Product Safety in Supply Chain – A literature Review

Authors:
Muhammad Saad Memon,
Young Hae Lee
Department of Industrial & Management Engineering
Hanyang University
Contents

- Introduction
- Safe Supply Chain
- Product Safety Issues in Most critical Industries
- Product Safety and Recalls
- Current Problems in Product Safety and Recalls
- Conclusion
- References
Introduction

• The present paper reviews the research on product safety in supply chain context.
• Product safety is a fact of life in today’s global economy.
• Consumers everywhere have higher expectations that their product will be safe for use, the reality is that things still go wrong or not as intended.
Safe supply chain management

- Safe Supply chain referred as to minimize the risks that may arise in any part of the supply chain continuum.
Causes of unsafe supply chain

- **Material**
  - Contaminated Raw Material
  - Spoiled
  - Expired
  - Poor Labeling

- **Storage**
  - Lack of humidity control
  - Lack of temp. control
  - Lack of pest control

- **Measurement**
  - Absence of TQM
  - Supplier quality check
  - Sample Inspection Plan

- **Method**
  - Shipping
  - Packaging
  - Manufacturing

- **People**
  - Lack of Training
  - Poor communication
  - Traceability
  - Work instruction

- **Policies**
  - Lack of Policies Knowledge
  - Traceability

- **Unsafe Product**
Product safety issues in most critical industries

• Following section includes:
  
  - Food Industry
  - Pharmaceutical industry
  - Consumer products

• These are found to be most critical to humans, because these industries provides the products that are incase unsafe leads to fatality.
Product safety in food supply chain

• Food supply chain is an integrated system that guarantees a series of links organically and economically operate, ranging from raw material, producing and processing, restoring to sales and consuming (Yong-Sheng Liu et al, 2012).

• An assurance is required from the consumers of food that the food they eat and buy will be safe and of same high quality when consumed as when they have manufactured.
### Some critical incidents in food industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Incident</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td><em>E. coli</em> Contamination of bean sprout</td>
<td>In Europe <em>E. coli</em> Causes 3000 plus people sickened and 37 killed. For the vegetable farmers who are affected by the crises 210 million euro’s emergency relief grant has been approved by European union.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008-2009</td>
<td>Salmonella outbreak in peanut butter paste</td>
<td>Nine people died and thousands of people suffered in US and Canada due to use of contaminated peanut butter paste (Layton and Miroff, 2009).</td>
</tr>
<tr>
<td>2008</td>
<td>Dioxine in Irish Pork</td>
<td>Large quantity of Irish Pork was recalled from 23 countries of the world (EFSA, 2008).</td>
</tr>
</tbody>
</table>
### Some critical incidents in food industry (Cont.)

<table>
<thead>
<tr>
<th>Year</th>
<th>Incident</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Melamine in Chinese milk products</td>
<td>Contamination of milk and infant formula. An estimated 300,000 people suffered in many countries (Roth et al., 2008)</td>
</tr>
<tr>
<td>1986-1987</td>
<td>Mad cow disease</td>
<td>Mad cow disease in UK affected hundreds of people (Colchester, 2005)</td>
</tr>
<tr>
<td>1858</td>
<td>Arsenic Poisoning in sweets</td>
<td>Due to the accidental adulteration of arsenic with sweets 200 plus people poisoned causing 20 deaths. After this unpleasant happening UK establishes the legislation for controlling the contamination of food stuff and pharmacy Act 1868 (Sheeran, 1992).</td>
</tr>
</tbody>
</table>
• There are various safety issues in Pharmaceutical products but in this paper safety problems with respect to supply chain are discussed.

• As discussed by Ann Marucheck et al. (2011) there are three major problems in pharmaceutical supply chain.
Product safety in pharmaceutical industry (Cont.)

- Substitution and Contamination of both inactive and active ingredients
- Fraudulent imitation of drugs
- Increasing growth of secondary distributors

Source: Ann Marucheck et al. (2011)
<table>
<thead>
<tr>
<th>Year</th>
<th>Incident</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>Viagra</td>
<td>The illegal manufacturing and import of imitated Viagra from some Indian and Chinese pharmaceutical manufacturers into the US. The active ingredients are often lacking in these illegal drugs and the harmful ingredients like fillers may be included. The outcome includes strokes, hypoglycemia and even death (Jackson, 2009).</td>
</tr>
<tr>
<td>2009</td>
<td>Tylenol</td>
<td>The drug was contaminated with chemical which believed to be used for the treatment of wood pallet that store and transport these drugs (Rogers, 2009).</td>
</tr>
<tr>
<td>2008</td>
<td>Heparin</td>
<td>A recall was issued after 81 deaths and over 400 injuries due to the contamination of an active ingredient in heparin with over-sulfated chondroitin (Blum, 2008).</td>
</tr>
</tbody>
</table>
Public attention towards consumer products is very lesser as compared to food and pharmaceutical products.

However, due to recent recalls by some manufacturers and also by Toyota some attention is directed towards the automobile industry.

In recent years the problems associated with safety of consumer products is continuously increasing.

Very less research have been done on the operational and supply chain issues leading towards recalls and unsafe products (Kumar and Schmitz, 2011).
Consumer products safety issues

Supply chain-related Issues

Manufacturing-Related Issues

Design-related Issues

Source: Ann Marucheck et al. (2011)
## Critical incident in consumer product Industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct-2012</td>
<td>Banana Boat UltraMist spray</td>
<td>The recall is made when five people catching fire after using Banana Boat UltraMist spray-on sunscreens (Louisa Hufstader, 2012).</td>
</tr>
<tr>
<td>2008-2011</td>
<td>Automobiles</td>
<td>Three separate recalls were made by Toyota due to different reasons. Worldwide over nine million cars were recalled. More recently two years back almost fifty million dollars were paid for delaying the recalls in federal fines (Thomas Kase, 2012).</td>
</tr>
</tbody>
</table>
### Critical incident in consumer product Industry (Cont.)

