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Impact of Different Factors on the Risk Perceptions of Employees in Container Shipping Companies: A Case study of Taiwan

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Abstract

This paper attempts to investigate the impact of several factors on the risk perception of the employees in container shipping companies. The investigation is conducted through an empirical study using Analysis of Variance (ANOVA) based on the Taiwan container shipping companies as a case study. The data were collected through a questionnaire survey in which the respondents were required to indicate their details (e.g. work experience, position, and department, etc.) and perceived risk factors in relation to container shipping logistics operations.

The study reveals that work experience has a significant impact on the perception of risks in aspects of financial loss and safety and security incident related loss. It is notable that the respondents whose work experience is less than 10 years have a significantly higher perception of risks than the others. The study also shows that the size of company impacts on risk perceptions in respect of financial loss and safety and security incident related loss. In addition, employees' position and their company type do not affect respondents' risk perception.

Keywords: Container shipping, Risk perception, Risk analysis, ANOVA

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## 1.	Introduction

Container shipping plays an increasingly important role in international trade. At present, about 52% of the world seaborne trade in value is carried by container ships (World Shipping Council, 2011). However, due to the involvement of multiple entities in its operations and its international nature, container shipping faces various risks ranging from information inaccuracy, pirate attack to having partners with bad credit. To tackle these risks, a great deal of effort has been made in academia to identify the associated risks and assess the impacts of these risks on shipping operations (e.g., Fu et al., 2010; Husdal and Bråthen, 2010; Vilko and Hallikas, 2012; Chang et al., 2014). A number of risks elements have been identified in previous studies, including IT failure, transportation delay, recession, etc.

The level of risk depends on the probability that a particular adverse event occurs and the consequence if the adverse event does occur. However, there is no general agreement on whether risk should be measured objectively or subjectively (Khan and Burnes 2007). In the shipping industry, the probability and the consequence of an adverse event are difficult to measure from the objective perspective. In particular, the intangible part of the consequence and the consequence of those near-miss adverse events are extremely difficult to measure objectively. In addition, shipping managers often make risk management decisions based on their subjective view of the risks. Therefore, it is reasonable to examine the risk from the perspective of the shipping managers. Namely, subjective risk or risk perception will be adopted in this paper.

Risk perception is defined as "the subjective assessment of the probability of a specified type of accident happening and how concerned we are with the consequences" (Sjöberg et al., 2004, p.8). Following the arguments in Sjöberg et al. (2004), risk perception can be measured by the product of two elements: the probability of an adverse event occurring and the significance of loss if the adverse event occurs. Risk perception may impact on people's behaviour (Renn, 1992; Jenkin, 2006), as fear of a risk may force people to learn how to deal with such a risk. For example, fear of crime is an important factor that leads urban teenagers' to adopt defensive behaviours such as learning self-defence, carrying spray and safety whistle (Williams et al., 1994).

It has been found that risk perception may be affected by many factors, such as gender (Flynn et al., 1994; Davidson and Freudenburg, 1996; Gustafson, 1998; Slovic, 1999), cross-culture (Dake, 1991; Weber and Hsee, 1998; Renn and Rohrmann, 2000), and occupation (Belrose and Pilisuk, 1991). Studies (e.g. Sjöberg, 1998; Jenkin, 2006) have notes that there are differences in risk perception between experts and the general public, and one commentator concludes that "groups that are different with regard to education, interest, and employment differ greatly in how they perceive risks" (Sjöberg, 1998, p.10). Personal background such as work experience and position is found to be relevant to business related risks. Rundmo (1995, 1996) noted that risk perception of offshore oil employees after experiencing an accident differs from before. Those who have experienced accidents feel unsafe as compared to those who have not (Rundmo, 1996).

No research has touched up risk perception in the maritime field. Although there are many risk analysis studies in the field, most of them have only focused on analysing risk itself and its management. Risk analysis studies are normally empirical in scope and the data are collected through questionnaire and/or interview survey. Usually, information about the respondents' personal and background details is included in the surveys, they are normally treated as a homogenous group and the differences in how they perceive risks are not considered.

Against this background, this paper aims to investigate empirically the impact of a number of important factors on risk perception of employees in container shipping companies. The factors considered include work experience (year) (Lu and Shang, 2005; Yang et al., 2009), position (Lu and Shang, 2005; Lu and Tsai, 2008; Yang et al., 2009), department (Lu and Shang, 2005; Oltedal and Wadsworth, 2010), company's ownership (Lu and Tsai, 2008; Yang et al., 2009) company's main business (Yang et al., 2009), and company's size (Yang et al., 2009). It attempts to provide a better understanding of how risk perception is impacted by employees' background; it will also provide recommendations for managing risk perceptions in container shipping.

The rest of the paper is structured as follows: Section 2 describes the research methodology; Section 3 presents the data analysis and research findings; and Section 4 includes discussions and conclusions.

2.   Research Methodology

To identify risk perceptions of container shipping managers in different department or with different characteristics, this paper uses Analysis of Variance (ANOVA) which is a common method to test whether significant differences exist among different respondent groups. To conduct ANOVA in this paper, three steps were taken: (1) in order to identify risk factors, a systemic review of literature about container shipping operations and general supply chain was conducted. A number of interviews were then conducted to confirm the identified risk factors and to explore additional risk factors; (2) the different types of risk perceptions were defined in the context of this study; (3) a large scale of questionnaire survey were then conducted and ANOVA was applied to analyse the impact of the respondents' background on their risk perceptions. Details about the methods and steps are presented below.

2.1 Taiwan case study

This paper uses Taiwan's container shipping companies as a case study. Taiwan is an island country which largely relies on international trade by sea. In that sense, the case of Taiwan is representative for the countries rely on shipping such as the UK, Australia, Japan, and South Korea. According to the Ministry of Transportation and Communications (2011), ships transport around 99% of international trades in Taiwan. Under this situation, container shipping plays an important role for Taiwan's economy. It is expected that a case study of Taiwan will be able to provide some insights into the risk analysis issues in the wider maritime context.

2.2 ANOVA

ANOVA is a common statistic method mainly used to analyse whether the results have significant difference from different groups by analysing and comparing different groups' mean value. It is used to deal with the problem that statistics data is usually impacted by different groups' background

(Chen, 2004). As explained below, before using ANOVA, a set of steps were conducted in the paper, including identifying and confirming risk factors through literature review and interview, defining the types of risk perceptions, and measuring risk perceptions through a questionnaire survey.

