their logistics operations. And then, all identified risks were collected and aggregated into a set of risks. As a result of this brainstorming of all relevant logistics risks, 124 risks were identified.

(2) Measuring the identified risks

Once potential and/or existing risks are identified, the metrics for measuring the risks indicating the probability of occurrence and impact of the risks were determined on a 5-point Likert scale with values of 1 to 5 where 5 means the highest possibility of occurrence and the greatest impact when occurring.

(3) Assessing risks

A risk map was drawn with the probability and impact and illustrated in Figure 7. The risks are categorized into key risks, major risks, and minor risks according to their importance measured by their occurrence probability and impact. 15 key risks, 25 major risks, and 84 minor risks were identified, and Table 1 shows a list of 15 key risks with their probability of occurrence and impact.

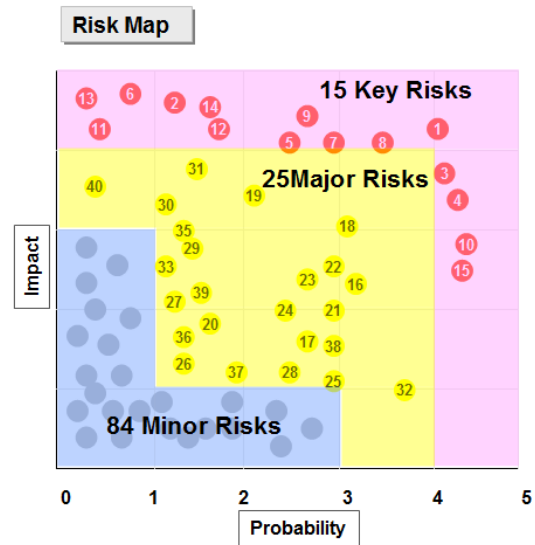


Fig. 7. A Risk Map for the Logistics Operation of Company X.

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

(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 of a driver, companies should give a priority to hiring more skilled drivers and have to keep the information related to drivers. Also safety training courses

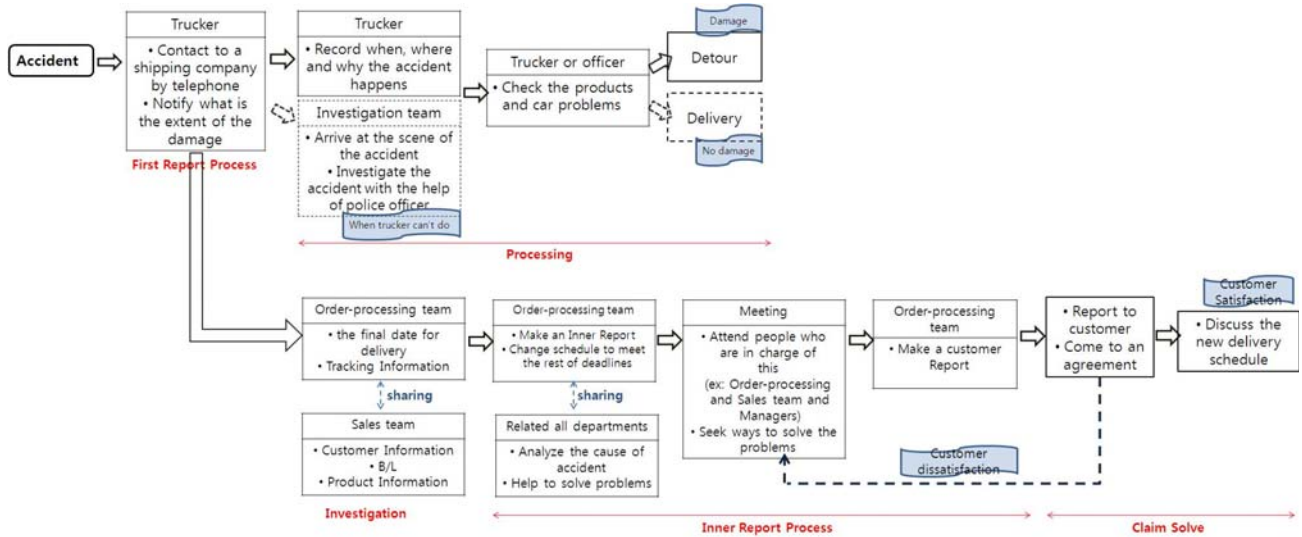


Fig. 8 A flow of action plan.

should be compulsory for all drivers regularly. All trucks should be tuned up regularly and outdated ones have to be replaced by age and condition. Furthermore, it is also critical to make KPI (key performance index) standards on damages and evaluate performance.

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 8.

- 1) First Report: Once an accident occurred, a truck driver should report all the circumstances in detail.
- 2) Return: When boxes containing products have some damages from the 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.

6. 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. So, companies put many efforts to operate logistics more efficiently and effectively using information technology and better supply chain network. However, there still remain many risks in logistics, such as delay of parts availability and delivery, changes in the production schedule of products, and unavailability of containers or trucks, which disturb logistics operations. Thus, There should be a formal company-wide management system for reducing/eliminating risks in the logistics operations. To this end, this research applied an ERM process to establishing a logistics risk management process.

A logistics risk management process with the six phases of the ERM framework was used to identify, measure, assess, mitigate, control, and continuously monitor risks. To demonstrate this logistics risk management process, 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. This research presented an action plan with action flows to handle an accident during delivery of goods. The industrial case presented in this research clearly showed that the ERM with six processes in Section IV can be used as a logistics risk management team framework to present or reduce the logistics risks.

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