Analysis of Crew Readiness for Anchoring on the KMP Trisna Dwitya

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Abstract.
The crew's readiness to anchor on the KMP Trisna Dwitya is still lacking, which has the potential to affect navigation safety. This study aims to identify the crew's readiness to anchor and identify factors that influence the implementation of anchoring maneuvers on the KMP Trisna Dwitya ship. The research method used is descriptive qualitative with primary and secondary data sources. Data collection techniques were carried out through observation, direct interviews with the captain, chief officer, second officer, helmsman, boatswain, and documentation, while data analysis used the fishbone method to regularly identify causal factors. The results show that in general the implementation of anchor on the KMP Trisna Dwitya has run well and according to procedures, starting from the selection of the anchoring site to the adequate anchoring process. Most of the navigation tools functioned well such as Radar, GPS, ECDIS, Echo Sounder, but were hampered by the windlass which was jammed and the anemometer was not working, the bridge-bow communication was less effective when using a handy talky, as well as strong currents and dense traffic in the Bali Strait which affected the maneuvering process. In conclusion, the ship's crew is ready to carry out the anchoring maneuvering process but needs to carry out routine equipment maintenance, briefing before the anchoring process, and procurement of anemometer navigation tools to reduce the risk of accidents and improve safety.
Keywords: *Ship's Crew, Procedures, Anchoring Maneuvers, KMP. Trisna Dwitya and Fishbone Analysis.*

I. INTRODUCTION

Navigation safety is a crucial element in maritime transportation because ships operate in dynamic, high-risk environments, influenced by the ship's technical condition and the crew's readiness during maneuvers such as anchoring in confined waters or unstable weather. The anchoring process is often seen as a routine activity and therefore receives little attention, even though errors can lead to anchor dragging, collisions, or stranding, resulting in material losses and threats to the ship's crew, cargo, and the surrounding marine environment.

One of the busiest sea transportation routes in Indonesia is the Bali Strait crossing, which connects Ketapang Port in East Java with Gilimanuk Port in Bali. This is crucial for passenger, logistics, and vehicle transportation between the islands of Java and Bali. Due to the high volume of ferry traffic operating throughout the day, it is crucial to maximize shipping safety, especially for ship maneuvers such as docking, undocking, and anchoring in port and anchorage areas. This phenomenon is evident on busy traffic routes such as Ketapang-Gilimanuk in the Bali Strait, where the KMP Trisna Dwitya, a Ro-Ro ship dating back to 1975, faces challenges such as strong currents, rapid tides, and traffic congestion.

Problems arise from crew readiness, which includes physical, mental, knowledge, skills, and procedural understanding, where fatigue, poor communication, and errors in selecting the location or length of the anchor chain often trigger incidents. The KNKT findings indicate that human factors dominate anchoring accidents, such as lack of planning, bridge-bow cooperation, and discipline supervision, especially on ships such as KMP Trisna Dwitya which operates intensively in the Bali Strait with narrow and current water conditions. In addition, IMO regulations such as SOLAS Chapter V Reg. 34-34-1 emphasize the master's responsibility for personnel readiness, while STCW A-II/1-2 and ISM Code Section 6-7 require training, SOPs, and briefings to reduce risks.

The problem was further complicated by the lack of team synergy, as stipulated in IMO Resolution A.960(23), which requires effective communication during maneuvers, plus COLREG Rule 5 on constant observation to avoid collisions while anchoring. On KMP Trisna Dwitya, specific challenges such as circling currents and rapid tides made maneuvering difficult, reducing crew effectiveness despite the implementation of SOPs.

This study aims to identify the readiness of the KMP Trisna Dwitya crew in carrying out anchoring maneuvers and identify factors that influence anchoring maneuvers. The urgency lies in reducing incidents on the busy Bali Strait route, supporting safety according to IMO and KNKT regulations, while the novelty of this study provides a specific empirical contribution to older Ro-Ro vessels in dynamic Indonesian waters, complementing previous, more general studies by Pratiwi & Santoso (2021) or Nugroho et al. (2022).

II. METHOD

Types and Methods of Research

This study uses a qualitative descriptive research type to reveal the readiness of the KMP Trisna Dwitya ship crew in carrying out anchoring maneuvers in depth in the operational context of the Ketapang-Gilimanuk route, as defined by Mukhtar (2013) as a way of describing phenomena at a certain time through verbal descriptive data and behavioral observations. This method is suitable for analyzing factors that influence anchoring maneuvers, because it allows contextual analysis without statistical generalization.