2.2.1 Identify and confirm risk factors through literature review and interview

Waters (2007) stated that risk identification is usually deemed as the first stage of a risk research, and he suggested that relative literature review and interviews are common method to identify risk in risk analysis studies. In this study, both methods were used to identify risk factors in container shipping operations. The literature review includes the risk factors in container shipping operations and in general supply chain. The purpose to review literature about general supply chain is to make an inclusive risk factor list. As some of the risk factors were identified from general supply chain, a further set of interview with open questions was used to confirm the existing risk factors from the previous literature review and explore new risk factors that are not mentioned in previous studies.

2.2.2 Define types of risk perceptions

Risk perception represents the level of risk that a person perceives. It can be measured using the product of two elements: risk likelihood (or probability of loss) and risk consequence (or significance of loss) (Sjöberg et al., 2004). Risk likelihood is defined as the probability that a risk caused by a risk-source will occur (Elky, 2006); and risk consequence refers to the outcome or the potential outcome of a risk event (NPSA, 2008).

The first element, risk likelihood, is well defined, whereas the second element, risk consequence, may be interpreted in different ways. Although risk consequences are often measured in monetary terms (e.g. a lost container), in some cases it is not that straightforward, e.g. it is difficult to measure a delayed delivery in monetary terms owning to the intangible characteristics of the consequence. More specifically, risk factors could lead to reputation loss, which is normally considered as a non-financial loss (Bebbington et al., 2008). In container shipping operations, some types of safety (Kasperson et al., 1988; IMO, 2009) and security (Tzannatos, 2003; IMO, 2009) damage (e.g., pain and suffering of the crew and their family) are the characteristics of non-financial loss. Note that an adverse event may not only incur monetary/financial loss, but also non-financial losses in terms of reputation and safety and security damage. Therefore, in this paper, three types of risk consequences are considered, namely, financial loss, reputation loss, and safety and security incident related loss. Consequently, we introduce three types of risk perceptions, which are defined by multiplying the risk likelihood with each of the risk consequences. Their mathematical definitions are given in the next sub-section.

2.2.3 Measure risk perceptions through a questionnaire survey

After identifying an inclusive risk factor list and clarifying the types of risk perceptions, a large scale questionnaire survey was used to collect the respondents' risk perceptions. This survey consists of two major parts: respondent's details and their risk perceptions. The respondent's details part includes several questions such as the respondent's work experience, department, position, company's main business, company's ownership, and company's size.

The questions of the respondent's risk perception part are designed by using a five-point Likert scale to measure the level of risk likelihood, and also using a five-point Likert scale to measure three types of risk consequences from the respondents' reception respectively. More specifically, in the questionnaire the respondents were asked on "how they feel the likelihood of the risk factors" and

"how they feel the consequences of the risk factors in terms of financial loss, reputation loss, and safety and security incident related loss respectively". The value of the perceived risk likelihood is normally described by a number between 0 and 1; however, many studies (e.g. Waters, 2007; NPSA, 2008) have used five abstractive categories to describe the probability of an event: very low (or impossible; rare), low (or unlikely), medium (or occasional; possible), high (or frequent; likely), and very high (or almost certain). In this paper, numbers 1, 2, 3, 4, and 5 are used to represent "rare", "unlikely", "possible", "likely", and "almost certain" respectively. In addition, the value of risk consequence perceived by the respondents also used five abstractive categories in many studies (e.g. Waters, 2007; NPSA, 2008) to describe the severity of a risk factor, such as negligible (or no effect), minor, moderate (or major), serious (or hazardous), and critical (or catastrophic). In this paper, numbers 1, 2, 3, 4, and 5 are used to represent "insignificant", "minor", "moderate", "major", and "catastrophic" respectively.

After obtaining the values of risk likelihood and risk consequence, this study uses risk scale method to calculate the respondents' risk perceptions through combining these two elements together. Risk scale is usually calculated through the level of risk likelihood multiplied with the level of risk consequence (Shen et al., 2001; Tzannatos, 2003; Zou et al., 2007; Cox, 2008; NPSA, 2008). It is a simple and effective method to measure the level of risks. This method can produce a vector of risk perceptions from each respondent. In this study, we firstly multiply each risk factor's likelihood with one type of consequences from each respondent, and then average the value to represent the importance of a specific risk factor over the population. This procedure is performed three times corresponding to three types of risk perceptions. The equation can be formed as Eq. (1):

$$R_r^k = \frac{1}{N} \sum_{i=1}^{N} R_{ri}^k = \frac{1}{N} \sum_{i=1}^{N} l_{ri} \cdot c_{ri}^k , \text{ for } 1 \leq r \leq M \tag{1}$$

Where
M = the total number of risk factors under investigation;
N = the total number of respondents;
r = the index of the risk factors;
i = the index of the respondents;
k = the index of the types of risk perceptions (k=1, 2, 3; representing financial loss, reputation loss, and safety and security incident related loss respectively);
R_r^k = the mean value of risk perception type k for the risk factor r;
R_{ri}^k = the risk scale of risk perception type k assessed by respondent i for the impact of risk factor r;
l_{ri} = the level of risk likelihood for risk factor r given by the respondent i;
c_{ri}^k = the level of risk consequence type k for risk factor r given by the respondent i;

The survey population is based on the list of 2010 ROC National Association of Shipping Agencies in Taiwan. All of the 116 container shipping companies on the list were included. Three shipping managers in each container shipping companies, from information/ documentation department, physical/ operation department, and financial/ accounting department, are selected. A total 342 questionnaires were sent in 2011.

2.2.3 Comparison of different groups' risk perception

This study applies ANOVA for comparing means of different types of risk perceptions between groups. ANOVA is based on three assumptions: (1) each data value is independent and does not relate to any of the other data values; (2) the data for each group should follow normal distribution;

and (3) the data for each group have the same variance (i.e. standard deviation squared) (Hays, 1994). ANOVA uses sum of square and degree of freedom to calculate within groups mean square (W) and between groups mean square (B), and then obtain an F ratio through dividing B with W (Chen, 2004). MSB with MSW (Chen, 2004), which can be denoted as Eq. 2

$$F = MSB/MSW \qquad\qquad (2)$$

Where F ratio represents the differences within and between groups of data, and a large F ratio indicates the significant difference within and between groups (Saunders et al., 2007). If the p-value of F ratio is significant (p-value < 0.1), which means that there is at least a pair of groups that have significantly different risk perceptions, and we need to conduct multiple comparison to check which groups are significantly different. The common methods for multiple comparison are Scheffe, Tukey's Honestly Significant Difference (Tukey's HSD), and Bonferroni correction (Chen, 2004).

