CRUISE SHIPPING ACCIDENTS IN ASIA: THE TRENDS, CAUSAL FACTORS AND IMPLICATIONS

Yui Yip Lau[1 2 3]
Ka-Chai Tam[2 4]
Adolf K.Y. Ng[2 5]
Hong-Oanh Nguyen[6]
Natalia Nikolova[7]

[1] Division of Business, Hong Kong Community College, The Hong Kong Polytechnic University, Hong Kong, yylau@hkcc-polyu.edu.hk
[2] Transport Institute, University of Manitoba, Canada
[3] School of Education, Faculty of Social Sciences and Law, University of Bristol, United Kingdom
[4]Department of History, Hong Kong Baptist University, Hong Kong, kctam@hkbu.edu.hk
[5]Department of Supply Chain Management, Asper School of Business, University of Manitoba, Canada, adolf.ng@umanitoba.ca
[6]Australian Maritime College, University of Tasmania, O.Nguyen@utas.edu.au
[7] Australian Maritime College, University of Tasmania, Natalia.Nikolova@utas.edu.au

Abstract

Since the 'Titanic' disaster in 1912, safety in cruising has attracted international concerns. A number of shipwrecks have highlighted high frequencies of human failures in the cruise industry over the last century. The safety regulations and ineffective cultures of safety reflected weaknesses on increasing risks of losing lives in cruise ship accidents, notably in Asia. The paper undertakes a critical review on the trends and causal factors in cruise ship accidents using information on marine casualties and incidents since 1912. It shows how human and organizational factors contribute to cruise shipping accidents and raises issues on how to develop comprehensive safety measures and policies in Asia, where the cruise industry is rapidly growing.

Keywords: Cruise shipping; Shipwrecks; SOLAS Convention; Maritime Safety Committee; Asia

1. Introduction

In the context of passenger transport, cruising is recognized as a safe method of taking vacation (Lois et al., 2004). Over the past century, scientific and technological advances have led to major breakthroughs in power supply, design, catering facilities, and accommodation of cruise ships (Lois et al., 2004). Indeed, since the 'Titanic' disaster in 15 April 1912, safety in cruising has attracted international concerns and academic world. A number of shipwrecks have highlighted relatively high frequencies of human failures in the cruise industry over the last century. For instance, there were 580 cruise shipwreck events recorded from 1989 to 2013, especially for the major disaster of Costa Concordia in 2012. Tremendous cruise ship accidents, notably, 2006 Star Princess have attracted global attention to the cruise industry and resulted in investigations and legal actions on safety concerns (Mileski et al., 2014). The National Transportation Safety Board (NTSB) found that 37% of the marine accidents from 1988 to 2014 were related to passenger vessels. The Cruise Line International Association (CLIA) has investigated the causes and deficiencies of serious accidents and managerial practice of the industry to highlight potential regulations on cruise ships (Mileski et al., 2014). In this case, Gossard (1995, p. 157) noted that "although most critics acknowledge that the cruise industry in general has an excellent safety record, serious losses can and do occur. Fire may be the biggest danger to a cruise ship but collision and grounding may also have serious consequences. In most instances, the ship's crew has responded professionally". Maritime safety analysis concentrates on qualitative analysis on the enforcement of safety regulations, training of seafarers, the health of seafarers at the high sea (Mileski et al., 2014), assessment of the safety of individual vessels, as well as ship designs, structures and backwards (e.g. Stiehl, 1977; Pate-Cornell, 1990; Guedes Sorars, 1997). After the 1990s, maritime safety analysis focused on methodological, rather than conceptual or theoretical, issues (Zohar, 2010) and underwent transformation in operational research with a variety of advanced techniques including fuzzy logic (e.g., Yang et al., 2009; Gaonkar et al., 2011), evidential reasoning (e.g. Wang et al., 2004; Liu et al., 2005), Bayesian networks (e.g. Eleye-Datubo et al., 2006), genetic algorithm (e.g. Montewka et al., 2010; Nwaoha et al., 2010), Markov chains (e.g. Kolowrocki and Soszynska, 2011), to name but a few. However, few research efforts have been put to cruise ship accidents in Asia (Lau et al., 2017). Recently Asia has witnessed increasing demand for cruising, the newly-developed cruising destinations, as well as the competition between cruise lines. Understanding such, this papers aims to understand how various factors may enhance cruise liners to develop comprehensive safety measurement for future research and policymaking for Asia. It presents a historical account on 48 cruise ship accidents in Asia between 1972 and 2015.