Data Collection Instruments and Techniques

The main instruments include observation, interviews, and documentation for data sources consisting of primary data obtained through observation and interviews, while secondary data were obtained through documentation reports. Collection techniques include direct observation of anchoring activities to observe physical-mental readiness, coordination and events directly. Interviews were conducted verbally with the captain, chief officer, second officer, helmsman, and boatswain to explore perceptions of factors affecting anchoring maneuvers. Documentation in the form of photographs of the anchoring process completes the data for field validation.

Population and Sample

The research population was all officers and crew members of the KMP Trisna Dwitya owned by PT Lintas Sarana Nusantara, with a focus on the deck crew involved in anchoring maneuvers. The purposive sample included five key informants, including the captain, first officer, second officer, helmsman, and boatswain, selected based on their competence and direct experience, in accordance with the principle of purposive sampling in maritime qualitative research for data saturation.

Research Procedures

The research was conducted for 12 months (July 26, 2024-July 26, 2025) during sea practice on KMP Trisna Dwitya, starting with initial observations of daily operations, followed by in-depth interviews, and documentation in the form of photographs. Data were analyzed using a fishbone diagram based on Manpower, Machines, Methods, Materials, Environment to identify the readiness of the ship's crew in carrying out anchoring maneuvers and the factors that influence anchoring maneuvers by steps: determining the problem, categorizing factors, tracing causes, and providing solutions. Validation through source triangulation and member checks ensured credibility, resulting in recommendations in accordance with IMO SOPs to improve safety from Pratiwi & Santoso (2021) or Wiradi (2023).

III. RESULTS AND DISCUSSION

Data Presentation

The data presented here is based on observations, interviews, and documentation obtained on board the KMP Trisna Dwitya. This analysis focuses on anchoring maneuvers.

1. Observation Results

Observations of the anchoring maneuver process were conducted through direct visual observation by the author during the maneuvering activity until the anchor was lowered and secured. Observations focused on the readiness of navigational equipment on the bridge such as ECDIS, Radar, GPS, Echo Sounder, anchoring equipment on the deck such as Anemometer and Windlass, as well as coordination between the bridge and the bow when using a walkie talkie. In general, most navigational equipment and anchoring equipment functioned well and could still be used to support the smooth anchoring process.

During the anchoring maneuver, several obstacles directly affected the smoothness, effectiveness, and safety of the operation. The first obstacle encountered was the suboptimal condition of the windlass. During initial operation, the windlass movement was not smooth and tended to stutter. When the anchor was about to be lowered, the anchor chain came out unstably and even jammed. After further observation, it was discovered that the lack of routine maintenance was the main factor causing the problem, particularly in the lubrication system (greasing) of the gears, bearings, and drive shafts. The lack of lubrication caused excessive friction on the mechanical components, resulting in harsh sounds, jerks at the start of rotation, and increased the risk of premature wear. This condition not only slowed the anchor lowering process but also potentially endangered the safety of the deck crew if there was a sudden increase in load on the anchor chain.

The second obstacle was the malfunctioning anemometer on the ship's bridge. This instrument should provide real-time wind speed and direction information to assist the captain in determining approach strategies to the anchorage point. However, during observations, the anemometer did not provide accurate data, or even gave no readings at all. As a result, the officer on watch and the captain relied solely on visual observations of sea surface conditions and personal experience to estimate the effect of wind on the ship's motion. This lack of quantitative data increased uncertainty in drift calculations, making determining the ship's heading before dropping anchor less precise. In maneuvering conditions requiring high precision such as anchoring, inaccurate wind information could cause the ship to drift off course or require repeated engine corrections.

The third obstacle stems from environmental factors, namely strong currents in the Bali Strait. As the approach to the anchorage point approaches, the surface current is observed to be quite strong and unstable in direction. This current causes the ship to shift, making it difficult to maintain its bow facing the current. This condition requires more intensive coordination between the bridge and the engine room because engine power corrections must be made continuously to maintain a minimum speed and maintain the ship's position. The strong current also makes it difficult to determine the right moment to drop the anchor, because if the timing is inaccurate, the ship can overshoot the anchor point or fall too far from the planned position. Furthermore, the pressure of the current on the ship's hull after the anchor is lowered has the potential to increase the risk of anchor dragging if the length of the chain released is not appropriate for the water conditions.