In this paper, various types of group categorisation were developed from the categorisation of respondents' details (Section 2.2.2), i.e. work experience (by years), departments, positions, company types (main business), company owners, and employee numbers. As the characteristics of departments, company types, and company owners are nominal variables and are clear to categorise, this study only conducts discriminant analysis to examine whether the categorisation of work experience (by years), positions, and employee numbers are grouped correctly. Discriminant analysis is used to predict a categorical dependent variable by one or more continuous independent variables when groups are already categorised (Cohen et al., 2013).

Both discriminant analysis and ANOVA analysis were carried out using SPSS 20 for Windows and the results of the data analysis are discussed in the next section. In ANOVA, the difference will be called "significant" when the p-value of F ratio is less than 0.1. Then, this paper will use Tukey's Honestly Significant Difference (Tukey's HSD) to conduct the multiple comparison and examine which groups are "significantly" different.

3.   Data Analysis And Research Findings

3.1 Identification of Risks in Container Shipping

Risks in container shipping operations are many; they can be roughly classified into three risk categories: risks associated with the information flow, risks associated with the physical flow, and risks associated with the payment flow (Chang et al., 2014). Each risk category consists of several risk elements, and each risk element consists of several risk factors. The detailed lists of the risks identified in previous studies are presented below.

3.1.1 Risks associated with information flow

As shown in Table 1, three risk elements associated with information flow are identified, namely, information delay, inaccurate information, and IT failure. There are 4 risk factors under information delay, 5 risk factors under inaccurate information, and 3 risk factors under IT failure.

Table 1 Risks associated with information flow

Information delay		
Code	Risk factor	Literature sources
InfoD_1	Using different communication channels in the supply chain and consequently increasing the time	Metters, 1997

	of information transmission. (e.g. telephone, Email, EDI)	
InfoD_2	Supply chain partners not transmitting essential information on time	Angulo *et al.,* 2004; Yang, 2010, 2011
InfoD_3	Processing documents being detained by government departments (e.g. customs)	Husdal and Bråthen, 2010; Yang, 2010
InfoD_4	Shipping company not transmitting essential information on time	Angulo *et al.,* 2004
Inaccurate information		
InfoI_1	Lack of information security during the information flow	Sharma and Gupta, 2002; Finch, 2004; Qi and Zhang, 2008
InfoI_2	Information asymmetry/incompleteness	Forrester, 1961; Lee *et al.,* 1997; Angulo *et al.,* 2004; Husdal and Bråthen, 2010
InfoI_3	Lack of information standardisation and compatibility	Tummala and Schoenherr, 2011
InfoI_4	Shippers requesting extra service information	Interviews
InfoI_5	Shippers hiding cargo information (non-declare)	Interviews
IT failure		
InfoIT_1	IT infrastructure breakdown or crash	Qi and Zhang, 2008; Swabey, 2009; Tummala and Schoenherr, 2011
InfoIT_2	Unsuitable human operation on IT infrastructure	Millman, 2007
InfoIT_3	Unsuitable human operation on application software	Millman, 2007

3.1.2 Risks associated with physical flow

Table 2 shows the two risk elements associated with physical flow, i.e., transportation delay and cargo/asset loss or damage. There are 9 risk factors identified under transportation delay and 6 risk factors identified under cargo/asset loss or damage.

Table 2 Risks associated with physical flow

Transportation delay		
Code	Risk factor	Literature sources
PhTD_1	Port strikes	Notteboom, 2006; Drewry, 2009; Husdal and Bråthen, 2010; Tummala and Schoenherr, 2011
PhTD_2	Port congestions (unexpected waiting times before berthing or before starting loading/discharging)	Notteboom, 2006; Drewry, 2009; Tummala and Schoenherr, 2011
PhTD_3	Port/terminal productivity being below expectations (loading/discharging)	Notteboom, 2006; Tummala and Schoenherr, 2011
PhTD_4	Unstable weather	Notteboom, 2006; Husdal and Bråthen, 2010
PhTD_5	Inappropriate empty container transportation	Song *et al*., 2005; Drewry, 2006; Song and Dong, 2011

PhTD_6	Container shortage (e.g. Shippers use containers as storage, container revamp, unexpected demand)	Interviews
PhTD_7	Lack of flexibility of fleet size and designed schedules	Song *et al*., 2005; Qi and Song, 2012
PhTD_8	Cargos being detained by customs	Interviews
PhTD_9	Oil price rise	Notteboom and Vernimmen, 2009; Husdal and Bråthen, 2010
Cargo/asset loss or damage		
PhCD_1	Damage to containers or cargo due to terminal operators' improper loading/unloading operations	Husdal and Bråthen, 2010
PhCD_2	Cargo being stolen from unsealed containers	Drewry, 2009;Husdal and Bråthen, 2010
PhCD_3	Damage caused by transporting dangerous goods	Talley, 1996; Husdal and Bråthen, 2010
PhCD_4	Damage to ship or quay due to improper berth operations	Talley, 1996; Husdal and Bråthen, 2010
PhCD_5	Damage to frozen cargo/ reefer containers due to electricity failure	Interviews
PhCD_6	Attack from pirates or terrorists	Drewry,2009; Fu *et al.,* 2010; Tummala and Schoenherr, 2011; Liwång et al., 2013

3.1.3 Risks associated with payment flow

The three risk elements associated with payment flow are listed in Table 3. They are currency exchange, payment delay, and non-payment. There are 2 risk factors identified under currency exchange, 2 risk factors identified under payment delay, and 4 risk factors identified under non-payment.

Table 3 Risks associated with payment flow

Currency exchange		
Code	Risk factor	Literature sources
PayCE_1	Change of currency exchange rate during payment process	Tummala and Schoenherr, 2011
PayCE_2	Financial crisis in the loan countries	Interviews
Payment delay		
PayPD_1	Payment delay from partners or shippers	Seyoum, 2009
PayPD_2	Unrealized contract with partners	Tummala and Schoenherr, 2011
Non-payment		
PayNP_1	Shippers going into bankruptcy	Husdal and Bråthen, 2010; Tummala and Schoenherr, 2011
PayNP_2	Shippers abandoning cargos when cargos have already reached the port of destination	Interviews
PayNP_3	Shippers breaking the contract or reducing the container volume	Chen, 2008
PayNP_4	Having partners with bad credit	Tummala and Schoenherr,

		2011

After identified all the risk elements from the literature and interview, another set of interviews were conducted with 6 senior managers in container shipping in Taiwan through email on 6th May 2011. The purpose of this set of interviews is to verify the identified risk elements above. The result shows that all the risk elements were verified and confirmed by the 6 managers.

