

# VESSEL CREW ROTATION OF THE NATIONAL SHIPPING COMPANY DURING COVID-19 PANDEMIC PERIOD

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## Abstract

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This research aims to analyze vessel crew rotation during the COVID-19 pandemic at a national shipping company. Before the pandemic, vessel crew recruitment was carried out based on company procedures safely and on time. In contrast to when the COVID-19 pandemic swept the world, the vessel crew recruitment and rotation system significantly changed. Concerns about being infected with the deadly COVID-19 virus have made vessel crew rotations unpredictable and scheduled on time. Mapping and identification of vessel crew rotation variables dynamically using the causal loop diagram (CLD) technique. This model shows that the vessel crew rotation process requires handling, quick adjustments to the existing situation, and planning strategies on the vessel crew rotation during this pandemic. The CLD analysis results show that in systems thinking, vessel crew performance and company performance have the highest impact. The delay in implementing and handling the vessel crew rotation will affect the company's reputation. Also, it may result in the termination of collaboration between the company and the recruitment agency, resulting in distrust in the company.

**Keywords:** Causal Loop Diagram, Vessel Crew Performance, Vessel Crew Rotation, Vessel Crew Recruitment Agency

**Authors' individual contribution:** Conceptualization — P.R., E.S., and E.E.; Methodology — E.S., S.T., and E.E.; Investigation — P.R., E.E., and A.A.S.; Resources — P.R., A.S., and I.M.D.W.; Data Curation — E.E., Y.K., K., and F.; Writing — Original Draft — P.R., E.S., S.T., and Y.K.; Writing — Review & Editing — E.E., A.A.S., and I.M.D.W.; Supervision — P.R., E.E., and K.; Project Administration — E.E., A.A.S., and F.; Funding Acquisition — P.R., E.S., and S.T.

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## 1. INTRODUCTION

The national shipping business is facing severe challenges during the COVID-19 pandemic. The impact of COVID-19 on the maritime industry has caused many problems for vessel crew

recruitment agencies which ultimately affect the crews which also have implications for health problems and threats to the supply chain of essential commodities (Kaptan & Kaptan, 2023; Stannard, 2020; Yazir et al., 2020; Zhou et al., 2023). There is only so much that can be done other than

hoping for stakeholder encouragement and supports to maintain the performance of national shipping. National shipping companies also have to face various impacts due to the pandemic, which is currently endemic in Indonesia. In this line of business, recruiting the vessel crews is the responsibility of the crewing department. It is part of the shipping company's responsibility to prepare vessel crews to be employed on board ships and to prepare vessel operational needs. The COVID-19 pandemic emergency has had a vast impact, one of them being the impact on the vessel crew recruitment business.

As a result, the operational activities of the vessel are hampered. It is included in the vessel crew rotation process, and those on board must experience setbacks for replacement in the next few weeks to one month. In addition, the departure process, such as making flights and continuing overland trips to the local port, is also constrained by several regulations, so it takes longer and is more expensive. National shipping also requires a dispensation for delaying the processing of ship certificates and processing vessel crew documents before leaving for the ship, such as managing sea contract agreements, on-off passports, and safe books. Dispensation is carried out as long as the certificate can be postponed and does not endanger workers' lives on board. The vessel crew rotation proc-delays ess will also result in user complaints regarding vessel crew performance.

This research was conducted with a case study on the shipping company Oceanindo Crewing Services. The vessel's crew can be scheduled to depart to work on the ship if the medical check-up results-up is declared "fit to work" by the doctor from the recommended hospital. Certificates that are still valid for at least one work contract, documents that have been completed, and will then be prepared for departure tickets to the country or region of destination. If the destination is in Indonesian territory, it will be done by land via train, bus, car, or air travel. With the COVID-19 pandemic, the crewing department faces several obstacles in the vessel crew rotation process, such as document processing, certification, medical check-up, and vessel crew travel arrangements.