Based on the observation results, it can be concluded that the anchoring maneuvering process has not been running optimally because it is influenced by three main obstacles, namely the windlass that is not functioning properly due to lack of maintenance and lubrication, the anemometer not functioning so that wind data cannot be used as a reference in maneuvering, and the strong currents of the Bali Strait that make it difficult for the ship to maintain position during anchoring. These three factors increase the level of difficulty and risk in anchoring so that better equipment maintenance is needed, routine checking of navigation equipment and anchoring equipment, and maximum coordination between ship crews.

After conducting several observations, the researcher successfully obtained and collected data that will be used as research material. The data and observation results obtained by the researcher will be attached as follows:

2. Interview Results

On this occasion, the information observed by the researcher was obtained from interviews with the Captain, Chief Officer, Second Officer, Helmsman, and Boatswain. The following interviews were conducted during the researcher's sea practice on KMP Trisna Dwitya. The interviews discussed the ship's crew's readiness for anchoring maneuvers and the factors influencing the anchoring process. The following are the interview results:

A. Information Results from Source 1 (Captain)

Based on information provided by the captain, the anchoring maneuver was generally carried out according to procedure, but there were still shortcomings in terms of crew readiness and coordination. The captain stated that some crew members were not fully focused on communication during the anchor drop process. This indicates a problem with vertical coordination between the bridge and the crew at the bow when using walkie talkies. The captain assessed that the lack of concentration during the maneuver could increase the risk of operational errors.

B. Information Results from Source 2 (Chief Officer)

The Chief Officer stated that anchoring in the Bali Strait presents significant challenges compared to other waters. The main obstacle frequently encountered is strong currents that change direction quickly, especially during tidal changes, making it difficult to control the ship's course as it approaches the anchorage. Furthermore, the high volume of ferry traffic on the Ketapang-Gilimanuk route limits the ship's maneuverability and requires high precision in determining the anchor drop point to avoid disturbing other vessels. Seasonal winds also affect the ship's stability during the anchor drop process. The Chief Officer also emphasized the importance of quick and precise communication between the bridge and the bow, as even a small error in coordination can cause the ship to shift from its designated position. Therefore, crew readiness, experience in interpreting the characteristics of the Bali Strait currents, and intensive supervision are crucial in overcoming these challenges.

C. Information Results from Source 3 (Second Officer)

The second officer explained that during the anchoring maneuver in the Bali Strait, the anemometer on the bridge experienced problems, preventing it from accurately displaying wind speed and direction data due to sensor damage. This condition occurred when the ship was approaching the anchorage point in a situation with strong currents and changing seasonal winds. Nevertheless, the second officer stated that the ship's officers were still able to detect the direction and estimated wind strength based on sailing experience, by observing the direction of waves, ripples on the water surface, the waving of the flag, and the movement of the ship's chimney smoke.

D. Information Results from Source 4 (Helmsman)

The helmsman explained that during the anchoring process, the main obstacle experienced was the difficulty in maneuvering the ship due to the strong currents in the Bali Strait. The currents were quite strong and changed direction, causing the ship to tend to drift from the planned course, so the helmsman had to make continuous steering corrections to maintain a stable course. This condition increased the level of difficulty in maintaining the ship's position as it approached the anchoring point and required more intensive concentration and coordination with officers on the bridge. The strong currents also affected the accuracy of the anchor drop time because the ship was more difficult to control according to initial calculations.

E. Information Results from Source 5 (Boatswain)

The Boatswain, acting directly at the bow, stated that during the anchoring maneuver, there were minor issues with the windlass at the start of operations. At the first moment of lowering the anchor, the windlass engine did not immediately operate smoothly and experienced a brief jam, requiring greater caution. The anchor chain did not come out smoothly as it should, requiring inspection and adjustment before operations could resume. According to the Bosun, this condition was likely caused by suboptimal maintenance and lubrication of the windlass' mechanical components. Although these issues were quickly resolved, the situation slowed down the process and required increased vigilance from the crew on duty at the bow.

3. Documentation Results

A. *Windlass*

To support the results of this research, the researcher presents documentation in the form of a windlass, namely a tool that. Its function is to mechanically raise and lower the anchor, and to help hold the ship when anchored by controlling the anchor chain so that the ship does not move due to currents, wind or waves.

Fig 1. Windlass

Source: Researcher Document (2025)

Based on documentation obtained during the anchoring maneuver, it was apparent that the windlass was not functioning optimally at the start of the operation. At the first moment of lowering the anchor, a jam occurred, preventing the anchor chain from coming out smoothly. This indicated a disruption in the windlass' mechanical system, which impacted the smoothness of the initial anchoring process. This documentation reinforces the observation that greater attention is needed to ensure the condition and maintenance of the equipment for a safe and effective anchoring process.