3.2 Characteristics of the respondents

In reference to the list of ROC National Association of Shipping Agencies, this study selected and invited the managers to participate in the questionnaire survey. This research sent out 342 questionnaires on 14th July 2011 and then got 88 replies, include 62 valid ones and 26 invalid ones within a month. The valid return rate was 18.13% (Table 4). Non-response bias is further conducted through a randomised one-way ANOVA (Juntunen et al., 2011). A total 45 questionnaires were included in the first wave, and 17 questionnaires were responded after the reminder. The result shows that no statistically significant difference between the two waves. It is therefore assumed that non-response bias is not a problem in this study and the samples represent the target group.

Table 4 Questionnaires reply detail

Questionnaire	Return	Invalid reply	Valid reply	Valid reply rate
342	88	26	62	18.13%

Table 5 presents the 62 respondents' detail. In the work experience (year) aspect, approximately 75% of respondents have already worked within shipping industry for more than 16 years. This result shows that most of the respondents have very professional work experience within container shipping supply chain and the result of this questionnaire has a high reliability. In department aspect, the most respondents work in operation/shipping department (48.4%), information/document department has 12.9% and financial/ accounting department occupies 19.4%. Although this study has already tried to distribute similar sample number between information, financial and operation departments, the replied respondents' department are uncontrollable. This unbalance sample might become a bias to the result of risk identification and risk mitigation strategy choice. In terms of professional role, the most type of respondent is manager/assistant manager (35.5%), and the second one is direct/vice direct (29%). There are 30 respondents' positions above than manager, which shows 48.4% of respondents have the power to make decisions within shipping companies. More than 60% of respondents work in container shipping agency, and approximately 30% of respondents work in container shipping company. In ownership type sector, more than 70% of respondents work in local container shipping companies. In the company size aspect, 35.5% of respondents work in small companies (fewer than 50 employees), and around 45% of respondents work in companies which have more than 200 employees.

Table 5 respondents' detail

	Groups	number	%
Work experience (year)	1 - 5 years	9	14.5
	6 - 10 years	4	6.5
	11 - 15 years	3	4.8
	16 - 20 years	12	19.4
	21 - 25 years	17	27.4
	Over 25 years	17	27.4
Department	President/ vice-president	7	11.3
	Information/ document	8	12.9

	Financial/ accounting	12	19.4
	Operation/ shipping	30	48.4
	Other	5	8.1
Job title	Vice president or above	8	12.9
	Manager/Assistant manager	22	35.5
	Director/Vice Director	18	29.0
	Clerk	10	16.1
	Sales representative	3	4.8
	Others	1	1.6
Type of business	Container shipping company	19	30.6
	Container shipping agency	38	61.3
	Others	5	8.1
Ownership pattern	Local firm	44	71.0
	Foreign-owned firm	10	16.1
	Foreign-local firm	7	11.3
	Others	1	1.6
Number of employees	1 - 50 people	22	35.5
	51 - 100 people	11	17.7
	101~200 people	1	1.6
	201~500 people	15	24.2
	over 500 people	13	21.0

3.3 Results from ANOVA

Before conducting ANOVA, the three assumptions of ANOVA are tested (i.e. independence, normality, and homogeneity of variance). Independence is verified through Durbin-Watson test, and the results show that all the values of Durbin-Watson are higher than 2, which means the data achieves independence. Normality is verified through Kolmogorve-Smirnov test, and the results show that all of the p-values are higher than 0.1, which means the data achieves normality. Homogeneity is verified through Scatter plot/dot plot, the results show that all graphs are upward trends, which means that the data achieve homogeneity. The results of ANOVA are discussed in the following sections.

3.3.1 About work experience

In *work experience* dimension, four groups are segmented, including 1-10 years of work experience (Group A, N=13), 11-20 years of work experience (Group B, N=15), 21-25 years of work experience (Group C, N=17), and over 25 years of work experience (Group D, N=17). The result of such categorisation through discriminant analysis shows that 92.8% of the originally grouped cases are correctly classified, which means that this categorisation has high correct classification and can further conduct ANOVA.

According to the results of ANOVA, many p-values of the independent variables achieve significant level ($p<0.1$), which means at least one category with the groups of different work experience have significant different risk perceptions. In order to understand which groups are significant different in which category, this study further conduct Tukey's HSD to obtain the detailed results. Table 6 shows the results about different risk perceptions of employee with different work experiences. In general, Group A has the highest risk perception among the four groups. This indicates that employees who

have extensive work experience might not be as alert as the junior staff since they are fully familiar with the operations.

In financial loss, there are seven risk categories that have significant p-value, including InfoD, InfoIT, PhTD, PhCD, PayPD, InfoI, PayNP, and PayCE. The results show that Group A and Group B have significant different risk perception on InfoD, InfoIT, PhTD, PhCD, PayPD, and PayNP, and the mean values of Group A are higher than Group B. Moreover, Group A is also higher than Group D on InfoD, InfoI, InfoIT, PhTD, PhCD, PayPD, and PayNP. This indicates that Group A, people who are junior (work experience between 1 and 10 years), has significant higher sense of risk in financial loss than other groups. In addition, Group C and Group D have significant different risk perception in InfoI and the mean value of Group C is higher than Group D.

In reputation loss, there are seven risk categories that have significant p-value, including PhTD, InfoI, InfoIT, PhCD, PayPD, PayNP, and PayCE. The result shows that Group A and Group B have significant different risk perception on InfoIT, PhTD, and PayPD, and the mean values of Group A are higher than Group B. Group A and Group D have significant different risk perception on InfoI, PhTD, PhCD, PhyPD, and PayNP, and the mean values of Group A are higher than Group D. This indicates that people who are junior has significant higher sense of risk in reputation loss than other groups. In addition, Group C and Group D have significant different risk perception on PhTD, PhCD, and PayPD, and the mean value of Group C is higher than Group D.

In safety and security related incident loss, there are seven risk categories that have significant p-value, including InfoIT, PhTD, PayPD, InfoD, InfoI, PhCD, and PayNP. The results show that Group A is significant higher than Group B in InfoIT, PhTD, and PayPD, and the mean values of Group A are higher than Group B. Moreover, Group A is also significantly higher than Group D on InfoI, InfoIT, PhTD, PhCD, and PayPD. This indicates that people who are junior that have significant higher sense of risk in safety and security related incident loss than other groups on InfoI, InfoIT, PhTD, PhCD, and PayPD. In addition, Group C and Group D have significant different risk perception on InfoI, InfoIT, and PhCD, and the mean value of Group C is higher than Group D. Group B and Group C have significant different risk perception on PhTD, and the mean value of Group B is higher than Group C.