<table>
<thead>
<tr>
<th>Year</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-2011</td>
<td>Notebook</td>
<td>After some unpleasant incidents occurred like Overheating of batteries and catching fire, there is a recall of more than 4 million Sony notebook batteries.</td>
</tr>
<tr>
<td>2010</td>
<td>Children toys</td>
<td>There was a recall of over 11 million toys &amp; high chairs because of safety hazards.</td>
</tr>
<tr>
<td>2009</td>
<td>window shades</td>
<td>After 5 children died due to strangulation, there was a recall for over fifty million window shades.</td>
</tr>
</tbody>
</table>
Product safety and recall

• Product recall refers to removing defected products permanently from the market or removing product temporarily

• It is shown by both the research and media reports that there is a rise in product recalls (Beamish and Bapuji, 2008; Gallozzi and Tucker, 2007).
In last five years the recall rate increased dramatically, for instance,

- the recall is increased by about 25% in 2012 compared to year 2011 in South Korea (Global Recalls portal, 2012).
- In Australia it is increase by 8.5% in the current fiscal year, when compared to a year earlier.
- In united sates the recall rate of toys are increasing very faster as compared to the increase rate of imports when looking from 1992 to 2006.
• This same trend was also observed in the European Union, which shared 1,803 notifications in 2011, when compared to 139 notifications in 2003.

• Estimation by a federal US agency (CPSC, 2009) shows that the annual cost associated with consumer product incidents including property damages, injuries and deaths is greater than eight hundred billion dollars.
Product safety and recall (cont.)

- Fig: Food Recall Incidents of Year 2006-2012. (Source: CFIA, 2012)
Fig: Consumer Product recalls during 2011-2012. (Source RAPEX, 2012)

- According to RAPEX-European commission 99% increase is recorded in consumer product in Jan 2012 when compared to previous year. Similarly in August 2012 there is 6% increase as of August 2011
Fig: Category of Consumer product recalls.
(Source: RAPEX, 2012)
## Current Problems in Product safety and Recalls

<table>
<thead>
<tr>
<th>Problem</th>
<th>Author</th>
<th>Proposed Research</th>
<th>Future Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimizing time to recall</td>
<td>Manpreet et al. (2011)</td>
<td>An empirical research is conducted considering toy industry of USA, subjects to the time to recall and its relationship with recall strategies.</td>
<td>The empirical research is limited to one industry therefore generalize conclusion cannot be drawn. Also effects of suppliers are not included in the study. It is required to investigate supplier perspective and including some other industries to make generalize conclusion.</td>
</tr>
<tr>
<td>Effect of recall</td>
<td>Sébastien Pouliot (2012)</td>
<td>Investigates the market effects of the egg recall (in August 2010)</td>
<td>The models are limited to particular product, there is need to work on general model to investigate the Recall effects.</td>
</tr>
<tr>
<td>Problem</td>
<td>Author</td>
<td>Proposed Research</td>
<td>Future Suggestion</td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
<td>-------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>• Designing the traceability system for product recall</td>
<td>Hongyan Dai et al. (2011)</td>
<td>Systematic method was provided to design a supply chain traceability system.</td>
<td>Product quality is not considered in this model, also sales price of final product assume to be exogenous. Whereas customer may want to buy clearer and high quality product. It is assumed that all recalled products are recovered, which is practically not possible. A model should be developed considering these factors.</td>
</tr>
<tr>
<td>• Risk analysis in food supply chain</td>
<td>S. Piramuthu et al., (2012)</td>
<td>The RFID-generated model is proposed for traceability of contaminated product recall in perishable food supply networks.</td>
<td>The model has some limitation like it not include the transportation cost which surely made some impact on proposed model. Therefore this model can be improved by considering this factor.</td>
</tr>
<tr>
<td>• Risk analysis in food supply chain</td>
<td>Xiaojun Wang, et al (2012)</td>
<td>Proposed a fuzzy model for aggregative food safety risk assessment in food supply chains.</td>
<td>The model does not provide the knowledge of how risk migrate to food supply chain, ultimately there is need to develop the model on risk transmission over the food supply chain.</td>
</tr>
</tbody>
</table>
The article highlights the emerging need of safe supply chain especially where product directly affects the humans.

It is concluded that the costs associated with the unsafe products are substantial may include:
- product redesign,
- enforcement actions and penalties,
- loss of reputation,
- recall and recovery of goods sold,
- retooling,
- loss of business and
- liability lawsuits.
• One of the big problems for managing product safety in supply chain is design the safer transportation and storage system.

• In case of food and pharmaceutical products specially, storage and shipment are critical supply chain activities because there are many chances that product may be spoiled or contamination may occur which make products unsafe for consumers.

• Therefore it is suggested to build such system that can help to protect the consumers from unsafe products.
Conclusion (cont.)

- Manufacturer should now have to focus on safe supply chain concept in order to gain competitive advantage, because Safe supply chain concept insure safety in all parts of supply chain i.e. from purchase of raw material to delivery of final product to consumer.
- It is found that product recall puts high stress on companies, which may lead to loss of business
- It is economical decision to implement tracking and tracing system at every stage of supply chain in order to recognize any hazard as and when occur in product for high safety which results a great need of designing methodologies for information processing during the entire product life cycle.
The review concluded here that there is high need of research in the area of safe supply chain in order to deal with product safety issues especially in critical industries like food and Pharmaceutical which directly affects the human being.
Reference


감사합니다
Thank You