B. Anemometer

Anemometers on ferry ships are crucial navigational tools installed to measure wind speed and direction in real-time.

Fig. 2. Anemometer

Source: Researcher Document (2025)

Based on documentation during the anchoring maneuver, it was discovered that the anemometer on the ship's bridge was not functioning. This was evident from the lack of wind speed or direction data displayed on the indicator screen. This condition indicated that the instrument could not be used as a reference for monitoring wind conditions during the anchoring maneuver, resulting in an inadequate availability of weather information that would have supported decision-making.

Data analysis

In this study, researchers will use the fishbone diagram method to determine the crew's readiness for anchoring maneuvers on the KMP Trisna Dwitya and to determine the factors influencing anchoring maneuvers. The data sources used include direct observations during sea practice, interviews with the crew, and documentation in the form of windlasses and anemometers.

In the problem identification process, the first step is to identify the primary problem. The next step is to select the most relevant problem from the various identified alternatives. The following are the results of the problem identification obtained based on the analysis conducted by the researcher according to the procedure:

Table 1. Problem identification

Observed Factors	Exercise Procedures	Conditions on board the KMP. Trisna Dwitya ship
Manpower (Labor)	-In preparing the ship before anchoring: 1. KKM, deck officers and other designated officers are notified to prepare the maneuvering machines and equipment required half an hour or one hour before anchoring., 2. For the time being, all activities that might interfere with anchoring are stopped. -When the ship approaches the anchorage, the Bosun is responsible for managing the anchor machinery equipment, and the Chief Officer always reports to the bridge about the direction of the chain, length, tension or slack and other information deemed necessary.	-On the research vessel, procedures have been implemented according to applicable regulations. The KKM, deck officers, and other designated officers have been notified and asked to prepare the maneuvering machine and navigation equipment such as GPS, Radar, ECDIS, Echo Sounder required approximately half an hour to one hour before the anchoring is carried out. In addition, to support the smooth process, all activities on board the vessel that could potentially interfere with the anchoring are also temporarily stopped, so that the crew's focus and readiness can be focused on the maneuvering activity. -When the research vessel approached the anchorage location, the duties and responsibilities of each crew member were carried out according to applicable procedures. The Boatswain was responsible for managing and ensuring the readiness of the anchor machine equipment (windlass) in operational condition, while the Chief Officer actively reported to the bridge regarding the direction of the chain exit, the length of chain that had been lowered, the tension (tight) or slack (slack), and other important information needed. Coordination between the bow and the bridge was less than optimal when using a walkie-talkie. However, overall, the anchorage maneuvering process was still carried out well, safely,

Observed Factors	Exercise Procedures	Conditions on board the KMP. Trisna Dwitya ship
		and under control thanks to the cooperation and experience of the ship's crew.
Machines (Equipment)	-In preparing the ship before anchoring, the navigation equipment and anchoring equipment are checked as well as the communication equipment used from the bridge to the bow. -In the implementation of anchor lego, the anchor machine remains *standby* during *man euver*.The machine is finished when the anchor feeds and the anchor is in the desired position.	-In the preparation stage before anchoring, inspection of anchoring equipment and communication equipment using walkie talkies between the bridge and the bow has generally been carried out. However, based on observations, inspection of navigation equipment such as GPS, Radar, ECDIS, Echo Sounder, and Anemometer has sometimes not been carried out thoroughly and it was found that the ship's anemometer was not functioning where this tool should be used to determine the direction and strength of the wind which plays a very important role in the ship's maneuver. This condition has the potential to cause risks if there is a disturbance during the maneuvering process, so it is necessary to increase discipline in carrying out routine equipment checks before anchoring activities are carried out. -During anchoring operations on research vessels, the anchor engine (windlass) remains on standby throughout the maneuver to anticipate the need for anchor chain adjustments. Engine operation is only stopped once the anchor is confirmed to be firmly anchored and the vessel is at the designated anchoring point, ensuring a safe and controlled anchoring process.
Materials (Supporting Equipment)	When anchoring, the anchor chain must be in good condition, and regular maintenance and adequate lubrication are necessary.	During the anchoring operation on the research vessel, the anchor chain was generally in good condition, although some parts showed minor corrosion. However, this corrosion did not affect the strength or smoothness of the lowering and retracting of the anchor chain during the maneuver. Nevertheless, routine maintenance and adequate lubrication are still required to prevent more serious damage and maintain the equipment's long-term reliability.
Method (Work procedures)	When preparing the ship before anchoring, the anchor engine propulsion is turned on so that the anchor does not get stuck, then selecting and approaching the anchoring place when the ship turns must be free from other ships.	During the preparation phase before anchoring the research vessel, the anchor engine's propulsion system is first turned on to ensure the windlass is operational and prevent jamming during anchor drop. Furthermore, the selection and approach to the anchorage site are carried out with attention to surrounding safety. When the vessel maneuvers, the surrounding area is ensured to be clear of other vessels, ensuring the maneuvering process can proceed safely and under control.
Environment (Environment)	External factors of the ship are 1. sea conditions such as wind strength and direction, wind can help in some situations speed up the ship's maneuver, the ship's maneuver is greatly influenced by the wind, especially in narrow and difficult areas, 2. Current strength and direction, the current has a comparable effect to the wind on the ship's maneuver. 3. The crowding of the waters which will make it difficult for the ship to maneuver so that water conditions that are not too crowded are needed.	External factors such as currents and water density significantly influence anchoring maneuvers, particularly in the Bali Strait, known for its strong and changing currents and heavy ferry traffic. These conditions can complicate course control and anchorage determination if not properly anticipated. However, these obstacles can be overcome because ship officers have experience and a good understanding of the current characteristics and local water conditions, enabling them to accurately calculate maneuvers and coordinate operations to ensure safe navigation.