Notably, InfoD in safety and security incident related loss (p-value: 0.026) has significant p-value (i.e. p-value < 0.05); however, the results of their Tukey's HSD show that no groups have significant different within these two risk elements.

Table 6 Results from different work experiences

k	Category	Element	Work experience (Year)				P value	Tukey's HSD
			1-10 (N = 13)	11-20 (N = 15)	21-25 (N = 17)	Over 25 (N = 17)		
1	Risks associated with information flow	InfoD	11.33	6.05	9.35	6.72	0.007***	(A,B) (A,D)
		InfoI	11.28	7.77	9.95	6.24	0.016**	(A,D) (C,D)
		InfoIT	11.00	6.04	9.14	5.78	0.003***	(A,B) (A,D)
	Risks associated with physical flow	PhTD	12.16	8.08	11.26	7.88	0.006***	(A,B) (A,D)
		PhCD	13.03	8.98	10.87	7.22	0.004***	(A,B) (A,D)

	Risks associated with payment flow	PayCE	11.31	7.00	10.71	7.79	0.095^*	N/A
		PayPD	12.54	7.23	10.24	6.41	0.004^{***}	(A,B) (A,D)
		PayNP	11.92	7.47	8.85	6.18	0.017^{**}	(A,B) (A,D)
2	Risks associated with information flow	InfoD	8.88	6.12	9.25	6.32	0.101	N/A
		InfoI	10.92	7.29	9.49	6.04	0.019^{**}	(A,D)
		InfoIT	9.92	5.60	9.25	5.82	0.024^{**}	(A,B)
	Risks associated with physical flow	PhTD	10.64	6.53	9.84	5.68	0.003^{***}	(A,B) (A,D) (C,D)
		PhCD	11.12	7.87	9.98	6.02	0.013^{**}	(A,D) (C,D)
	Risks associated with payment flow	PayCE	10.19	5.4	9.15	5.74	0.078^*	N/A
		PayPD	10.27	5.67	9.47	5.00	0.010^{**}	(A,B) (A,D) (C,D)
		PayNP	10.04	5.85	8.16	4.72	0.026^{**}	(A,D)
3	Risks associated with information flow	InfoD	9.35	5.60	9.10	5.81	0.026^{**}	N/A
		InfoI	11.55	7.77	10.84	6.86	0.014^{**}	(A,D) (C,D)
		InfoIT	11.03	6.47	10.08	5.88	0.000^{***}	(A,B) (A,D) (B,C) (C,D)
	Risks associated with physical flow	PhTD	10.40	5.74	9.40	6.07	0.006^{***}	(A,B) (A,D)
		PhCD	11.50	10.04	12.27	7.64	0.021^{**}	(A,D) (C,D)
	Risks associated with payment flow	PayCE	9.08	5.13	9.15	5.97	0.155	N/A
		PayPD	9.58	4.90	8.15	4.85	0.009^{***}	(A,B) (A,D)
		PayNP	8.85	5.18	8.26	4.97	0.064^*	N/A

* p-value < 0.1
** p-value < 0.05
*** p-value < 0.01
$k = 1$ for the risk perception "financial loss"
$k = 2$ for the risk perception "reputation loss"
$k = 3$ for the risk perception "safety and security incident related loss"

3.3.2 About professional field

There are five groups in *professional field* dimension, including president/vice-president (Group A), information/document (Group B), financial/accounting (Group C), operation/shipping (Group D), and other department (Group E). The result of ANOVA shows that several categories with different departments have significant different risk perceptions. Table 7 shows that results about different risk perceptions of employee with different department.

In financial loss, there are four risk categories that have significant p-value, including PhTD, PhCD, PayCE, and PayPD. The results show that Group B and Group D have significant different risk

perception in the above four risk categories and the mean values of Group D are higher than Group B. This indicates that managers in operation/ shipping department have more risk perceptions on PhTD, PhCD, PayCE, and PayPD than managers in information/ document department.

In reputation loss, there are three risk categories that have significant p-value, including PayPD, PhTD, and PayNP. The results show that Group B and Group D have significant different risk perception in the above three risk categories and the mean values of Group D are higher than Group B. This indicates that managers in operation/ shipping department have more risk perceptions on PhTD, PayCE, PayPD, and PayNP than managers in information/ document department.

Under safety and security incident related loss, five risk categories have significant p-value, including PhTD, PayPD, PhCD, PayCE, and PayNP. The results show that Group B and Group D have significant different risk perception on PhTD and PayPD and the mean values of Group D are higher than Group B; whilst Group A and Group B have significant different risk perception on PhCD and the mean values of Group A are higher than Group B. This indicates that managers in operation/ shipping department have more risk perceptions on PhTD and PayPD than the managers in information/ document department; whilst president/ vice-president have more risk perceptions on cargo/asset loss or damage than the managers in information/ document department. In addition, PayCE and PayNP have a significant p-value; however, there are no significant different groups that address on the two risk categories.

Table 7 Results from different professional field

k	Category	Element	Department A	Department B	Department C	Department D	Department E	P value	Tukey's HSD
1	Risks associated with information flow	InfoD	10.79	6.31	6.50	8.84	8.54	0.252	N/A
		InfoI	10.17	6.30	7.70	9.47	8.46	0.428	N/A
		InfoIT	7.62	4.83	6.50	9.40	7.71	0.104	N/A
	Risks associated with physical flow	PhTD	10.14	5.81	9.12	11.39	8.43	0.015**	(B,D)
		PhCD	9.74	5.85	9.28	11.54	8.88	0.038**	(B,D)
	Risks associated with payment flow	PayCE	9.50	5.06	9.00	10.84	6.86	0.094*	(B,D)
		PayPD	9.00	5.38	8.83	10.75	5.93	0.055*	(B,D)
		PayNP	9.46	5.41	7.25	9.89	7.00	0.170	N/A
2	Risks associated with information flow	InfoD	10.04	5.81	6.27	7.95	8.21	0.346	N/A
		InfoI	9.83	5.98	6.73	9.22	8.54	0.294	N/A
		InfoIT	8.57	4.17	6.03	9.01	7.33	0.112	N/A
	Risks associated with physical flow	PhTD	8.03	4.64	7.92	9.65	5.97	0.051*	(B,D)
		PhCD	8.31	5.10	8.32	10.01	7.60	0.113	N/A
	Risks associated with payment flow	PayCE	8.07	3.19	7.58	9.27	4.86	0.110	N/A
		PayPD	8.21	3.81	6.50	9.45	4.86	0.047**	(B,D)
		PayNP	7.39	3.53	6.13	8.82	5.25	0.092*	(B,D)
3	Risks associated with information flow	InfoD	9.21	5.34	6.29	8.19	6.71	0.371	N/A
		InfoI	12.37	7.03	7.97	9.50	9.03	0.246	N/A
		InfoIT	8.24	6.17	7.03	9.29	8.62	0.320	N/A
	Risks associated with physical flow	PhTD	8.48	3.90	8.06	9.21	5.59	0.030**	(B,D)
		PhCD	13.21	6.60	9.44	11.11	9.86	0.057*	(A,B)
	Risks associated	PayCE	9.00	3.19	7.38	8.96	3.43	0.059*	N/A

