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Analysis of Delay Prevention Efforts in the Loading Process on MV Xin Lin Hai 16

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ABSTRACT

Cargo holds must be clean and fit to receive cargo before loading, so delays in their preparation can disrupt the loading schedule and reduce a vessel's operational efficiency. This study aims to identify the causes of loading delays related to cargo hold preparation and to formulate measures to prevent them. The object of the study is the cargo hold preparation process on board MV Xin Lin Hai 16. A qualitative descriptive method was used. Data were collected through direct observation, interviews with the crew, and a literature review on loading delays caused by insufficient supervision by the chief officer, bosun, and helmsman. The results show that problems in the cargo hold cleaning process were caused by poor communication and coordination between the crew and workers. Another cause was that the cargo hold cleaning equipment was not maintained according to procedure. These conditions slowed the cleaning process, so the holds were not ready on time and loading was delayed. The study concludes that supervision, coordination, and communication between the crew and workers should be improved. Cleaning equipment should also be maintained routinely according to procedure so that cargo hold preparation is completed on schedule. These findings are expected to help officers and crew plan cargo hold preparation more effectively.

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1. INTRODUCTION

Indonesia is widely recognized as one of the largest archipelagic countries in the world, consisting of thousands of islands connected primarily by maritime transportation routes. In such geographical conditions, sea transportation plays a fundamental role in supporting economic activities, logistics distribution, and inter-island connectivity. Compared with land and air transportation, maritime transport offers advantages in terms of carrying capacity, operational efficiency, and cost effectiveness, particularly for large volumes of cargo (Muis et al., 2024; Rubiyanto & Wahyuni, 2022).

The increasing demand for global trade has intensified the role of maritime shipping in ensuring the smooth movement of goods between ports. In maritime operations, the loading and unloading process is a critical stage that significantly affects the efficiency of ship operations and port performance (Dewanto & Rumita, 2022). Any disruption or delay in cargo

handling activities may lead to operational inefficiencies, increased turnaround time, and financial losses for shipping companies, charterers, and port operators (Sihombing et al., 2025; Widyawati & Hinriyani, 2020). Therefore, maintaining the efficiency and reliability of loading operations is essential to ensure optimal vessel utilization and to minimize operational costs.

One of the key operational aspects that influences the smoothness of the loading process is the proper preparation of cargo holds. Before new cargo is loaded, the cargo hold must be thoroughly cleaned and inspected to ensure that it meets safety and cleanliness standards (Kismantoro, 2020; Lestari et al., 2021). This is particularly important when the vessel carries different types of cargo in consecutive voyages. Residues from previous cargoes, especially chemical or bulk materials, may contaminate the next cargo, potentially causing cargo damage, quality degradation, or rejection by the cargo receiver (Widodo et al., 2023). For this reason, international requirements for the carriage of solid bulk cargoes call for cargo holds to be properly prepared, and their readiness is verified through inspections conducted by surveyors prior to loading activities (International Maritime Organization, 2020; Rahman et al., 2026).

However, in practice, the preparation of cargo holds often encounters several operational challenges, such as inadequate supervision, lack of coordination among crew members, limited maintenance of cleaning equipment, and time constraints during port operations (Djaelani, 2026; Nugraha et al., 2026; Rochman et al., 2021). These factors may result in incomplete cleaning processes, which can lead to inspection failures and ultimately cause delays in the loading schedule (Saputra et al., 2026). Such delays not only disrupt the operational planning of the vessel but may also generate additional costs for shipping companies.

Previous studies have discussed the importance of cargo handling management, cargo documentation, and operational efficiency in maritime transportation (Alfi & Vega, 2020; Dasira et al., 2022; Purwantono, 2021; Rosihin et al., 2021). However, limited research has specifically examined operational delays caused by inadequate cargo hold preparation on bulk carrier vessels when the hold must be changed over from a chemically active cargo, such as bulk fertilizer, to a contamination-sensitive cargo, such as steel coils. Understanding these operational constraints is important to identify effective preventive measures that can improve shipboard operational performance.

Based on these considerations, this study aims to analyze the factors that cause delays in the loading process on board MV Xin Lin Hai 16, particularly those related to the preparation of cargo holds after unloading bulk fertilizer cargo. Furthermore, this study seeks to identify preventive efforts that can be implemented to improve coordination, supervision, and maintenance practices in order to minimize delays during loading operations.

2. METHODS

2.1. Research Design

This research applies a qualitative descriptive approach. According to Roosinda et al. (2021), qualitative research is based on complex data and diverse reference sources from various points of view, so that it is able to generate arguments from different perspectives that produce conclusions in observing social phenomena or a particular environment.

A case study approach was adopted, with a single loading operation on one vessel as the unit of analysis, so that the sequence of events and the factors contributing to the delay could be examined in their actual operational context.

