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Identification of Container Damage During Loading and Unloading on Full Geared Container Deck Vessels: USG Method

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Abstract: This study examines the factors that cause damage to containers during the loading and unloading process on full geared container deck ships with port destinations including Pasir Panjang Port (Singapore), Laem Chabang Port (Thailand), and Penang Port (Malaysia) and determines the priority problems that must be resolved immediately. This research uses mixed methods by combining quantitative and qualitative methods with an explanatory sequential design. The quantitative analysis used is the Urgency, Seriousness, and Growth (USG) method. Qualitative methods used observation, interviews, and documentation. The sample used is container damage on the MV. SS in the period August 2018 to August 2019. Causes of container damage during the loading and unloading process on the ship include the lack of supervision and concern of the crew for the security of containers during the loading and unloading process on the ship. From the results of USG method, it was found that container security activities were disrupted due to the duty crew participating in routine ship activities while at the port, even though the duty crew was fully responsible for reefer plug/unplug activities. Furthermore, there is no monitoring of the availability of loading and unloading equipment carried out by the crew so that the ship does not know the real number of lashing equipment on board.

Keywords: Damage, Containers, Maritime Transport, Handling

INTRODUCTION

Currently, transport technology is increasingly developing, to facilitate and accelerate the shipping process based on time and cost aspects (Bilican et al., 2024; Gattuso & Pellicanò, 2023). In sea transport, one of the tools used as a medium in shipping goods is containers (Setiawan et al., 2016). With the containerisation system, import or export activities are easier

to handle and become more efficient so that service users benefit from using this technology (Castrellon et al., 2023). The development of containers is increasing, this is because the use of containers has economic value in terms of cost, time, and place(Oktavia et al., 2020). Shipping cargo using containers is expected to deliver cargo from the loading port to the unloading port (Januarny & Harimurti, 2021). Then the capacity of the Port in loading containers needs to be considered for smooth loading and unloading, especially the utilisation of Port facilities (Mako et al., 2021). So, the loading and unloading process of ships is carried out safely and responsibly from both the port and the ship so that there is no damage to the cargo (Jiang et al., 2024). In addition, the concept of environmentally friendly and low emissions in the loading and unloading process at the container terminal needs to be considered for the implementation of IMO regulations in reducing emissions by 50% by 2050 in the maritime sector (Budiyanto et al., 2022).

Container security during the loading and unloading process is very important, to optimise the good condition of the container and no damage occurs (Kim et al., 2022). Therefore, the crew has a duty service responsibility to secure the container loading and unloading process. In the loading and unloading process, the containers to be loaded must also be in good condition before loading, because the ship is fully responsible when the container has been loaded and then sent to the destination port (Moros-Daza et al., 2024). Thus, crew members must have sufficient knowledge of containers as well as the loading and unloading process and their handling for the safety of containers on board (Alattas et al., n.d.; Priyadi et al., 2021)

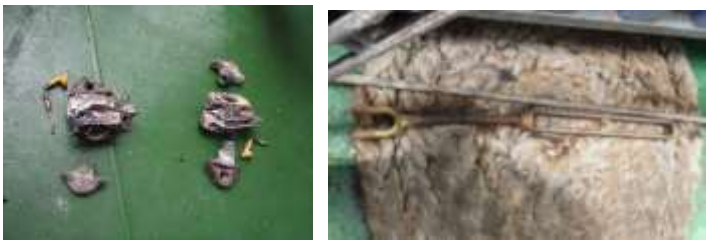
The occurrence of container damage during the loading and unloading process on the ship is due to operators in charge of the gantry and crane paying less attention to the unloading of containers from the ship or when loading containers onto the ship. Then, the crew did not carefully monitor the loading and unloading process which resulted in the container being damaged during loading and was not reported to the officer on duty. In addition, damaged containers will be held accountable at the destination port. The following is an example of container damage that occurs during the loading and unloading process.

Figure 1. Container damage
Source: Observation data

Furthermore, another component in container loading is lashing. Lashing is a method of binding goods / cargo for security so that the goods are in good condition and safe when they reach their destination, to avoid cargo above the hatch moving or falling overboard during the voyage, the cargo above the hatch needs to be lashed, so when the ship goes through a storm with high waves, the cargo remains in place and does not fall overboard. Thus, the arrangement of cargo at the port and the installation of lashing equipment are very important, to ensure the safety of the ship, crew, and container cargo until the destination port. In addition, container shipping must consider a dynamic trucking system equipped with the latest IoT technology (Jin et al., 2024).

Damage to containers in terms of lashing occurs due to the lashing equipment used being in poor condition, making it unable to hold and tie the container to the ship's body properly. Furthermore, when fully loaded, there is a high risk that the container will not be securely

fastened. In addition, container storage planning needs to be considered to minimise damage (van Twiller et al., 2024). The following presents a picture of the damage to the lashing device on the ship which caused delays in the unloading process.