| | with payment | PayPD | 7.43 | 3.25 | 7.33 | 8.07 | 3.86 | 0.048** | (B,D) |
| | flow | PayNP | 9.04 | 3.09 | 6.69 | 7.81 | 4.39 | 0.080* | N/A |

A: president/vice-president (N = 7)
B: information/document (N = 8)
C: financial/accounting (N = 12)
D: operation/shipping (N = 28)
E: other (N = 7)
*p-value < 0.1
**p-value < 0.05
***p-value < 0.01
$k = 1$ for the risk perception "financial loss"
$k = 2$ for the risk perception "reputation loss"
$k = 3$ for the risk perception "safety and security incident related loss"

3.3.3 About position in company

Three groups have been classified in the *position in company* dimension, including president and manager (Group A), Director and clerk (Group B), and Sales and other (Group C). The result of categorising through discriminant analysis shows that 89.8% of original grouped cases are correctly classified, which means that this categorisation has high correctly classification and can further conduct ANOVA.

Table 8 shows the result of ANOVA, it shows that only two p-values of independent variable achieve significant level. They are PayCE and PayNP under safety and security incident related loss, and the mean values of Group A are higher than Group B. This indicates that presidents and managers have higher risk perceptions than director and clerk on PayCE and PayNP under safety and security incident related loss.

Table 8 ANOVA result from different position

| k | Category | Element | Professional role | | | P value | Tukey HSD |
			President & manager (N = 23)	Director & clerk (N = 28)	Sales & other (N = 11)		
1	Risks associated with information flow	InfoD	8.78	7.52	8.98	0.554	N/A
		InfoI	9.14	8.48	8.25	0.846	N/A
		InfoIT	7.80	7.40	9.15	0.577	N/A
	Risks associated with physical flow	PhTD	10.24	9.12	10.37	0.576	N/A
		PhCD	10.12	9.92	9.17	0.858	N/A
	Risks associated with payment flow	PayCE	10.33	7.71	10.27	0.203	N/A
		PayPD	9.41	8.13	10.05	0.529	N/A
		PayNP	9.17	7.65	8.84	0.563	N/A
2	Risks associated with information flow	InfoD	8.60	6.54	8.27	0.245	N/A
		InfoI	8.78	7.66	8.98	0.627	N/A
		InfoIT	8.35	6.43	8.85	0.263	N/A
	Risks associated with physical flow	PhTD	8.82	7.19	8.74	0.400	N/A
		PhCD	9.10	8.38	8.23	0.833	N/A
	Risks associated with payment flow	PayCE	8.72	5.98	8.95	0.209	N/A
		PayPD	8.70	6.32	7.95	0.295	N/A
		PayNP	8.02	6.02	7.66	0.378	N/A
3	Risks associated with	InfoD	8.34	6.52	7.70	0.371	N/A

	information flow	InfoI	10.02	8.69	8.55	0.569	N/A
		InfoIT	8.38	7.86	9.00	0.741	N/A
	Risks associated with physical flow	PhTD	8.85	6.65	8.59	0.196	N/A
		PhCD	11.37	9.76	9.44	0.387	N/A
	Risks associated with payment flow	PayCE	8.98	5.41	8.55	0.091*	(A,B)
		PayPD	7.80	5.88	6.82	0.364	N/A
		PayNP	8.46	5.37	6.64	0.099*	(A,B)

* p-value < 0.1
** p-value < 0.05
*** p-value < 0.01
$k = 1$ for the risk perception "financial loss"
$k = 2$ for the risk perception "reputation loss"
$k = 3$ for the risk perception "safety and security incident related loss"

3.3.4 About employer's main businesses

Three groups are classified in the *employer's main businesses* dimension, including shipping company (Group A), shipping agency (Group B), and others (Group C). Several p-values of independent variable achieve significant level. Table 9 shows the detailed results. In general, the employees who work in shipping agencies have higher risk perception than employees who work in shipping companies.

The results of ANOVA show that under reputation loss has four risk categories with significant p-value, including PhCD, PayCE, PayPD, and PayNP. The result shows that Group A and Group B have significant different risk perceptions in these four risk categories and the mean values of Group A are higher than Group B, this means that managers in shipping agencies have significant higher risk perception on PhCD, PayCE, PayPD, and PayNP than managers in shipping companies.

In safety and security incident related loss, there is only one risk category that have significant p-value, which is PayNP with Group A (mean value: 4.49) and Group B (mean value: 7.74). This indicates that manager in shipping agencies have higher risk perception on PayNP than managers in shipping companies. In addition, there is no risk category that has significant different risk perception in financial loss.

Table 9 Results from different main businesses

k	Category	Element	Main business			P value	Tukey's HSD
			Shipping company (N = 19)	Shipping agency (N = 38)	Other (N = 5)		
1	Risks associated with information flow	InfoD	7.24	8.80	7.85	0.502	N/A
		InfoI	7.43	9.18	9.68	0.392	N/A
		InfoIT	6.79	8.54	6.80	0.360	N/A
	Risks associated with physical flow	PhTD	8.78	10.20	10.07	0.506	N/A
		PhCD	8.56	10.29	11.60	0.300	N/A
	Risks associated with payment flow	PayCE	7.87	9.43	11.70	0.360	N/A
		PayPD	7.89	9.30	10.20	0.562	N/A
		PayNP	7.39	8.64	10.75	0.408	N/A
2	Risks associated with information flow	InfoD	6.50	7.91	9.55	0.339	N/A
		InfoI	7.07	8.59	10.92	0.237	N/A
		InfoIT	6.16	8.04	9.33	0.298	N/A