2.2. Research Setting and Time

The research was conducted on board MV Xin Lin Hai 16 during the voyage from the unloading port of Zhenjiang to the loading port of Shanghai, China, in June 2024. The period of observation covered the unloading of bulk fertilizer at Zhenjiang, the cleaning of the cargo holds during the passage, and the surveyor's inspection before the loading of steel coils in Shanghai.

2.3. Informants

Informants were selected purposively from the crew members directly involved in cargo hold preparation, namely the chief officer, who is responsible for planning and supervising cargo hold preparation, the bosun, who leads the deck crew during cleaning work, and the helmsmen, who carried out the cleaning of the holds.

2.4. Data Collection

Data were collected through three techniques. First, direct observation was made of the cargo hold preparation process, covering the cleaning steps, the equipment used, the condition of the holds, and the coordination between the crew and the workers involved. Second, interviews were conducted with the chief officer, bosun, and helmsmen regarding the obstacles encountered and the causes of the delay. Third, a literature study was carried out on cargo hold preparation, cargo hold inspection, and loading delays.

2.5. Data Analysis

The data were analyzed descriptively by comparing the observed practices with the applicable procedures and the relevant literature. Information obtained from observation and interviews was cross-checked to identify consistent explanations of the delay. The causes were then grouped into human, equipment, method, material, and environmental factors and

summarized in a cause-and-effect diagram, from which the preventive measures were formulated.

3. RESULTS AND DISCUSSION

3.1. Research Results

The ship arrived at the unloading port of Zhenjiang, China, on June 5, 2024 and immediately began unloading its bulk fertilizer cargo after berthing. During the unloading process, the ship's management and the charterer contacted the master to ensure that, once unloading was completed, the emptied cargo holds would be cleaned immediately without using the bilge pump to dispose of the remaining bulk fertilizer mixed with water, and recommended the use of a submersible pump instead. Cleaning of a cargo hold after bulk fertilizer consists of several steps, starting with sweeping. In this phase, the remnants of the bulk fertilizer in the cargo hold are collected at the center of the hold, after which they are removed using the unloading equipment so that the hold can be cleaned effectively.

By June 9, 2024, the ship had completed the unloading process, and the shore workers completed spraying the holds at 19:00 local time. The ship then sailed to Shanghai, China, to load steel coil cargo. Because the passage to the loading port took only 15 hours, the crew had to continue cleaning the cargo holds during the voyage. The crew went down into the holds and installed a submersible pump to drain the water mixed with the remaining bulk fertilizer cargo. When disposing of the remaining cargo, it was found that the residual bulk fertilizer had hardened as a result of mixing with water.

Table 1. Chronology of cargo hold preparation on MV Xin Lin Hai 16

Time	Location	Activity
5 June 2024	Zhenjiang	Arrival and start of bulk fertilizer unloading; management and charterer instruct that the holds be cleaned immediately after unloading using a submersible pump instead of the bilge pump
During unloading	Zhenjiang	Sweeping: fertilizer remnants collected at the center of each hold and removed with the unloading equipment
9 June 2024, 19:00	Zhenjiang	Unloading completed and holds sprayed by shore workers; departure for Shanghai
Passage (about 15 hours)	Zhenjiang–Shanghai	Crew install a submersible pump to drain water mixed with residues; residual fertilizer found to have hardened
Arrival	Shanghai	Surveyor's inspection obstructed by hardened residues remaining on the hold floor and gutters
Before loading	Shanghai	Additional cleaning by scraping, brushing, and sweeping, carried out from morning to evening
After additional cleaning	Shanghai	Re-inspection; surveyor issues a certificate that the holds are ready; loading of steel coils begins

Table 1 shows that the time available between the completion of unloading and the arrival at the loading port was very limited, while the most time-consuming task, namely the removal of hardened residues, became apparent only after the vessel had left Zhenjiang. Because the holds had been sprayed with water before departure, the remaining fertilizer that had not been swept out mixed with the water and hardened, making it considerably more difficult to remove during the short passage.

The next cargo to be loaded was steel coil, which must not come into contact with the residues of the previous cargo. Bulk fertilizers, especially chemical fertilizers, can leave powder residues, moisture, and active chemical elements that stick to the surface of the hatch or the floor of the cargo hold. If the hold is not thoroughly cleaned before the steel is loaded, these residues may cause corrosion or rust on the steel surface. This not only degrades the quality of the steel but can also cause considerable losses to the receiver. Therefore, before loading iron and steel, it is very important to ensure that the cargo hold has been cleaned and declared free of bulk fertilizer residues. This procedure is part of the operational standards for maintaining safety, the quality of goods, and a smooth distribution process (International Maritime Organization, 2020; Widodo et al., 2023).