(a) (b)

Figure 2. (a) Twistlock damage on a ship, (b) Damage to lashings on the ship
Source: Observation data

The purpose of this study is to determine the factors that cause damage to containers during the loading and unloading process on the ship and then handling.

METHOD

The research method used is mixed with an explanatory sequential design. The mixed method is a combination of quantitative and qualitative methods to produce in-depth answers to research questions (Indrawan & Jalilah, 2021). The stages carried out, first starting with quantitative research to obtain data analysis results, then continued with qualitative research to find more detailed explanations for these results. Quantitative methods emphasise measurement, while qualitative emphasise observation. This means that these two mechanisms are combined to produce strong, broad and deep conclusions and new findings. By integrating quantitative and qualitative data, additional information is obtained beyond the information obtained from quantitative or qualitative data alone. The stages of the research design are presented in the following figure.

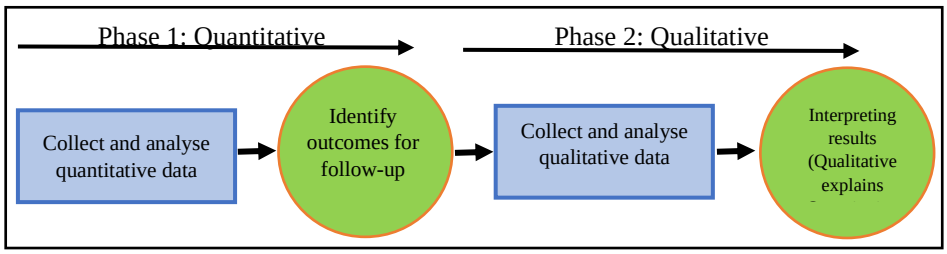


Figure 3. Research phases of exploratory sequential design

Then, the quantitative analysis used was to create a questionnaire based on the problems found and then analysed using the urgency, seriousness, and growth (USG) method. The respondents selected were all crew members on the MV. SS as many as 25 people. In the USG method, identification of the priority order of problems that must be resolved is carried out, by determining the level of urgency, seriousness, and growth of the issue by selecting a score from a value of 1 to 5 (Utari et al., 2020), as shown in the following table.

Table 1. Scoring using the USG method

U (Urgency)	S (Seriousness)	G (Growth)
1 : very Unurgent	1 : very not serious	1 : very undeveloped
2 : not urgent	2 : not serious	2 : not developing
3 : quite urgent	3 : quite serious	3 : quite developed
4 : urgent	4 : serious	4 : developing
5 : very urgent	5 : very serious	5 : very developed

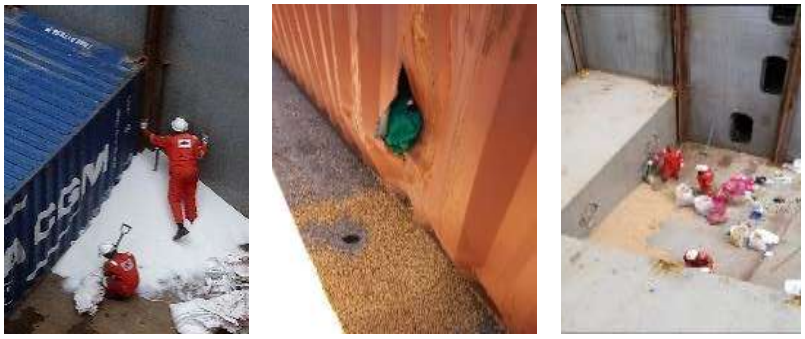
Furthermore, qualitative methods used to interpret the results of quantitative data include observation, interviews, and documentation. In this case, the researcher conducted observations on a full geared container deck ship named MV. SS with port destinations including Pasir Panjang Port (Singapore), Laem Chabang Port (Thailand), and Penang Port (Malaysia). The population of this study is container damage data on the ship, while the sample used is container damage on the MV. SS in the period August 2018 to August 2019.

RESULTS AND DISCUSSION

Data from the recapitulation of container damage on the MV. SS from August 2018 to August 2019 in 32 voyages obtained a total of 45 units of container damage. From the results of observations and interviews, the following data were obtained.

a. Voyage 503 South (Voyage route: Laem Chabang, Thailand - Singapore), Pasir Panjang Port, Singapore

On voyage 503 south there was damage to the container when loading was carried out in the hold of MV. SS, loading was carried out at Laem Chabang Port Thailand then there was a collision with the cell guide on the hatch so that the container wall was torn which caused the spill of cargo in the form of plastic beans in the hatch (Figure 4.a), this was due to the lack of expertise of the crane operator when loading the container so that the container did not occupy its proper place.