	Risks associated with physical flow	PhTD	6.58	8.92	7.27	0.183	N/A
		PhCD	6.50	9.65	8.83	0.061*	(A,B)
	Risks associated with payment flow	PayCE	4.79	8.83	8.00	0.066*	(A,B)
		PayPD	5.18	8.92	5.40	0.032**	(A,B)
		PayNP	5.05	8.24	5.60	0.080*	(A,B)
3	Risks associated with information flow	InfoD	6.00	8.00	8.20	0.285	N/A
		InfoI	7.68	9.83	9.64	0.289	N/A
		InfoIT	7.16	8.90	7.47	0.309	N/A
	Risks associated with physical flow	PhTD	6.49	8.55	7.24	0.269	N/A
		PhCD	8.96	10.85	11.23	0.330	N/A
	Risks associated with payment flow	PayCE	4.79	8.39	8.40	0.105	N/A
		PayPD	5.21	7.76	5.00	0.113	N/A
		PayNP	4.49	7.74	7.65	0.069*	(A,B)

* p-value < 0.1
** p-value < 0.05
*** p-value < 0.01
$k = 1$ for the risk perception "financial loss"
$k = 2$ for the risk perception "reputation loss"
$k = 3$ for the risk perception "safety and security incident related loss"

3.3.5 About company type

Three groups are classified in the *company type* dimension, including Taiwan local company (Group A), foreign company (Group B), and Taiwan with foreigner cooperation (Group C). Table 10 shows the results. The results show that Group A and Group B have significant different risk perception in PhTD under financial loss and InfoI under safety and security incident related loss, and the mean values of Group A are higher than those of Group B. This means that managers in Taiwan local companies feel that PhTD and InfoI would cause serious risk impact compared to managers in foreign companies in financial loss and safety and security incident related loss respectively. In addition, the mean value of Group C is significant higher than those of Group B on PayPD in reputation loss. This indicates that Taiwan with foreigner cooperation companies have higher risk perception than foreign companies on PayPD in reputation loss.

Table 10 ANOVA result from different company types

			Company type				
	Category	Element	Taiwan local company (N = 45)	Foreign company (N = 10)	Taiwan with foreigner cooperation (N = 7)	P value	Tukey HSD
Financial loss	Risks associated with information flow	InfoD	8.34	6.38	10.32	0.238	N/A
		InfoI	8.98	6.36	10.09	0.214	N/A
		InfoIT	7.90	6.53	9.48	0.441	N/A
	Risks associated with physical flow	PhTD	10.18	6.89	11.14	0.059*	(A,B)
		PhCD	10.20	7.37	11.29	0.160	N/A
	Risks associated with payment flow	PayCE	9.52	6.35	10.64	0.213	N/A
		PayPD	9.20	6.70	10.50	0.297	N/A
		PayNP	8.57	6.55	10.21	0.342	N/A
Reputation loss	Risks associated with information flow	InfoD	7.53	6.33	9.96	0.267	N/A
		InfoI	8.43	6.98	9.46	0.553	N/A
		InfoIT	7.64	5.90	9.48	0.353	N/A

	Category	Element					
	Risks associated with physical flow	PhTD	8.05	6.36	10.63	0.171	N/A
		PhCD	8.89	6.13	10.48	0.142	N/A
	Risks associated with payment flow	PayCE	7.53	5.30	10.64	0.221	N/A
		PayPD	7.49	5.10	10.93	0.095*	(B,C)
		PayNP	7.02	5.55	9.43	0.337	N/A
Safety and security incident related loss	Risks associated with information flow	InfoD	7.52	5.13	9.93	0.101	N/A
		InfoI	9.92	5.44	9.57	0.028**	(A,B)
		InfoIT	8.60	6.37	8.71	0.304	N/A
	Risks associated with physical flow	PhTD	7.97	5.54	10.02	0.126	N/A
		PhCD	10.54	7.87	12.24	0.136	N/A
	Risks associated with payment flow	PayCE	7.42	4.60	10.29	0.170	N/A
		PayPD	7.02	4.60	8.14	0.255	N/A
		PayNP	6.88	4.28	9.36	0.123	N/A

3.3.6 About company size

Two groups are classified in the *employer's main businesses* dimension, including company that has less than 50 employees (Group A, N=33), company that has more than 51 employees (Group B, N=29). The result of categorising through discriminant analysis shows that 88.7% of original grouped cases are correctly classified, which means that this categorisation has high correctly classification and can further conduct ANOVA.

In ANOVA, a number of p-values of independent variable achieve significant level. Table 11 shows that results about different risk perceptions of employee in different company size. In general, Group A has the highest risk perception than the Group B. This indicates that employees who work in small company might have higher risk perception than the employees who work in large company.

In reputation loss, there are five risk categories that have significant p-value, including PhTD, PhCD PayCE, PayPD, and PayNP. The results show that Group A and Group B have significant different risk perception on the above five risk categories and the mean values of Group A are higher than Group B. This indicates that managers in company size which under 50 employees have more risk perceptions than managers in company size over 51 employees in PhTD, PhCD, PayCE, PayPD, and PayNP.

In safety and security incident related loss, there are six risk categories that have significant p-value, including InfoD, InfoIT PhTD, PayCE, PayPD, and PayNP. The results show that Group A and Group B have significant different risk perception on the above six risk categories and the mean values of Group A are higher than Group B. This indicates that managers in company size which under 50 employees have more risk perceptions than managers in company size over 51 employees in InfoD, InfoIT, PhTD, PayCE, PayPD, and PayNP.

Table 11 Results from different company size

k	Category	Element	Employee number		P value
			1-50 (N = 33)	Over 51 (N = 29)	
一	Risks associated with information flow	InfoD	8.95	7.44	0.214
		InfoI	9.05	8.27	0.528
		InfoIT	8.60	7.02	0.185

	Risks associated with physical flow	PhTD	10.41	9.01	0.206
		PhCD	10.47	9.17	0.283
	Risks associated with payment flow	PayCE	10.14	8.00	0.140
		PayPD	9.71	8.07	0.230
		PayNP	9.13	7.63	0.259
2	Risks associated with information flow	InfoD	8.07	7.09	0.406
		InfoI	8.45	8.16	0.813
		InfoIT	8.23	6.82	0.272
	Risks associated with physical flow	PhTD	9.37	6.59	0.017[**]
		PhCD	9.65	7.45	0.070[*]
	Risks associated with payment flow	PayCE	9.80	4.93	0.002[***]
		PayPD	9.47	5.24	0.002[***]
		PayNP	8.87	4.98	0.003[***]
3	Risks associated with information flow	InfoD	8.52	6.13	0.041[**]
		InfoI	9.75	8.48	0.307
		InfoIT	9.10	7.29	0.090[*]
	Risks associated with physical flow	PhTD	9.09	6.36	0.018[**]
		PhCD	11.17	9.31	0.121
	Risks associated with payment flow	PayCE	9.33	4.97	0.005[***]
		PayPD	8.26	5.05	0.007[***]
		PayNP	8.45	4.78	0.004[***]