2. Cruise traffic in the Asian region

Once being a preferred mode of travel for the social elite (Johnson, 2002) in the 1920s, cruising was challenged by air transport in the 1980s (Mileski et al., 2014). Cruising revived after reshaping into leisure mode of traffic. Currently, it is a fast-growing and dynamic sectors of transport (Castillo-Manzano et al., 2014) with 100 million passengers worldwide between 2005 and 2012 (Mileski et al., 2014). Broadly speaking, cruise markets have divided into three main regions, namely North America, Europe, and Asia, spreading from Alaska to Asia (Castillo-Manzano et al., 2014).

In this regard, Asia is a key maritime region with a strategic role in international shipping activities and 20 countries classified as maritime nations with long coastlines (Zhu, 2006). The region increased its attractiveness as a result of new cruising destinations with their cultural, leisure and touristic offerings (Castillo-Manzano et al., 2014; Lau et al., 2014). By the end of this coming decade, Asian passengers will accumulate one in every five cruisers (Lau et al., 2014). Indeed, Asia has a dominating trend in terms of cruise travelers for the last 15 years (Table 1), while a similar phenomenon can be found in terms of cruise fleet (Table 2).

Table 1: Trend in Asian cruise travelers (millions of cruise passengers) Source: Ocean Shipping Consultants (2012)

Regions	2005	2010	2015
Japan	0.23	0.27	0.32
East Asia (China, South Korea and Taiwan)	0.44	0.72	1.00
South East Asia	0.04	0.55	0.07
Sub-total (Asia)	1.07	1.54	2.02
Total (Global)	13.6	18.0	22.6
The proportions of Asia region to global	8%	9%	9%
Growth rate global		29.5%	11.1%
Growth rate of Asia regions		43.9%	31.2%

Table 2: Cruise growth and deployment trends in major regions (2008-2013) Source: CILA (2013)

Region	Growth of capacity (2008-2013)	Share in 2008	Share in 2013
Asia	302%	1.20%	3.60%
Australasia	155%	2.20%	4.10%
South America	57.0%	2.90%	3.40%
Mediterranean	57.0%	8.30%	9.80%
Caribbean	49.0%	17.60%	19.90%
Europe	33.0%	37.20%	37.30%
Alaska	-5.40%	7.60%	5.40%

3. Safety regulations

The history of maritime safety can be traced back to a series of maritime accidents followed by regulatory responses, with a good example being the UK with its courts of marine inquiry (Schroder-Hinrichs et al., 2012; Schroder-Hinrichs et al., 2013). The faith on Titanic raised the attention on cruise safety and provoked international dialog (Yang et al., 2013; Mileski et al., 2014). Results are the international maritime safety convention – Safety of Lives at Sea (SOLAS) – adopted in 1914, the International Convention for the Prevention of Pollution from Ships (MARPOL) adopted in 1978, and the formation of the International Maritime Organization (IMO) in 1948 (Knudsen and Hassler, 2011; Wu, Jeng, 2012). A resolution of IMO in 1993 introduced the International Safety Management (ISM) Code that aims to provide a holistic and integrated approach for cruise shipping companies to develop the Safety Management System (SMS) so as to reduce human error in cruise ship accidents and align with the interests of the public good (Mukherjee, 2007; Tzannatos, Kokotos, 2009; Batalden, Sydnes, 2014; Li et al., 2014). In 2010, the new IMO Casualty Investigation Code mentioned that safety investigations should be on top of the agenda for administrations (Schroder-Hinrichs et al., 2012). The Costa Concordia grounding has brought significant impact on cruise ship industry. In response, IMO's Maritime Safety Committee (MSC) launched a resolution recommending operational measures to enhance the safety of large cruise ships.

Cruise ships are subject to much higher risk of human casualties due to the nature of cruising services (Gemelos, Ventikos, 2008; Mileski et al., 2014), and the growth of the Asian market raises the question on cruising safety within the region. In fact, the region has different maritime regulatory regimes and levels of economic development across the countries (Zhu, 2006). In a competitive market, the cruise lines are pressurized to cut costs by recruiting less qualified (and lower cost) labors, re-flagging vessels to circumvent regulations by flag states (Batalden and Sydnes, 2014). Some Asian countries even have a lack of training, awareness, expertise, and resources in the implementation of the ISM Code.