(a) (b) (c)

Figure 4. (a) Spillage of plastic seed granules on the container, (b) Spillage of soya seeds on the container, (c) Checking the damage to the container at MV. SS

Furthermore, the duty crew did not know about the incident because the duty crew on board the ship was carrying out other activities, including helping the chief cook and steward to lift the provision to be loaded onto the ship and the helmsman was plugging the reefer so that the duty officer guarded the gangway and carried out ISPS activities on board. Therefore, no one supervises the loading and unloading activities so that the damage to the container is not known by the ship, finally the container is still loaded and covered with other containers so that it cannot be seen and its condition is unknown. So, human resource development is needed to improve the competence and performance of crew members (Adam et al., 2021).

b. Voyage 550 North (Route Singapore - Penang, Malaysia), Penang Port Malaysia

On voyage 550 North the MV. SS was loading containers at Pasir Panjang Port, when loading in the hold of a container there was a collision and friction against other containers causing a large enough hole in the container that caused the container's cargo to come out and the cargo was soybean seeds (Figure 4.b), the officer on duty did not know about the incident because he was doing a reefer plug and monitoring the condition of the reefer container, then 2nd officer maintained ISPS to supervise visitors who came and keep the gangway in accordance with the land so that supervision on board was reduced and endangered the safety of containers on board.

When the ship arrived at Penang Port, the ship unloaded the containers in the hold and continued in the hold. During the unloading of the containers in the hold, it was discovered that there was a hole in the container and soybean seeds were released during lifting from the hold to shore.

c. Voyage 548 North (Route Singapore - Penang, Malaysia), Penang Port Malaysia

On voyage 548 North of the MV. SS sailed from Singapore to Malaysia, damage occurred to the lashing equipment which caused the unloading process to stop temporarily because of the twistlock on board the MV. SS, the twistlock is able to lock the container at the loading port but the twistlock cannot be reopened so the unlocking process on the twistlock requires special attention. The first way is to open with stick lashing so as not to damage the container and the twistlock, but this method is not effective to open the twistlock that has been locked and the next way is to cut the damaged twistlock (Figures 5.a and 5.b) so that the two stacked containers can be separated and of course the incident takes quite a long time because the ship must get permission from the port for the cutting of the fire-related twistlock which makes the unloading process temporarily stopped (Figure 5.c).

(a) (b) (c)

Figure 5. (a) Cutting the twistlock, (b) The cut twistlock, (c) The separation of the twistlock and the container

From the results of observations and interviews, the causes of container damage on the MV. SS which is presented in the following figure.

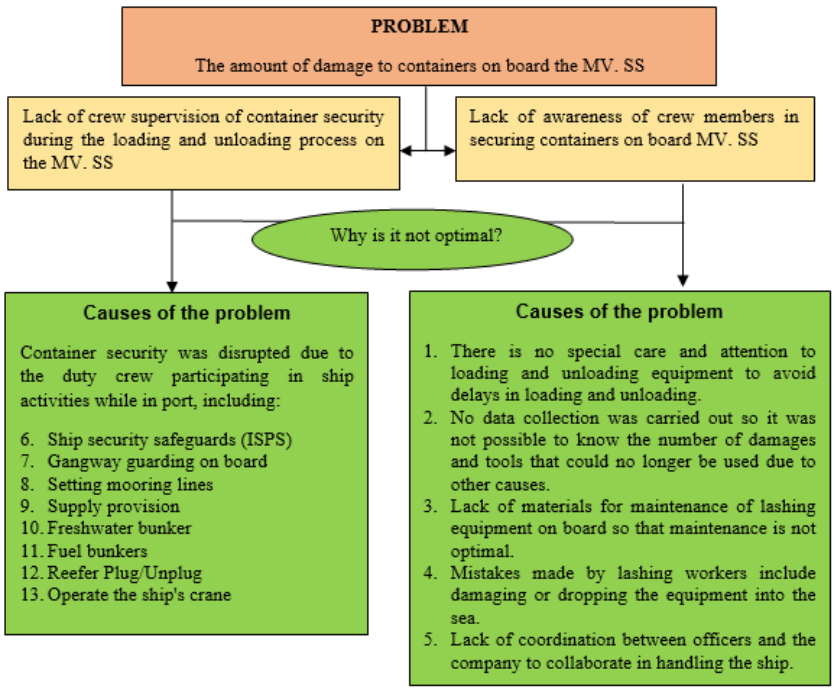


Figure 6. Identification of causes of problems based on observations and interviews

To determine the priority of the causes of container damage problems, a questionnaire was distributed based on Urgency, Seriousness, and Growth (USG) method. The results of the USG method analysis for the problem of lack of crew supervision of container security during the loading and unloading process on the MV. SS is presented in the following table.