Based on the problem identification above, a detailed fishbone chart can be presented of several main factors causing the crew of the KMP Trisna Dwitya to be less prepared in carrying out anchoring maneuvers on the ship as follows:

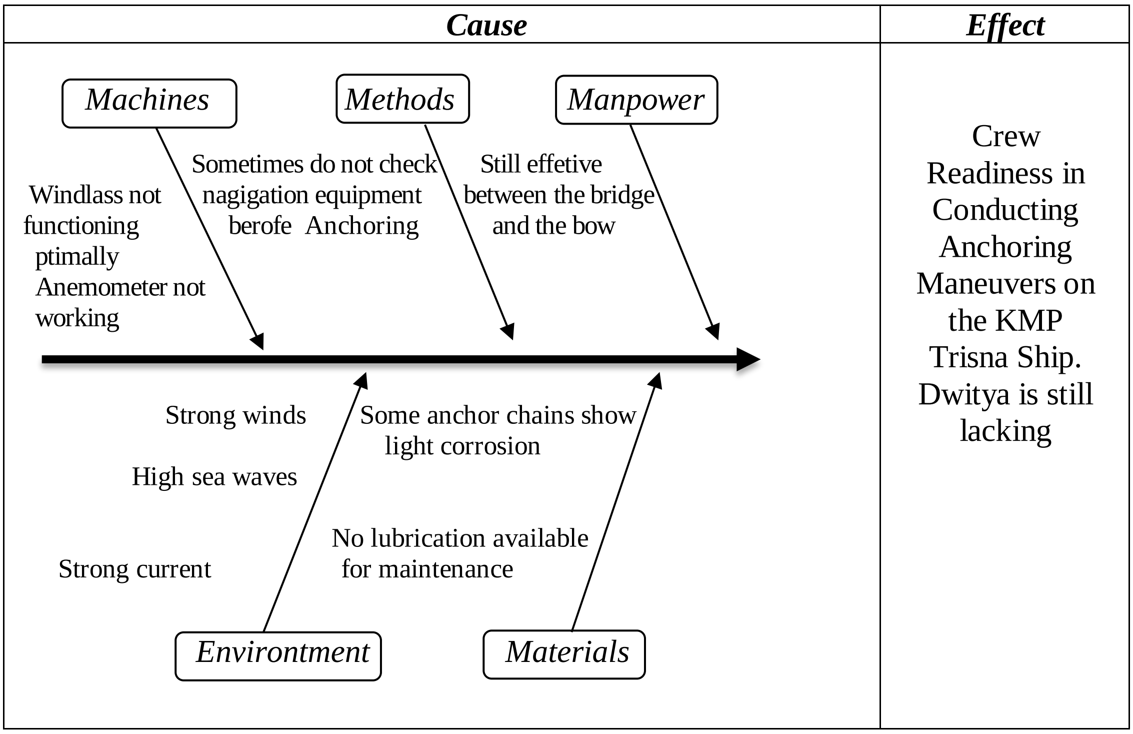

Fig 3. Fishbone Chart
Source: Processed Researcher Data (2025)

IV. DISCUSSION

Crew Readiness for Anchoring Exercises on the KMP Trisna Dwitya Ship.