Finally, the floor and gutter surfaces were cleaned by scraping, brushing, and sweeping until they were free of dirt. However, this process took a long time because it was carried out only from morning to evening. After completion, the surveyor was invited back to inspect the

cargo holds. At the re-inspection, especially of the floor and gutters, the surveyor issued a certificate stating that the holds were ready for loading. Nevertheless, problems arose from poor coordination within the team in preparing the cargo holds: hardened cargo residues remained that should have been cleaned properly earlier. This situation created obstacles during the surveyor's inspection and delayed the loading process. The delay was detrimental to the company, as time that could have been allocated to other activities was spent on additional cleaning that could have been prevented through more careful preparation in advance. Similar cases of holds failing the surveyor's inspection because of residues and incomplete washing have been reported on other bulk carriers (Rahman et al., 2026; Saputra et al., 2026).

The causes of the delay identified from the observations and interviews are summarized in Figure 1. The human factors include insufficient supervision by the chief officer, bosun, and helmsmen, poor communication and coordination between the crew and the workers, limited skills in operating the cleaning equipment, and individualism within the team. The equipment factor concerns cleaning equipment that was not maintained according to procedure. The method factors relate to the requirement to drain the holds with a submersible pump rather than the bilge pump, cleaning that was not completed before departure, and additional cleaning that was carried out only from morning to evening. The material factor is the hardening of fertilizer residues after mixing with water, while the environmental factors are the short passage of about 15 hours and the sensitivity of the next cargo, steel coil, to residues of the previous cargo.

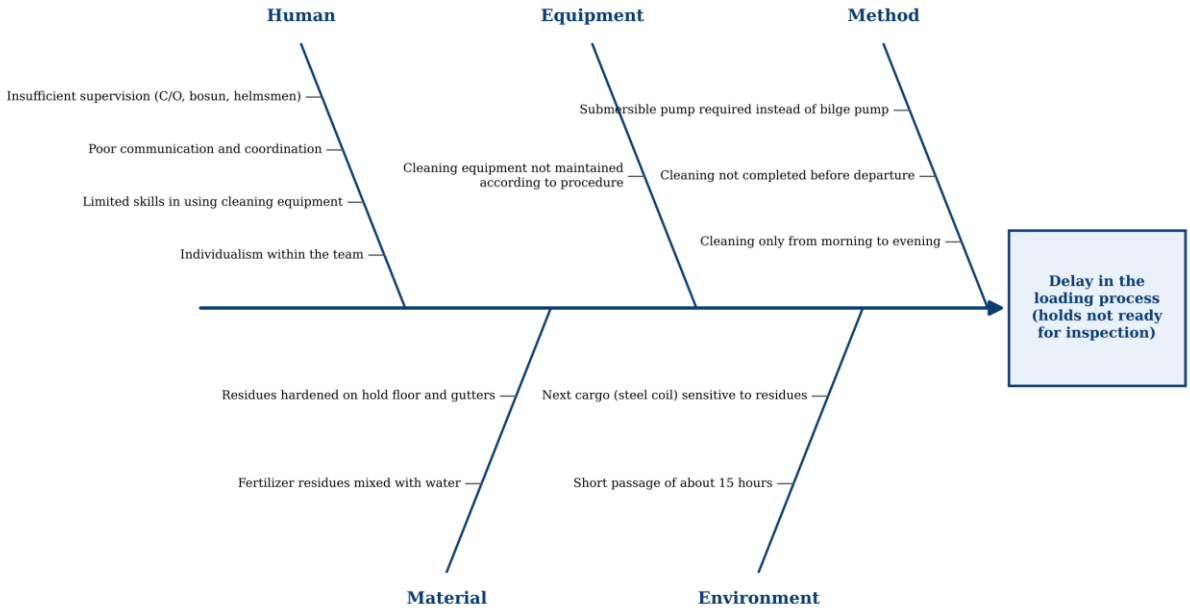


Figure 1. Cause-and-effect diagram of the loading delay on MV Xin Lin Hai 16

Figure 1 indicates that the delay did not result from a single cause but from the interaction of several factors. The short passage time and the hardening of the residues reduced the margin available for cleaning, while weaknesses in supervision, coordination, and equipment readiness meant that this margin was not used effectively. Most of these factors are organizational rather than technical and can therefore be addressed through better planning and management on board.

3.2. Discussion

To improve the efficiency and smoothness of the unloading and hold preparation process, especially after bulk fertilizer cargo, it is very important to improve the skills, capabilities, and knowledge of the crew in using and operating the equipment used to clean the cargo holds. Awareness of the importance of caring for the cleaning equipment also needs to be instilled as a preventive measure against damage to the equipment and to support a smooth work process. No less important, efforts are needed to build awareness of the importance of teamwork and to reduce individualism among the crew. These findings are in line with studies that identify limited crew knowledge and skills, insufficient manpower, and coordination gaps as the main obstacles to cargo hold preparation (Nugraha et al., 2026; Rochman et al., 2021).