While the human aspect is vital for cruise ship safety (Ek et al., 2014), 80-85% of all the recorded severe cruise ship accidents are related to human errors (Barnett, 2005; Tzannatos, Kokotos, 2009). These stem from cruise seafarers working for long hours with insufficient recuperative rest, thus causing ill-health conditions (Barnett, 2005; Gemelos, Ventikos, 2008). However, the IMO stresses that the root cause of human errors is the lack of professionalism of cruise seafarers, being influenced by performance and attitudes (Ek et al., 2014). Human error in cruise ship accidents seems to sustain despite technological progress made in the cruise industry for the past three decades.

4. Factual information of cruise ship disaster

To analyze this question in a systematic way, this paper discusses the factors of cruise ship accidents in Asia by evaluating 48 cruise ship incidents between 1972 and 2014. A comprehensive dataset was built with 9,000 records from 1900 to 2014 from the Global Integrated Shipping Information System: Marine Casualties and Incidents of the IMO. The cruise ship casualty records in Asia are 48 in the final dataset. All unspecified type of casualties are excluded as they fail to provide sufficient key data and information. The dataset contains descriptive variables, e.g., date, location, cruise ship events (collisions, contacts, fires/explosions, foundered, hull/machinery damage, wrecks/stranded, groundings), type of casualty (very serious, serious, less serous, unspecified).

Table 3: Types of cruise ship accidents in the Asian region from 1972 to 2014

Year	Foundered	Capsizing/Listing	Collision	Fire/Explosion	Poor Weather	Contact	Stranding/Grounding	Hull/Machinery	**Total**	Year	Foundered	Capsizing/Listing	Collision	Fire/Explosion	Poor Weather	Contact	Stranding/Grounding	Hull/Machinery	**Total**
2014	1	0	0	0	0	0	0	0	**1**	1992	0	0	1	0	0	0	0	0	**1**
2013	0	1	1	0	0	0	0	0	**2**	1991	0	0	0	0	0	0	0	0	**0**
2012	1	1	1	1	0	0	0	0	**4**	1990	0	0	0	0	0	0	0	0	**0**
2011	0	1	2	1	1	0	0	0	**5**	1989	0	0	0	0	0	0	0	0	**0**
2010	0	0	0	0	0	0	0	0	**0**	1988	0	0	0	0	0	0	0	0	**0**
2009	0	0	0	0	0	0	0	0	**0**	1987	0	0	0	0	0	0	0	0	**0**
2008	0	0	0	0	0	0	0	0	**0**	1986	0	0	0	0	0	0	0	0	**0**
2007	0	0	0	0	0	0	0	0	**0**	1985	0	0	0	0	0	0	0	0	**0**
2006	0	0	0	1	0	0	0	0	**1**	1984	0	0	0	0	0	0	0	0	**0**
2005	0	0	0	0	0	0	0	1	**1**	1983	0	0	0	0	0	0	0	0	**0**
2004	0	0	0	0	0	0	0	0	**0**	1982	0	0	0	0	0	0	0	0	**0**
2003	0	1	1	0	0	1	1	0	**4**	1981	0	0	0	0	0	0	0	0	**0**
2002	0	1	0	3	0	0	0	1	**5**	1980	0	0	0	0	0	0	0	0	**0**
2001	0	0	1	1	0	0	1	0	**3**	1979	0	0	0	0	0	0	0	0	**0**
2000	0	3	2	3	0	0	0	0	**8**	1978	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	**0**	1977	0	0	0	0	0	0	0	0	**0**
1998	0	0	0	0	1	0	0	3	**4**	1976	0	0	0	0	0	0	0	0	**0**
1997	0	1	3	2	0	1	1	0	**8**	1975	0	0	0	0	0	0	0	0	**0**
1996	0	0	0	0	0	0	0	0	**0**	1974	0	0	0	0	0	0	0	0	**0**
1995	0	0	0	0	0	0	0	0	**0**	1973	0	0	0	0	0	0	0	0	**0**
1994	0	0	0	0	0	0	0	0	**0**	1972	0	0	0	1	0	0	0	0	**1**
1993	0	0	0	0	0	0	0	0	**0**	**Total**	**2**	**9**	**12**	**13**	**2**	**2**	**3**	**5**	**48**

Analyzing the cruise ship accidents in Asia by cause from 1972 to 2014 (Table 3), it is evident that the most common cause is collision (25%) and fire/collision (27.1%) that contributes the cruise ship accidents, followed by capsizing/listing at 18.8%, hull/machinery at 10.4%, stranding/grounding at 6.3%, foundered, contact and poor weather at 4.2%. The cruise accident caused by human error is 95.8% of all recorded during the period of study. Human errors are mainly due to the psychological and physiological characteristics of seafarers (Schroder-Hinrichs et al., 2012), and it could affect the seafarers' behaviors at work (Gemelos, Ventikos, 2008).