Table 2. Priority identification of the problem of lack of crew supervision of container security during the loading and unloading process on the MV. SS

No	Statement	Criteria			Total	Ranking
		Urgency	Seriousness	Growth		
1	The crew did not optimally supervise the loading and unloading process because they were implementing the International Ship and Port Security Code (ISPS Code) on board and serving visitors on board.	48	35	32	115	VI
2	The duty crew must manage the ship's gangway during the loading and unloading process due to the changing tides and mass of the ship, thus reducing attention to the loading and unloading process on board.	43	32	29	104	VIII
3	The watch crew adjust the mooring lines of the ship, this is done periodically during the watch so that the ship's position remains upright and tight, thus facilitating the loading and unloading process on board, but this makes the loading and unloading supervision not optimal.	40	35	34	109	VII
4	The duty crew participates in the process of transporting the provision to the ship so that the supervision of the loading and unloading process must be abandoned, until the entire cargo provision is on board the ship.	54	40	34	128	IV
5	The duty crew is fully responsible for the freshwater bunker activities.	57	45	33	135	III
6	The duty crew participates in the fuel bunker process on board the ship with a predetermined task, 2 duty crew are needed to dock the tanker, so the number of duty crew carrying out supervision is 1 crew.	58	47	39	144	II
7	The duty crew is fully responsible for reefer plug/unplug activities.	60	49	55	164	I
8	The duty crew must also be able to operate the ship's crane, so they are unable to supervise optimally.	55	41	28	124	V

From the results of data analysis using the USG method, the priority ranking of problem-solving ranging from rank I to VIII was obtained. Furthermore, interviews were conducted

regarding the problem of lack of crew supervision of container security during the loading and unloading process on the MV. SS to the respondents, the following solutions were obtained:

1) Co-operate with the engine department to plug/unplug reefer containers on board and exclude the duty crew from the bunker process with the record being replaced by bosun and mate.
2) Bosuns and mates assist the duty crew in freshwater bunker activities and during provisioning.
3) 1st officer changed the work responsibilities of the crew members who did not participate in the watch service to participate in the watch in order to increase the number of watch crew members in accordance with the loading and unloading process.
4) The captain made a request for additional crew members to secure containers in the loading and unloading process.

Then for the results of the USG method analysis for the problem of the lack of crew handling of securing containers on board is presented in the following table.

Table 3. Identification of priority problems of lack of crew handling of container security on MV. SS

No	Statement	Criteria			Total	Ranking
		Urgency	Seriousness	Growth		
1	Lack of maintenance of lashing equipment resulting in damage to lashing tools.	42	46	56	144	II
2	There is no monitoring of the availability of loading and unloading equipment carried out by the crew so that the ship does not know the real number of lashing tools on board.	41	55	60	156	I
3	Lack of materials used to maintain the lashing equipment on the ship, so lashing maintenance was stopped.	38	44	43	125	IV
4	The negligence of lashing labourers working on board ships, so that lashings can be damaged, left at the Port and fall into the sea or holes that cannot be reached, even colliding with containers that are being loaded.	33	38	45	116	V
5	The company's lack of role in assisting the first mate in monitoring the quality and quantity of the ship's inventory including the lashing equipment and no supplies from the company.	33	51	48	132	III

From the results of data analysis using the USG method, the priority ranking of problem-solving ranging from rank I to V was obtained. Furthermore, interviews were conducted related to the problem of the lack of crew handling of container security on the ship obtained solutions, including:

1) Carry out periodic maintenance on lashing equipment to avoid delays in the loading and unloading process.
2) Carry out data collection of lashing equipment properly and correctly to find out the conditions of each lashing equipment.

3) The captain made a request for materials for the maintenance of lashing equipment by submitting evidence of material shortages on board the ship.
4) Appeal to lashing workers on the use of lashing equipment on board.
5) Create a good relationship between the ship's crew and the company to carry out cooperative handling on board.

CONCLUSION

From the results of the research, it was found that the causes of container damage during the loading and unloading process on the MV. SS, including the lack of supervision and crew's concern for securing containers during the loading and unloading process on the ship. Furthermore, the factors causing the lack of crew supervision of container security are that container security activities are disrupted due to the duty crew participating in ship activities while at the port, even though the duty crew is fully responsible for reefer plug / unplug activities. Then, the factors of the crew's lack of concern for container security on the MV. SS, namely no special care and attention to loading and unloading equipment so that there is no delay in loading and unloading, no data collection is carried out so that it cannot find out the amount of damage and tools that cannot be used due to other causes, lack of materials for the maintenance of lashing equipment on the ship so that maintenance is not optimal, mistakes made by lashing workers, namely damaging or dropping equipment into the sea, and lack of coordination of officers with the company to collaborate in handling on the ship.

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