Another obstacle is if the vessel crew that will depart is on standby or waiting at home. Usually, the vessel crew can directly travel to the office in Jakarta, but in this pandemic, vessel crews have to do a COVID-19 rapid test which has to have a negative result. Another obstacle is many complaints from vessel crew on standby having to spend more budget to carry out the test because the vessel crew bears the test costs crew. However, obstacles will arise again if the COVID-19 rapid test results are tested positive for COVID-19, significantly hampering the vessel crew rotation schedule. Finally, the work unit must prepare a replacement vessel crew, which may experience the same problems and complaints.

The supporting data in this research is vessel crew rotation data throughout 2020, and there were delays in the rotation process, both vessel crews who will sign on or sign off. The condition of vessel crew rotation in normal situations showed the crew on board when the crew signs on rate related to the contract overdue and ready to join the crew. After that, rotation through the crew sign-off rate

and on-time ratio. This replacement activity is a series of processes scheduled weekly to monthly by the manning agency, which is adjusted to the vessel crews' work contract. There are several possibilities for the vessel crew replacement, such as the vessel crew contract period has been completed, unexpected events involving the vessel crew's family, i.e., the death of the closest family member, the occurrence of a natural disaster, or a severe illness so that the vessel crew can get off of the ship. There could also be a request for a sudden change of vessel crew by the master due to an event detrimental to the other vessel crew on board, i.e., the vessel crew leaving the ship (jumping ship) without the captain's permission. The next possibility is due to the condition of the vessel crew, who is sick on board for a very long period and cannot carry out responsibilities or work on board the ship.

From some of these possibilities, vessel crew rotation is an agenda and activity that must be carefully prepared as a weekly or monthly agenda. A manning agency needs to change or transition its employee to carry out their responsibilities on board the ship based on their qualification. In this case, the vessel crew change schedule requires excellent attention, diligence, and accuracy from the manning agency company.

Under normal circumstances, crew rotation will run smoothly and stable, balanced between the vessel crew who stand by and the vessel crew on board (Arleiny et al., 2021). There is no overdue contract or work agreement. However, during the COVID-19 pandemic, the vessel crew's performance and the crew rotation process were greatly affected, as well as charter policies and national and international principles — the difficulty in adjusting the vessel crew rotation procedure with the policies of each charter party or principal. The policy change will result in more delays in vessel crew rotation, in the operational activities on board the ship itself, and also in the performance of the crewing department in processing documents and certifications needed in the vessel crew rotation process by adjusting the situation and conditions in the policy enforced during the pandemic.

Several aspects affect the shipping business due to COVID-19; one is the vessel crew recruitment agency (Kaptan & Kaptan, 2023). This line of business is engaged in providing legal vessel crews. The recruiting process and the job placement meet the requirements (Baron et al., 2018; Chungyalpa & Karishma, 2016; Saluy et al., 2022; Lee, 2007; Thebe & van der Walddt, 2014). Before the pandemic, vessel crew recruitment was carried out based on company procedures safely and on time. This is in contrast to when the COVID-19 pandemic swept across the world when the vessel crew recruitment and rotation system went under a very significant change (Asare et al., 2021; Comper et al., 2017; Luchenko & Georgiievskiy, 2021; Massey, 2018). Fear of infection makes vessel crew rotations unpredictable and scheduled (Pauksztat, 2023; Sprajcer et al., 2023). It also impacts the operational performance of the vessel crews (Abrahamsen et al., 2023; Moreno et al., 2022; Zhao & Tang, 2023). This is because several workers and vessel crews in the field must follow various health procedures to minimize the spread of COVID-19 (Boviatsis & Daniil, 2022; Pauksztat et al., 2022). Causal loop diagrams (CLDs)

aim to explain a system of causal relationships and reciprocal influences, incorporating stakeholder views and ideas (Pineo et al., 2020). Several researchers have previously used CLDs. This system dynamics theory can overcome environmental challenges to allow more complex dynamics analysis (Blair et al., 2021). According to Park et al. (2016), using CLDs includes system dynamics analysis, which aims to develop and evaluate public policies and performance evaluations.