Nevertheless, it is noted that cruise ship accidents are not evenly distributed in the past 42 years with clusters in 1997, 2000, and 2011 (Table 4). In this case, The Philippines, Indonesia, and Japan demonstrate higher frequencies in serious cruise ship accidents, contributing to a total of 64.6% of all recorded cruise ship accidents. Among the rest, China and Malaysia contribute 14.6% and 6.3%, respectively. Other countries and regions, including Thailand, Hong Kong, Burma (Myanmar), and South Korea contribute a total of less than 5%.

Table 4 List of cruise ship accidents of the Asian region from 1972 to 2014

Year	Indonesia	Thailand	Philippines	Hong Kong	Burma	South Korea	Japan	China	Malaysia	**Total**	Year	Indonesia	Thailand	Philippines	Hong Kong	Burma	South Korea	Japan	China	Malaysia	**Total**
2014	1	0	0	0	0	0	0	0	0	**1**	1992	0	0	0	0	0	0	0	0	1	**1**
2013	0	1	1	0	0	0	0	0	0	**2**	1991	0	0	0	0	0	0	0	0	0	**0**
2012	1	0	1	1	1	0	0	0	0	**4**	1990	0	0	0	0	0	0	0	0	0	**0**
2011	1	0	1	0	0	1	2	0	0	**5**	1989	0	0	0	0	0	0	0	0	0	**0**
2010	0	0	0	0	0	0	0	0	0	**0**	1988	0	0	0	0	0	0	0	0	0	**0**
2009	0	0	0	0	0	0	0	0	0	**0**	1987	0	0	0	0	0	0	0	0	0	**0**
2008	0	0	0	0	0	0	0	0	0	**0**	1986	0	0	0	0	0	0	0	0	0	**0**
2007	0	0	0	0	0	0	0	0	0	**0**	1985	0	0	0	0	0	0	0	0	0	**0**
2006	0	0	0	0	1	0	0	0	0	**1**	1984	0	0	0	0	0	0	0	0	0	**0**
2005	0	0	0	0	0	0	0	1	0	**1**	1983	0	0	0	0	0	0	0	0	0	**0**
2004	0	0	0	0	0	0	0	0	0	**0**	1982	0	0	0	0	0	0	0	0	0	**0**
2003	1	0	0	0	0	0	1	2	0	**4**	1981	0	0	0	0	0	0	0	0	0	**0**
2002	2	0	1	0	0	0	2	0	0	**5**	1980	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	1	0	0	0	0	2	0	**3**	1979	0	0	0	0	0	0	0	0	0	**0**
2000	1	0	4	0	0	0	3	0	0	**8**	1978	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	**0**	1977	0	0	0	0	0	0	0	0	0	**0**
1998	1	0	1	0	0	0	1	1	0	**4**	1976	0	0	0	0	0	0	0	0	0	**0**
1997	2	0	1	0	1	0	1	1	2	**8**	1975	0	0	0	0	0	0	0	0	0	**0**
1996	0	0	0	0	0	0	0	0	0	**0**	1974	0	0	0	0	0	0	0	0	0	**0**
1995	0	0	0	0	0	0	0	0	0	**0**	1973	0	0	0	0	0	0	0	0	0	**0**
1994	0	0	0	0	0	0	0	0	0	**0**	1972	0	0	0	1	0	0	0	0	0	**1**
1993	0	0	0	0	0	0	0	0	0	**0**	**Total**	**10**	**1**	**11**	**2**	**3**	**1**	**10**	**7**	**3**	**48**

4.2 Case study – 2006 Star Princess

We discuss in detail the 2006 Star Princess as a representative cruise ship accident. Brief summary report of the event is generated from Marine Accident Investigation Branch (MAIB) (2006):