This discussion concerns the ship's crew's readiness for anchoring maneuvers on the KMP. Trisna Dwitya. The following researcher will explain the anchoring procedures carried out on the research vessel:

1. Choosing an Anchorage

A. Choose a location with a depth that suits the boat's load and takes into account the tides and avoids currents that are too strong:
On research vessels, anchorage locations are selected based on water depths appropriate to the vessel's draft and prevailing tidal conditions. Furthermore, anchorage locations are chosen to avoid areas with strong currents to maintain vessel stability and ensure safe anchoring.

B. Ensure the ship's turning space is safe enough to prevent collisions with other ships:
On research vessels, before dropping anchor, the vessel's turning space is calculated to avoid collisions with other vessels in the anchorage area. Careful monitoring of safe distances and surrounding traffic is carried out so that the vessel can turn and anchor safely and under control.

2. Approaching the Anchorage

A. Referring to the port map showing the boundaries and designated anchorage areas:
On research vessels, anchorage locations are not determined solely by port maps showing specific anchorage boundaries, due to the dense and dynamic waters of the Bali Strait. Anchorage positions are based more on general anchorage areas commonly used in the Bali Strait, taking into account currents, ship traffic density, and the experience of the ship's officers in determining safe anchorage points.

B. Lower the anchor ±4 times the sea depth until the anchor feeds, then put up a ship anchoring sign (white light at night and black ball during the day) :
On the research vessel, the anchor was lowered according to regulations, calculating a chain length of approximately four times the water depth until the anchor was securely

anchored. Once the vessel was securely and stably positioned, the anchoring signal was also installed according to regulations: a white light at night and a black ball during the day to indicate the vessel was at anchor.

3. **Implementation of Anchor Lego**

A. Activate the depth gauge, approach the anchorage point at low speed, and maneuver against the wind and current:

On the research vessel, before anchoring, the echo sounder is activated to determine the depth and condition of the seabed. The vessel approaches the anchorage point at low speed and maneuvers against the wind and current to maintain course control. If the current is strong enough to cause the vessel to reverse too quickly, the engine is advanced sufficiently to avoid excessive stress on the anchor chain, ensuring a safe lowering process.

B. Anchoring is done when the ship is moving (usually backwards) so that the chain does not pile up and the anchor can feed properly:

On research vessels, anchoring is performed while the vessel is slowly moving backward, allowing the anchor chain to flow out neatly and without bunching. This ensures the anchor rests securely on the bottom and prevents the chain from tangling or scratching the vessel's hull, ensuring a safe and controlled anchoring process.

C. The Chief Officer and crew are ready at the bow, the Boatswain adjusts the windlass, while the Chief Officer reports the condition of the chain (direction, length, tightness/slack) to the bridge:

On the research vessel, as the vessel approached the anchorage point, the Bosun, Chief Officer, and crew were ready at the bow according to their respective duties. The Boatswain adjusted and operated the anchor engine, while the Chief Officer monitored and reported the anchor chain's condition, such as direction, length, and slack, to the bridge. Although there was a problem with the windlass, which jammed during the initial operation, the anchor drop process was carried out safely and in a controlled manner.

D. The anchor machine remains on standby during the maneuver and is stopped after the anchor is fed and the ship's position is safe, the ship's anchored sign is installed and the number of chains is:

On research vessels, the anchor engine remains on standby during the maneuver and is only stopped once the anchor is confirmed to be feeding properly and the vessel is in the desired position. Afterward, the anchor chain is safely stopped using the chain stopper, and anchored signs are displayed in accordance with applicable regulations.

Based on the procedures mentioned above, the crew of the KMP. Trisna Dwitya was ready to carry out the anchoring maneuver, namely with a clear division of tasks according to each responsibilities. However, during the implementation there were several obstacles, namely the windlass that did not function optimally due to a brief jam at the start of operation and a malfunctioning anemometer so that wind direction and speed data were not read accurately. In addition, communication between the bow and the bridge was also still less effective when using a walkie-talkie, especially in conveying information on the condition of the anchor chain. Nevertheless, thanks to experience and maintained coordination, the anchoring process was still carried out safely and under control.

Factors Influencing the Implementation of Anchoring Exercises on KMP. Trisna Dwitya

A discussion of the factors influencing anchoring maneuvers on the KMP Trisna Dwitya shows that, in general, the activities were carried out according to procedure, but several aspects still need improvement. These maneuvers were analyzed based on factors such as manpower, machinery, environment, and method.