In general, the structure of the paper after the introduction is as follows. Section 2 reviews the literature related to vessel crews during the COVID-19 pandemic. Section 3 describes the data and analysis techniques using the CLD. Section 4 presents the research results and discusses them in more detail. Finally, Section 5 concludes with empirical findings and recommendations for future study agendas.

## 2. LITERATURE REVIEW

They were related to previous research regarding the condition of vessel crews during the COVID-19 pandemic. Pauksztat et al. (2022) stated that there were problems and vulnerabilities on board the ship due to the uncertainty of vessel crew changes and difficulties related to travelling to/from the ship, among others caused by flight cancellations, border closures, as well as visa and quarantine requirements. Based on research, Jepsen et al. (2017) and Zhao et al. (2023) stated that the risk for seafarers is very likely related to one of the risks of work during sailing and their fatigue factor. Coutroubis et al. (2020) explained that seafarers have to face many things due to the COVID-19 pandemic, including worries about their future career development, uncertain sources of income, and physical and mental health impacts due to excessive fatigue levels. They also added that COVID-19 impacted the maritime industry, seafarers, and health, and threats to the supply of essential goods faced many food problems.

The research results by Arleiny et al. (2021) showed that seafarers need health insurance with transparent systems and policies during and after the pandemic. Several other types of research related to vessel crew performance and crew rotation have been carried out previously (Ots et al., 2021). Lee et al. (2021) found that collaboration with International Maritime Organization (IMO) is needed for seafarers who need help with rotating seafarers. As for related to work-life balance during the COVID-19 pandemic, several researchers such as An et al. (2020), Pauksztat et al. (2022), Indrasari et al. (2022), and Slišković (2020) explained that the majority of seafarers who were on board the ship were impacted on mental well-being, depression, physical and social well-being, while seafarers at home impacted to their economic well-being. In some countries, especially developing countries such as Nigeria, the living and working conditions of maritime workers have a severe impact on their salary arrears and promotions that have not been paid during the pandemic became a serious concern (Okeleke, 2020). In European conditions that were not much different during the COVID-19 pandemic, research explains that the welfare of seafarers, their families, and the reality of their lives are becoming more complex (Jansson, 2021).

The rotation problem is also closely related to fatigue, sleepiness, and sleep quality. It has also been investigated by Massey (2018) and Riethmeister et al. (2018) by comparing work periods and time. In general, fatigue experienced by seafarers contributes to marine accidents and several long-term impacts of several diseases (Li et al., 2022). Thomas et al. (2003) stated that the transition between ship and shore was the most challenging work period of the cycle as seafarers struggled to adjust to life at sea. Working hours, sleep quality, and job rating are very influential with fatigue during work. They always have to weigh all the risks of burnout. Therefore, monitoring of working hours and seafarers' rotation needs to be improved. Finally, Tsai and Liou (2017) found that securing vessel crew rotation is the most important factor during an emergency rather than simply increasing wages and welfare. They added that routes for effective domestic vessel crew rotation should be well-designed during international voyages. Other countries should also be consulted to establish safe travel routes to their home countries. Tsai and Liou (2017) explained four main dimensions of vessel crew management: work attitude, loyalty, payment and welfare, and opportunity. Their research results stated that these four dimensions positively impact vessel crew performance.

The performance will contrite positively or negatively to achieving organizational goals (Virgiawan et al., 2021). Performance is individuals' or groups' quantity, and quality (Fatmawatie & Endri, 2022). Generally, every company expects its vessel crew to have high performance because having a high-performance vessel crew will provide an optimal contribution to the company. According to Nurahaju et al. (2019), the motivational aspect of the vessel crew is needed, especially if they do not have a strong personality and character, which ultimately impacts performance. Most shipping companies currently prioritize analyzing the performance of vessel crews so that improving their performance will be one of the determining factors for the success of every shipping company, and the company will be competitive in the trading market (Massami & Manyasi, 2021).