- On 23 March 2006, at 0309h, fire was detected at the Bermuda cruise ship Star Princess.
- The ship was on passage between Grand Cayman and Montego Bay, Jamaica, with 2690 passengers and 1123 crew on board.
- The fire began on an external stateroom balcony sited on deck 10 in the center of main vertical zone 3, on the vessel’s port side. It was caused by a discarded cigarette and heating combustible materials on a balcony, which smoldered for around 20 minutes before flames developed.
- The fire spread along adjacent balconies and assisted by a strong wind over the deck, it spread up to decks 11-12 and on stateroom balconies in fire zones 3 and 4 within 6 minutes.
- After further 24 minutes, it had spread to zone 5. The fire also spread into the staterooms as the heat of the fire shattered the glass in stateroom balcony doors, but was contained by each stateroom’s fixed fire-smothering system, the restricted combustibility of their contents, and their thermal boundaries.
- Large amounts of dense black smoke were generated from the combustible materials on the balconies, and the balcony partitions. This smoke entered the adjacent staterooms and alleyways, and hampered the evacuation of the passengers, particularly on deck 12.
- The captain immediately sounded the general emergency signal. Total of 7 short blasts were followed by 1 long blast on the ship's whistle (over the PA) and the ship's horn. All passengers were waked up over the ship.
- Passengers were stationed in muster stations, theatres, restaurants and other public areas for around 7 hours. Some passengers who needed regular medication required crew members to go into their suites and retrieve their medication.
- 13 passengers suffered from smoke inhalation and 1 passenger died from asphyxia secondary to inhalation of smoke and irrespirable gases.

The incident caused 6 fires on the balconies of cruise ships during which either beach towels or plastic chairs had caught alight. According to the UK’s Marine Accident Investigation Branch (MAIB) and the International Council of Cruise Lines (ICCL), the main issue was to allow the fire to spread quickly because: (1) balconies' polycarbonate partitions, polyurethane deck tiles, and the plastic furniture were highly combustible that created excessive very thick black smoke; (2) the strong wind over the deck and its direction; (3) the balconies crossed main zone fire boundaries both horizontally and vertically, and were without structural or thermal barriers at the zone or deck boundaries; (4) no fire detection or fire suppression systems were fitted on the balconies. Since the balconies were classified as 'open deck spaces', SOLAS II-2 has not covered any prevailing fire protection regulations (i.e., the use of non-combustible materials, smoke generation potential, toxicity of materials used) in external deck spaces. In response to Star Princess fire incident, the MSC approved draft amendments to SOLAS chapter II-2 aimed at ensuring that existing regulations 4.4 (Primary deck coverings), 5.3.1.2 (Ceilings and linings), 5.3.2 (Use of combustible materials), 6 (Smoke generation potential and toxicity) are also applied to cabin balconies on any new passenger ships. Also, the Sub-Committee on Fire Protection (FP) should review the fire safety of external areas on cruise ships and develop draft guidance for the approval of fixed water-spraying, fire detection, and fire alarm systems for cabin balconies.

6. Discussion and Conclusions

This paper critically reviews safety in cruise liners in Asia between 1972 and 2014. We identify some general trends of cruise ship accidents. 95.8% of cruise ship accidents were caused by human errors. To reduce similar errors, seafarers should be required to enhance their knowledge and work attitude towards cruise ship operations. By understanding these factors of cruise ship accidents, cruise liners operating in Asia should develop some more comprehensive safety measures. In this case, our findings offer the appropriate direction for future research and policymaking of the cruise industry in Asia.

Compared to ships dedicated for cargo transport, the design for cruise ships are more complex. In practice, cruise ships are floating hotels and sophisticated ship design leads to more complex maintenance (Lau et al., 2014; Mileski et al., 2014). On average, cruise ship typically carries over 4,000 passengers during any particular trips, thus making it very hard for crew members to look after cruise ship operations while simultaneously paying attention to every single passenger. Moreover, cruise ships face various operational challenges, such as quick port turnaround (less than one day) and timely service (Rodrigue, Notteboom, 2008). The stated challenges do not only exhaust crew members in terms of physical strength, but also contribute to the failure to conduct proper maintenance and check-ups. The long working hours with ill-health conditions, notably during peak seasons, are likely to increase human errors by crew members (Gemelos and Ventikos, 2008; Mileski et al., 2014).