From the manpower factor, crew readiness is evident from the clear division of tasks between the Master, Chief Officer, Second Officer, Helmsman, and Boatswain during the anchor drop process. The Chief Officer actively reports the condition of the chain, the Boatswain operates the windlass, and the bridge monitors the ship's position. However, some crew members still lack focus in communication during the anchor drop process, resulting in suboptimal vertical coordination between the bridge and the bow when using walkie talkies. This indicates the need for increased discipline, pre-maneuver briefings, and direct supervision to minimize the risk of operational errors.

Regarding the machine (equipment), the equipment was generally in good condition and ready for use during the anchoring operation. The anchor engine was on standby during the maneuver and was stopped after the anchor was properly fed. However, problems were encountered, such as a malfunctioning anemometer and a suboptimal windlass at the start of the anchoring operation, which caused congestion. These conditions demonstrate the importance of routine maintenance and thorough inspections before the maneuver to maintain equipment reliability.

From the material factor (supporting equipment) in the movement of anchoring, including routine lubrication of the chain and gear windlass is very important to prevent wear and mechanical problems during the process of lowering and pulling the anchor. The use of personal protective equipment such as helmets, gloves, safety shoes, and life jackets is mandatory to reduce the risk of work accidents. In addition, shackle markings must be maintained so that they remain clearly visible to facilitate control of the length of the chain that comes out, and the availability of spare parts needs to be managed properly so that the ship is always ready to carry out sudden operations without technical obstacles.

Environmentally, the Bali Strait is characterized by strong currents that change direction quickly, as well as heavy ferry traffic. These conditions complicate ship course control and anchorage determination. In some situations, ships must "drift" or pause to adjust to the current's direction and strength before anchoring. However, the experience of ship officers in interpreting local current and wind characteristics can mitigate the risks posed by these environmental factors.

In terms of method, the maneuvering process followed standard procedures, from anchor engine preparation and communication checks to reporting chain conditions to the bridge. However, there were still shortcomings in the consistency of navigation and anchorage equipment checks prior to anchoring. Therefore, more disciplined procedures, comprehensive checklist implementation, and post-activity evaluation are needed to improve work effectiveness and safety.

V. CONCLUSION

This study found that the readiness of the KMP Trisna Dwitya crew in carrying out anchoring maneuvers generally went well according to procedures with a clear division of tasks between the captain, chief officer, second officer, helmsman, and bosun, as well as coordination between the crew and ship's officers who have experience supporting in the Bali Strait. However, fishbone analysis revealed major obstacles such as less than optimal windlass due to minimal lubrication, malfunctioning anemometer, ineffective bridge-bow communication when using a handy talky, and strong currents and traffic density that made maneuvering difficult, so that the anchoring process was at risk of dragging or overshoot even though the SOP was implemented.

These findings are limited by the qualitative descriptive approach of the 12-month sea practice, which relied on a purposive sampling of five informants and subjective observations without extensive quantitative data, resulting in limited generalizability to older Ro-Ro vessels operating similar routes. Suggestions for future research include a mixed-methods approach with maneuver simulations and broader crew surveys to validate environmental factors. Practically, these results recommend routine equipment maintenance, pre-anchoring briefings, and the procurement of an anemometer for KMP Trisna Dwitya to improve safety, reduce human incidents, and support efficient operations in the dynamic waters of the Bali Strait.

REFERENCE

[1]. Ali, M. (2017). *Fishbone diagram: Analisis penyebab masalah*. Binus University. https://sis.binus.ac.id/2017/05/15/fishbone-diagram/

[2]. Andromeda, R. (2025). Analisis faktor kecelakaan berlabuh jangkar di perairan padat. ***Jurnal Teknik Maritim Nusantara***, *7*(1), 45-56. https://doi.org/10.12345/jtmn.2025.71.45

[3]. A. Istri Sri Wahyuni, Siti Fatimah, Ahmad Maulana, T. (2023). Analisis Kesiapan Kapal Ro-Ro Passanger dalam Menghadapi Cuaca Buruk di Pelabuhan Ketapang Banyuwangi. Jurnal Penelitian Transportasi Laut, 25(2), 60-69.

[4]. Creswell, J. W., & Poth, C. N. (2021). *Qualitative inquiry and research design: Choosing among five approaches* (5th ed.). SAGE Publications. https://doi.org/10.4135/9781483394717

[5]. Emzir. (2021). *Metodologi penelitian kualitatif: Teori dan aplikasi*. Pustaka Setia.