[*] p-value < 0.1
[**] p-value < 0.05
[***] p-value < 0.01
$k = 1$ for the risk perception "financial loss"
$k = 2$ for the risk perception "reputation loss"
$k = 3$ for the risk perception "safety and security incident related loss"

4. Discussion and Conclusion

This study explores the impact of employees' background on risk perceptions in container shipping. Taiwan container shipping is used as a case study and discriminant analysis and ANOVA are employed. A number of findings are obtained -

(1) The respondents' years of work experience has obvious impact on risk perception. In statistics perspective, the new employees with a work experience of less than 10 years have significantly higher value of risk perception on many risk elements compared to the employees with a work experience of between 11 and 20 years or over 25 years. This might be because that the new employees are not yet fully familiar with their job operations and thus take the risks more seriously. Notably, employees with a work experience of between 21 and 25 years have second higher risk perception. This might be because of their departments as half of them are in operation department and 4 of them are (vice) presents, which are the top two groups that have higher risk perception than others.

(2) In several cases, the respondents' professional field has impact on their risk perception. For example, employees of operation/shipping department have higher risk perception than employees of information/document department on "transportation delay". This might be because that in container shipping companies employees from operation/shipping department have to take the responsibility of transporting cargoes and are likely to experience high occurrence on transportation delay caused by unstable weather and/or port congestion. This finding is similar to the conclusion of Rundmo's (1995,

1996), which indicates that the offshore oil employees have higher risk perception if they have experience accident than those who have not. In addition, employees of operation/shipping department have significantly higher risk perception than employees of information/document department on PhCD, PayCE, PayPD in financial loss, PhTD, PayPD, PayNP in reputation loss, and PhTD, PayPD in safety and security incident related loss.

(3) The respondents' position shows that presidents and managers have higher risk perceptions than director and clerk on only "currency exchange" and "non-payment" under safety and security incident related loss. However, from general perspective among the three risk perceptions, presidents and managers have higher risk perceptions than director and clerk. This might because presidents and managers should consider risk management more comprehensively, the huge pressure of handling such comprehensive aspects of risk management make presidents and managers feel higher risk perception than directors and clerks.

(4) The respondents' company's main business area has some impacts on risk perception on risk associated with physical flow and payment flow in reputation loss. The employees who work in shipping agencies have higher risk perception than the employees who work in shipping companies on "cargo/asset loss or damage", "currency exchange", "payment delay", and "non-payment" in respect of "reputation loss". In addition, the mean values of shipping agency are higher than those of shipping company in all risk categories. This might be because the shipping agencies do not have their own ship to transport cargo and their capital is usually less than shipping companies, so they tend to emphasize more on all types of risk consequence.

(5) The respondents' company type has some impacts on risk perception. The employees who work in Taiwan local companies have higher risk perception than the employees who work in foreign companies on "transport delay" in respect of "financial loss" and "inaccurate information" in respect of "safety and security incident related loss". This might be because that the customers of Taiwan local companies are usually local; the shipping companies are thus familiar with the shippers who sometimes argue for penalty of transport delay or even want to save transportation fee by hiding real cargo information, which may cause serious safety and security incident to shipping companies. On the other hand, the managers of foreigners' companies sometimes come from other countries and do not familiar with the shippers with above issues, their risk perceptions are therefore lower than the managers in Taiwan local companies.

(6) The respondent's company size has some impact on risk perception. The employees who work in small companies of less than 50 employees have higher risk perception than the employees who work in company size over 51 employees on risks associated with payment flow in respect of both "reputation loss" and "safety and security incident related loss". This might be because that the small companies usually do not have huge capital to run the business and they largely rely on their sales which in turn is dependent on their reputation. Thus they tend to emphasize more on risks associated with payment flow that may cause reputation loss. Furthermore, safety and security incident related loss, if occurred, are normally in large quantity, the damage caused by which will be more serious to smaller companies than large companies.

From the point of view of improving risk management in container shipping companies, based on the above results, a number of recommendations may be made. (1) The shipping companies could consider holding regular trainings sessions about operation risks for their staff, especially those who have worked in the industry for more than 10 years to refresh and enhance their risk awareness. (2) The shipping company could arrange exchange of staff, or at least short term training, between different departments so that their risk perceptions with regard to different type of risk will not be too

different. (3) It is perhaps more important for larger shipping companies to pay more attention to risk and risk management training for their staff as their risk perception is relatively low. (4) For Taiwan local container shipping companies, they could consider implementing stricter policies with regard to revealing cargo information even the cargo is from a local shipper.

Main contributions of this study can be summarised below: (1) This paper contributes as the first empirical study on risk perception of container shipping operation. It fills a research gap in the maritime field which about how employees' background may impact on their risk perceptions. (2) This paper conducts a risk perception analysis in respect of six dimensions of employees' background, including years of work experience, professional field, position, company's main business area, company type, and company size. (3) The paper also provides recommendations for managing risk perceptions in container shipping. It is hoped that this paper will provide some useful insights for both the academics and container shipping industry practitioners.

The paper has some limitations. Firstly, this paper uses ANOVA as the main method to analyse risk perception in container shipping operations. There are other quantitative methods as well for analysing risk perceptions, e.g. willingness to pay (WTP) model (Weber and Hsee, 1998) and psychometric approach (Fischhoff et al., 1978; Slovic, 1992). It is suggested for the further research to apply more quantitative methods in the similar field so that the results from different methods could be compared and more accurate results could be achieved. Secondly, this paper only uses quantitative methods. According to Renn and Rohrmann (2000), using only quantitative approach is insufficient to reflect the complex pattern of individual risk perception. They suggested that research on risk perceptions should also include qualitative methods to measure the consequences of risk activities as the qualitative methods can help to obtain deeper and explainable results, e.g. the reasons why the respondents have higher risk perceptions on certain risk factors. It is suggested for further research that uses both quantitative and qualitative methods to address the similar issue. Thirdly, this paper use Taiwan as a case study. However, as Taiwan is an island and deeply relied on maritime industry for the economic, the results can provide some useful information for the countries that are similar to Taiwan.

Nevertheless, as an exploratory study, we hope this paper can shed some light on the issue of risk perception in the shipping industry and help those who are interested in studying the risks in container shipping to understand better how the risks are perceived by different groups of people.

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