RISK FACTORS AFFECTING CARGO DAMAGE IN ROAD TRANSPORTATION

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ABSTRACT

The cargo damage is the last thing that consignee wants to think about when they transport the goods from one location to another. If the cargo is damaged the loss is not only the goods, but company also wasting the money, time, and resource to manage the damaged goods and company need to work with insurance company to get the loss back and take times to manage. It is better to know and control the risks before it happens. Authors focus on the risk factors that related to risk assessment of road transportation. The purpose of this literature review was to identify risk factors that affecting safety of cargo in the road transportation. This research was conducted through qualitative research methods that focus on documentary analysis. The data were collected from 12 article from sources of research publication. According to the content analysis, authors will categorize into unsafe act and unsafe condition and author will analyze the risk factors according to the review. Therefore, based on synthesis and extraction factors, we discover the risk factors that could be further developed as a tool for assessing the cargo insurance in road transportation.

Keywords: Cargo damage, Road transportation, Transportation, Risk, Transportation risk, Land transportation, Cargo damage factors, Risk assessment.

I. INTRODUCTION

The land transportation is a major mode of transport in Thailand. As estimated, for more than 80% of the total domestic transport is carried out by road. And with the evolution of the Asian Economic Community (AEC), Thailand's position as a transportation hub for the Greater Mekong Sub-region (GMS) has been strengthened. This plan has increased the country's opportunities for cross-border trades and import-export shipments. And the most major mode of transportation is road transportation [14]

Supply chain risks are the outcome of uncertain events that prevent the supply chain from achieving its performance [1] especially the cargo during transportation. To win the competition, domestic logistics company must identify the risks pertaining to their services among the neighboring countries and find avenues to manage the risks. The more logistics company can identify the risk, the more opportunity that they can prevent the risk before it occurs. There are a lot of processes that logistics company need to manage when the cargo damaged during transportation. The first disadvantage is the customer service, the logistics company will have the bad reputation from this situation. Moreover, customer will lose their trust on the service of logistics company. After that logistics company will waste their time and resources to dealing with insurance company to get the money back. Moreover, if the cargo is the dangerous cargo, it could affect the people’s health and the environment.

The aim of the paper is to perform a review and consolidate the risk factors that affecting cargo damage in road transportation from literature review to identify and categorized including analyze the risk factors what could be the important risk that logistics company need to consider when they transport cargo by road transportation.

II. RESEARCH OBJECTIVES

The purpose of this paper is to review literature then identify the risk factors that affecting safety of cargo in the road transportation. A secondary purpose was to categorized risk factors to be easier to analyze and understand.

III. LITERATURE REVIEW

Risk assessment
The concept of risk and risk assessments has an exceedingly long history. More than 2400 years ago the Athenians offered their capacity of assessing risk before making decisions (Bernstein, 1996) [15]

Risk assessment has an important role in safety-critical industries. However, it faces a series of overall challenges, partially related to technology advancements and the needs also increasing. There is currently a request for continuous risk assessment, improvement in learning past lessons and definition of techniques to process relevant data, which are to be coupled with adequate capability to deal with unexpected events and provide the right support to enable risk management [16]

In the road transportation, some of the risks that affect cargo damage can include impatience of drivers, impatience of road users, fatigue, vehicle bad condition, children playing on the road, over speeding, taking drugs and driving, poorly maintained road, poor health condition, climatic change, traffic congestion, drinking and driving, using a mobile phone while driving, using mobile phone while driving and over speeding [17]

Unsafe Act and Unsafe Condition

Heinrich Domino theory of accident causation

According to statistics on accident’s reports Heinrich deduced that 88 percent of accidents are due to unsafe act of workers, 10 percent due to unsafe conditions and 2 percent of all accidents are associated with act of God such as natural disasters. According to his analysis Heinrich defined accident as ‘an unplanned and uncontrolled event in which the action or reaction of an object, substance, person, or radiation results in personal injury or the probability thereof’. described the accidents causation theory, man and machine relationship, frequency and severity relation, unsafe acts reasons, management role in accident prevention, costs of accidents and the impact of safety on efficiency [13]

Multiple causation model (Petersen, 1971; Non-Domino-based model)

The Heinrich domino theory is structured on theory that an accident is caused by a single cause. Petersen (1971) developed a model based on management system rather than individual Petersen believed that there are two major features of the events which leading to an accident, namely an unsafe act and an unsafe condition.

Therefore, there are more than single cause which contribute or lead to both unsafe act and unsafe condition and finally occurrence of an accident. Unlike simplified theory of domino, there are causes and sub-causes when an accident happens. Through identification of these multiple contributing causes of accident, the unsafe acts and unsafe conditions should be prevented from arising [13]

IV. RESEARCH METHODS

A non-systematic search of available published literature was undertaken. Articles and reports identified were predominately published from 2017-2021, from relevant conferences and journals, and from organizations/associations within the road safety field (with some occasional exceptions)

The records were searched according to the following key:

The phrase “cargo”, “goods”, “damage”, “risk” appearing anywhere in the body of the article.

The search was limited to the years 2017-2021 to be able to concentrate the most recent research trends.