The cleaning equipment must be maintained regularly to preserve its performance and reliability during work on board. The steps that need to be taken include the application of lubricant (grease) and periodic maintenance of each part of the equipment. In addition, a thorough inspection must be carried out to ensure that all cleaning tools are in good condition and ready for use. If damage is found, repairs must be made immediately before the damage becomes more severe and disrupts operations, and replacement parts should be fitted as soon as possible when the hatch cleaning equipment is not working as it should. Planned and preventive maintenance has been shown to improve the reliability of shipboard equipment (Karatuğ et al., 2023), and poor upkeep of cleaning equipment has been identified as a cause of incomplete cleaning and loading delays in comparable cases (Djaelani, 2026; Wantoro & Bagaskoro, 2021).

The efforts to overcome delays therefore include the selection of competent crew members, the use of experienced stevedoring services, the optimal use of equipment, and the proper handling of residual cargo. Supervision by the chief officer during the cleaning process and a briefing before the work begins help to ensure that each crew member understands the tasks and the required standard of cleanliness (Lestari et al., 2021; Rochman et al., 2021).

Table 2. Causes of the loading delay and corresponding preventive measures

Factor	Cause identified	Preventive measure
Human (supervision)	Insufficient supervision by the chief officer, bosun, and helmsmen	Supervision by the chief officer during cleaning; briefing on tasks and the required standard of cleanliness before work begins
Human (coordination)	Poor communication and coordination between the crew and the workers	Familiarization and briefing on the duties, responsibilities, and roles of each crew member; building teamwork
Human (competence)	Limited skills in operating the cleaning equipment	Training in the use and operation of cleaning equipment; selection of competent crew members
Equipment	Cleaning equipment not maintained according to procedure	Planned maintenance, lubrication, and inspection; prompt repair or replacement of damaged parts
Method and material	Residues left until the passage and hardened after mixing with water	Begin cleaning as soon as the holds are emptied; proper handling of residual cargo; use of experienced stevedoring services
Environment	Short passage of about 15 hours before loading	Plan the cleaning so that the holds are ready for inspection before arrival at the loading port

Table 2 links each cause of the delay to a corresponding preventive measure. The measures related to supervision, coordination, and planning can be applied immediately by the ship's officers, whereas the measures related to equipment maintenance and crew competence require continuous support from the company through the planned maintenance system and training programs. Applying these measures together is expected to ensure that cargo hold cleaning is started earlier, carried out more effectively, and completed before the vessel arrives at the loading port.

To address the lack of discipline of the crew in using work safety equipment, the first step is to provide familiarization, briefing, and direction to all crew members regarding the duties, responsibilities, and roles of each individual. The company also needs to supplement the work safety equipment on board, because most of the available equipment is still incomplete and does not yet fully meet the standards of ship safety regulations. Motivation for work safety among the crew can be provided through toolbox meetings and safety posters, in line with the importance of crew competence in the implementation of work safety (Gumelar et al., 2021).

This study has several limitations. The findings are based on a single loading operation on one vessel and on qualitative data from observation and interviews, and the duration of the delay and the cost incurred were not quantified. The results should therefore be understood as

a case-based explanation of the delay rather than a generalization to all bulk carriers. Nevertheless, the pattern of causes is consistent with other cases of cargo hold preparation on bulk carriers (Nugraha et al., 2026; Rahman et al., 2026; Saputra et al., 2026), suggesting that the preventive measures proposed here are relevant to vessels that must change over from chemically active bulk cargo to contamination-sensitive cargo within a short time.

4. CONCLUSION

Based on the results and discussion, it can be concluded that the delay in the loading process on MV Xin Lin Hai 16 was caused by the incomplete preparation of the cargo holds after the unloading of bulk fertilizer. Hardened fertilizer residues remained in the holds because of a lack of supervision by the chief officer, bosun, and helmsmen, poor communication and coordination within the crew, inadequate maintenance of the cargo hold cleaning equipment, and the short passage time between the unloading and loading ports. As a result, additional cleaning was required before the surveyor declared the holds ready for the steel coil cargo.

To prevent similar delays, the supervision, coordination, and communication between the ship's crew and the workers involved should be improved, the crew's skills in operating the cleaning equipment should be strengthened, and routine, planned maintenance should be carried out on the cargo hold cleaning equipment. Cleaning should begin as soon as the cargo holds are emptied and follow the established procedures so that the holds are ready for inspection before arrival at the loading port.

5. DECLARATIONS

Author contributions: M.: Conceptualization, Methodology, Supervision, Writing – review & editing; S.H.W.: Investigation, Data curation, Writing – original draft; A.F.: Formal analysis, Validation, Writing – review & editing. All authors have read and approved the final manuscript.

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