[6]. Firdaus, M. (2022). Teknik pengumpulan data dalam penelitian kualitatif maritim. ***Jurnal Maritim Indonesia***, *4*(2), 89-102. https://doi.org/10.56789/jmi.2022.42.89

[7]. Gasperz, V. (2002). *Lean six sigma for manufacturing and services industries*. PT Elex Media Komputindo.

[8]. Hardandi, Y. (2020). *Observasi partisipatif dalam penelitian lapangan nautika*. CV Andi Offset.

[9]. Hidayat, R. (2024). Tantangan operasi kapal Ro-Ro di Selat Bali. ***Jurnal Transportasi Laut***, *9*(1), 23-34. https://doi.org/10.7890/jtl.2024.91.23

[10]. International Maritime Organization. (1972/2021). *COLREG 1972: Convention on the International Regulations for Preventing Collisions at Sea* (2021 ed.). IMO Publishing.

[11]. International Maritime Organization. (1974/2020). *SOLAS 1974: International Convention for the Safety of Life at Sea* (2020 consolidated ed.). IMO Publishing.
[12]. International Maritime Organization. (1978/2022). *STCW 1978: Standards of Training, Certification and Watchkeeping for Seafarers* (Manila Amendments 2010, 2022 ed.). IMO Publishing.
[13]. International Maritime Organization. (2010/2024). *ISM Code: International Safety Management Code* (2024 ed.). IMO Publishing.
[14]. Khodijah, S. L. (2015). *Analisis faktor penyebab kerusakan produk dengan fishbone diagram* [Tesis]. Universitas Diponegoro. http://eprints.undip.ac.id/46149/1/06_KHODIJAH.pdf
[15]. Komite Nasional Keselamatan Transportasi. (2023). *Laporan tahunan investigasi kecelakaan pelayaran 2022*. KNKT.
[16]. Kurniawan, D. (2025). Evaluasi prosedur berlabuh jangkar kapal penumpang. ***Jurnal Cakrawala Bahari***, *11*(1), 12-25. https://jurnal.poltekpelsumbar.id/index.php/jcb/article/view/157
[17]. Mantra, I. B. N., et al. (2022). Metode observasi dalam penelitian kualitatif. ***Jurnal Pendidikan dan Kebudayaan***, *8*(3), 200-215. https://doi.org/10.23887/jpk.v8i3.200
[18]. Mukhtar. (2013). *Metodologi penelitian kualitatif*. Pustaka Pelajar.
[19]. Nugroho, A., et al. (2022). Dinamika arus Selat Bali terhadap operasi kapal feri. ***Jurnal Hidrodinamika***, *5*(2), 67-78. https://doi.org/10.1234/jhidro.2022.52.67
[20]. Pratiwi, D., & Santoso, A. (2021). Faktor manusia dalam kecelakaan pelayaran. ***Jurnal Keselamatan Maritim***, *6*(1), 34-45. https://doi.org/10.5678/jkm.2021.61.34
[21]. Sudaryono. (2023). *Prosedur penelitian lapangan di lingkungan maritim*. Graha Ilmu.
[22]. Sugiyono. (2017). *Metode penelitian kuantitatif, kualitatif, dan R&D*. CV Alfabeta.
[23]. Sugiyono. (2018). *Metode penelitian kuantitatif, kualitatif, dan R&D* (Edisi Revisi). CV Alfabeta.
[24]. Syahrir, M., et al. (2022). Analisis keselamatan manuver kapal di perairan sempit. ***Jurnal Teknik Pelayaran***, *10*(2), 112-125. https://doi.org/10.9012/jtp.2022.102.112
[25]. Ulfah, M. (2022). Dokumentasi sebagai teknik pengumpulan data kualitatif. ***Jurnal Metodologi Penelitian***, *7*(1), 56-67. https://doi.org/10.3456/jmp.2022.71.56
[26]. Wiradi, H. (2023). Komunikasi tim anjungan dalam manuver berlabuh. ***Jurnal Nautika Indonesia***, *12*(3), 78-89. https://doi.org/10.2345/jni.2023.123.78
[27]. Zainal, A. (2021). Faktor kelelahan awak kapal terhadap keselamatan pelayaran. ***Jurnal Kesehatan Maritim***, *3*(2), 45-58. https://doi.org/10.6789/jkm.2021.32.45.