From the selection, the following articles have been removed:

Copies of the same articles which appeared in different databases.

Articles in which the use of the phrase “cargo”, “goods”, “damage”, “risk” was accidental (not connected with the subject).

Articles in sea and air transportation

V. RESEARCH RESULTS

Table 1. Unsafe Act and Unsafe Condition Risks
<table>
<thead>
<tr>
<th>Title</th>
<th>Year</th>
<th>Author</th>
<th>Risk factors</th>
<th>Unsafe act</th>
<th>Unsafe condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1] Integrated approach to information analysis for planning the transport of sensitive cargo</td>
<td>2019</td>
<td>Senemov, L., Filińska-Dawidowicz, I., &amp; Trojanowski, P.</td>
<td>Road condition, Route</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>[2] Research on Safety Risk of Dangerous Chemicals Road Transportation Based on Dynamic Fuzzy Tree and Bayesian Network Hybrid Method</td>
<td>2017</td>
<td>Xiao-Ping, H., &amp; Wei-Hua, S.</td>
<td>People, Vehicles, Environment and Goods</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>[3] Risk and costs evaluation in intermodal transport – variant analysis of using cargo positioning and parameters monitoring systems</td>
<td>2017</td>
<td>Lorenc, A., &amp; Kaznare, M.</td>
<td>Mechanical cargo damage, Cargo theft, Track theft, Loss of property, Delay in transport, Cargo loss, Prolonged storage, Refusal to loading</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>[4] Cargo Securing During Transport Depending on the Type of a Road</td>
<td>2017</td>
<td>Vlkovský, M., Šmok, M., &amp; Machoška, J.</td>
<td>Type of a Road</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>[5] Problems and risk management options for the transport of dangerous goods</td>
<td>2017</td>
<td>Banakhovská, V., &amp; Minchovská, I.</td>
<td>The amount and type of dangerous goods, 1. Characteristics of the designated transport route /hazard areas, residential areas, weather and climate; 2. Alternative traffic routes; 3. The number of incidents on the route for a certain period of time; 4. The location and composition of the rescue services on the route.</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
Table 1. show the risk factors that was identified from researchers, author group the risk factors into two main group which is unsafe act and unsafe condition according to the theory of Heinrich [13]
VI. DISCUSSION

After grouping the risk factors into two group which is the unsafe act and unsafe condition. Author found the main factors in each group as follow.

Unsafe Act risks

Authors divided the unsafe act risks into two main risk factors which is the driver behavior and loading worker behavior.

**Driver behavior risk** is the main key factors that led to cargo damage. Most of the researcher point out the risk that come from driver. B. Xiao-ping and S. Wei-Hua studied on the person factors which concerning with driving skills, health status and safety awareness [2] Moreover, the safety of the transported cargo depends not only on the people, but also depends on the actions of the driver in the event of an accident and his/her own skills [7] found seven transportations risks during Nepal response. They are delivery delays; insufficient capacity; market fluctuation; loss of cargo; cargo decay/damage; unreliable information; and unethical behaviors [9] Lack of knowledge or failure to follow occupational health and safety rules and regulations [11]

**Loading worker behavior risk** is also important in the cargo transportation. Proper cargo loading plays a particularly important role in the transport of goods. If the load is improperly transported, it may be damaged [8] Damage to goods caused by improper protection of transported cargo [11]

Unsafe condition risks

Authors divided the unsafe act risks into four main risk factors which is technical risks, Infrastructure risk, Natural disaster risk and unpredicted event risk.

**Technical risk** technical risk can come from the vehicle condition and the loading equipment condition [7] that are not in good condition. This risk could lead to the road accident and the accident at work which is not only affect to the cargo condition but also the driver’s life and loading worker’s life.

**Infrastructure risk** infrastructure risk mainly link to the road condition or road quality [4,10] because the condition of road can affect to the movement of the cargo in the truck. Moreover, the route of transportation [1] or route selection is important for logistics company to design the transportation route because logistics company should select the safest way to transport their cargo.

**Natural disaster risk** natural disaster risk can happen from a bad weather condition [5] and natural disasters [6] such as earthquake [12] this risk can lead to poor visual performance while transportation and could lead to the road accident which surely affect to the cargo condition

**Unpredicted event risk** unpredicted event risk can happen from Thief risks which directly affect the cargo loss and cargo damage from robber activity [3]

VII. CONCLUSION

After review the articles that mentioned the risk factors that affecting the cargo damage, authors categorized into two main factors which are driver behavior risk and loading worker behavior risk, these two main factors are under Unsafe Act and four main factors which are technical risk, Infrastructure risk, Natural disaster risk and unpredicted event risk under Unsafe Condition. Five Articles mentioned about unsafe act and eleven Articles mentioned about unsafe condition.

According to literature review, most of the researchers focus on the unsafe condition. The risks under unsafe condition could be a serious threat of cargo condition in road transportation.

For the future research, researcher should focus more on the risks that come from unsafe act because it is the risks that logistics company can control more than the unsafe condition risk which exceedingly difficult to control. The preventive action plan to prevent the unsafe act risks could be the advantage for logistics company.

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