Training could improve crew members in terms of knowledge and work attitude. Yet, cruise liners often face intense competition and are often forced to recruit less qualified (and lower cost) seafarers. Some cruise ship accidents were due to insufficient manpower in the driving area. Crews from some Asian countries have a general lack of education, safety awareness, sense of expertise, and legal resources in the implementation of the ISM Code (Tunidau, Thai, 2010). In some cases, cruise ship operations still rely on outdated shipping technologies without proper equipment (e.g., light, radar, night vision). Some crew members do not even receive complete training in every aspect of the job before commencement, nor conducting physical test regularly. It is thus not surprising that some crew members do not understand how maritime assets integrate their skills particularly during a crisis (Mileski, Honeycutt, 2013). From the perspective of cruise liners, safety plan implementation occupies lower priorities due to profit maximization and infrequent cruise disasters. Hence, they have not actively participated in pre-planning for prevention and post-disaster follow-ups (Mileski et al., 2014). Besides, crew members and passengers come from different countries and regions, facing barriers of language and culture that cause miscommunication and deviation from the instructions in a crisis (Mileski et al., 2014).

Since economic development, legal systems, and size are significantly different among different Asian countries and regions, each country or region adopts diversified maritime safety standards and rules regardless of the IMO requirements (Zhu, 2006). Some countries set up tight regulations to ensure compliance with the Convention and the documentation as a proof of compliance, whereas some simply establish loose regulations, inadequate safety control systems, and lower safety standards. Due to the favorable situation of lower standards in terms of capital inputs, some cruise liners tend to re-flag their vessels to circumvent regulations imposed by the lower-standard flag states (Batalden, Sydnes, 2014). These cruise ships have indeed posed the greatest likelihood of disaster when passing through key locations in Asia, such as South East Asia, particularly the Coral Triangle area (MSC, 2014). All these have highlighted the urgent need for further research on this area.

References:

1. Barnett, M.L. (2005), Searching for the root causes of maritime casualties – Individual competence or organizational culture?, *WMU Journal of Maritime Affairs,* Vol. 4, No. 2, pp. 131-145.
2. Batalden, B. M. and Sydnes, A.K. (2014), Maritime safety and the ISM code: a study of investigated casualties and incidents, *WMU Journal of Maritime Affairs,* Vol. 13, pp. 3-25.
3. Castillo-Manzano, J.I., Fageda, X. and Gonzalez-Laxe, F. (2014), An analysis of the determinants of cruise traffic: An empirical application to the Spanish port system, *Transportation Research Part E,* Vol. 66, pp. 115-125.
4. Ek, A., Runefors, M. and Borell, J. (2014), Relationships between safety culture aspects – a work process to enable interpretation, *Marine Policy,* Vol. 44, pp. 179-186.
5. Eleye-Datubo, A.G., Wall, A., Saajedi, A. and Wang, J. (2006), Enabling a powerful marine and offshore decision support solution through Bayesian Network Technique, *Risk Analysis,* Vol. 26, No. 3, pp. 695-721.
6. Gaonkar, R.S.P., Xie, M., Ng, M.M. and Habibullah, M.S. (2011), Subjective operational reliability assessment of maritime transportation system, *Expert Systems with Applications,* Vol. 38, No. 11, pp. 13835-13846.
7. Gemelos, I.C. and Ventikos, N.P. (2008), Safety in Greek coastal shipping: the role and risk of human factor revisited, *WMU Journal of Maritime Affairs,* Vol. 7, No. 1, pp. 31-49.
8. Gossard, H.W. (1995), Marine safety on board cruise ship, *World Cruise Industry Review,* London: Sterling Publication Ltd.
9. Johnson, D. (2002), Environmentally sustainable cruise tourism: a reality check, *Marine Policy,* Vol. 26, pp. 261-270.
10. Lau, Y.Y., Ducruet, C., Ng, A.K.Y. and Fu, X. (2017), Across the waves: A bibliometric analysis of container shipping research since the 1960s, *Maritime Policy & Management,* Vol. 44, No. 6, pp. 667-684.
11. Lau, Y.Y., Tam, K.C., Ng, A.K.Y. and Pallis, A.A. (2014), Cruise terminals site selection process: An institutional analysis of t*he Kai Tak Cruise Terminal in Hon*g Kong, *Research in Transportation Business & Management,* Vol. 13, pp. 16-23.
12. Lois, P., Wang, J., Wall, A. and Ruxton, T. (2004), Formal safety assessment of cruise ships, *Tourism Management,* Vol. 25, pp. 93-109.
13. Marine Accident Investigation Branch, *Report on the investigation of the fire onboard – Star Princess off Jamica,* 23 March 2006.
14. Maritime Safety Committee – MSC (2014), available at http://www.imo.org/MediaCentre/MeetingSummaries/MSC/Pages/Default.aspx, last accessed on 3 March 2015.
15. Mileski, J.P. and Honeycutt, J. (2013), Flexibility in maritime assets and pooling strategies: A viable response to disaster, *Marine Policy,* Vol. 40, pp. 111-116.
16. Mileski, J.P., Wang, G. and Beacham IV, L.L. (2014), Understanding the causes of recent cruise ship mishaps and disasters, *Research in Transportation Business & Management,* Vol. 13, pp. 65-70.
17. Montewka, J., Hinz, T., Kujala, P. and Matusiak, J. (2010), Probability modelling of vessel collisions, *Reliability Engineering & System Safety,* Vol. 95, No. 5, pp. 573-589.
18. Mukherjee, P.K. (2007), The ISM code and the ISPS code: a critical legal analysis of two SOLAS regimes, *WMU Journal of Maritime Affairs,* Vol. 6, No. 2, pp. 147-166.
19. Nwaoha, T.C., Yang, Z., Wang, J. and Bonsall, S. (2010), Application of genetic algorithm to risk-based maintenance operations of liquefied natural gas carrier systems, *Journal of Process Mechanical Engineering,* Vol. 225, No. E1, pp. 40-52.
20. Ocean Shipping Consultants (2012). *Forecast of Asian Cruise Travelers*
21. Pate-Cornell, M.E. (1990), Organizational aspects of engineering system safety: the case of offshore platforms, *Science,* Vol. 250, No. 4985, pp. 1210-1217.
22. Rodrigue, J.P. and Notteboom, T. (2008), The terminalization of supply chain, I*AME Conference Proceedings,* Dalin.
23. Schroder-Hinrichs, J.U., Hollnagel, E. and Baldauf, M. (2012), *WMU Journal of Maritime Affairs,* Vol. 11, pp. 151-167.
24. Schroder-Hinrichs, J.U., Hollnagel, E., Baldauf, M., Hofmann, S. and Kataria, A. (2013), Maritime human factors and IMO policy, *Maritime Policy & Management,* Vol. 40, No. 3, pp. 243-260.Stiehl, G.L. (1977), Prospects for shipping Liquefied Natural Gas, *Marine Technology,* Vol. 14, No. 4, pp. 351-378.
25. Tunidau, J. and Thai, V.V. (2010), Critical factors for successful implementation of the ISM Code in some Pacific Islands States, *WMU Journal of Maritime Affairs,* Vol. 9, No. 1, pp. 63-80.

26. Wang, J., Sii, H.S., Yang, J.B., Pillay, A., Yu, D. and Liu, J., Maistralis, E. and Saajedi, A. (2004), *Use of advances i*n technology for maritime ris*k* assessment, *Risk analysis,* Vol. 24, No. 4, pp. 1041-1063.
27. Wu, W.J. and Jeng, D.J.F. (2012), Safety management documentation models for the maritime labor convention 2006, *The Asian Journal of Shipping and Logistics,* Vol. 28, No. 1, pp. 41-66.
28. Tzannatos, E. and Kokotos, D. (2009), Analysis of accidents in Greek shipping during the pre-and post-ISM period, *Marine Policy,* Vol. 33, pp. 679-684.
29. Yang, Z.L., Bonsall, S. and Wang, J. (2009), Use of fuzzy evidential reasoning in maritime security assessment, *Risk Analysis,* Vol. 29, No. 1, pp. 95-120.
30. Yang, Z.L., Wang, J. and Li, K.X. (2013), Maritime safety analysis in retrospect, *Maritime Policy & Management*, Vol. 40, No. 3, pp. 261-277.
31. Zhu, J. (2006), Asia and IMO technical cooperation, *Ocean & Coastal Management,* Vol. 49, pp. 627-636.
32. Zohar, D. (2010), Thirty years of safety climate research: Reflections and future directions, *Accident Analysis and Prevention,* Vol. 42, pp. 1517-1522.