Vessel crew performance, according to Wahyuni et al. (2022) and Malau et al. (2019), needs to conduct training to increase vessel crew awareness and conduct periodic evaluations of the implementation of activities that assess vessel crew discipline. Other studies also discuss the significant influence on vessel crew performance, especially those affecting their work (Yuen et al., 2018). In addition, in shipping companies, vessel crew performance is always related to safety perceptions (Lu & Yang, 2011). Research Stevens and Parsons (2002) explained that some ship designs had been developed, and the vessel crew was reduced. Thus, it is necessary to emphasize human factors related to motivation, fatigue, and vessel crew performance to ensure safety and efficiency during routine and emergency operations.

## 3. RESEARCH METHODOLOGY

This research was conducted with a qualitative descriptive approach to describe information on implementing the vessel crew rotation process

during a pandemic. Mapping and identification of vessel crew rotation variables dynamically using the CLD technique. Data collection is planned to be carried out through direct observation and in-depth interviews with competent and related informants in the field of research; they are from the Oceanindo Crewing Services company, both vessel crew and operations manager, and several national shipping companies such as Sillo Maritime Perdana, and from ship charters. This is planned to start in July 2021. The object of this research is the shipping company Oceanindo Crewing Services with six fleets of ships; they are anchor handling tug supply and self-propelled oil barge that work on the project of a Cooperation Contract Contracting Company (KKKS) in the Indonesian oil and gas sector and other national shipping companies such as Sillo Maritime and ConocoPhillips as ship charterers.

There were eight informants as sample of this research from various parts of the research, including four informants from vessel crew representatives with different positions on the ship, i.e., master, chief officer, able seaman, and also chief engineer, one crewing manager informant from Sillo Maritime company, one informant from Oceanindo Crewing Services, one informant from ship chartering and one informant from the Government

Circular Letters party that is reviewing government regulations with company procedures. Several questions were asked to the informants, such as:

1) How is the company's response to government regulations regarding travel restrictions during the COVID-19 pandemic?

2) How is the company response related to company procedures in preventing COVID-19?

3) Does the company respond to changes in vessel crew rotation procedures?

4) How does the vessel crew's new rotation procedure impact during the pandemic vessel crew performance on board?

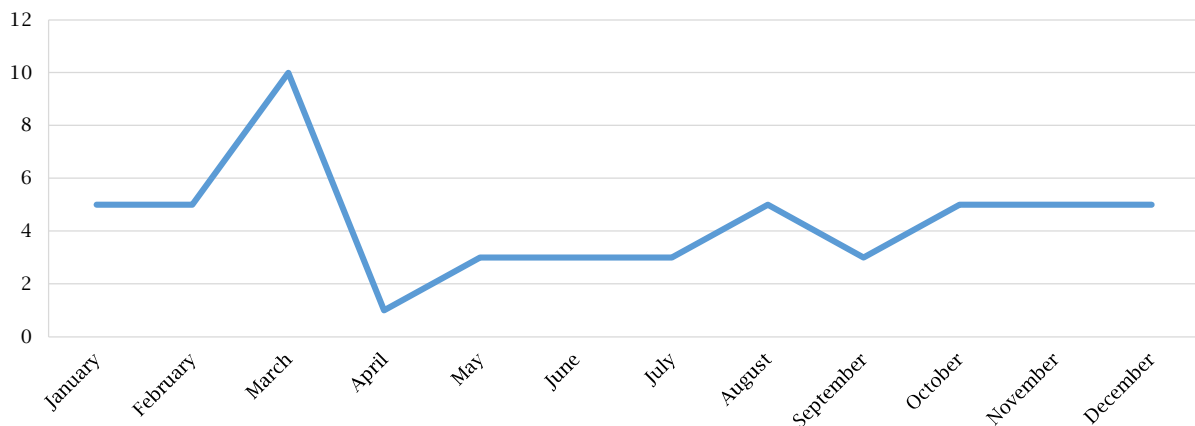
5) Suggestions regarding vessel crew rotation procedures during a pandemic?

## 4. RESULTS AND DISCUSSION

### 4.1. Crew sign-on

An essential indicator of the vessel crew rotation process is the vessel crew sign-on and sign-off rate. This considers the vessel crew's schedule and contract period on board. However, due to the COVID-19 pandemic, the number of crew sign-ins has reduced.

Figure 1. Sign on chart January-December 2020 period

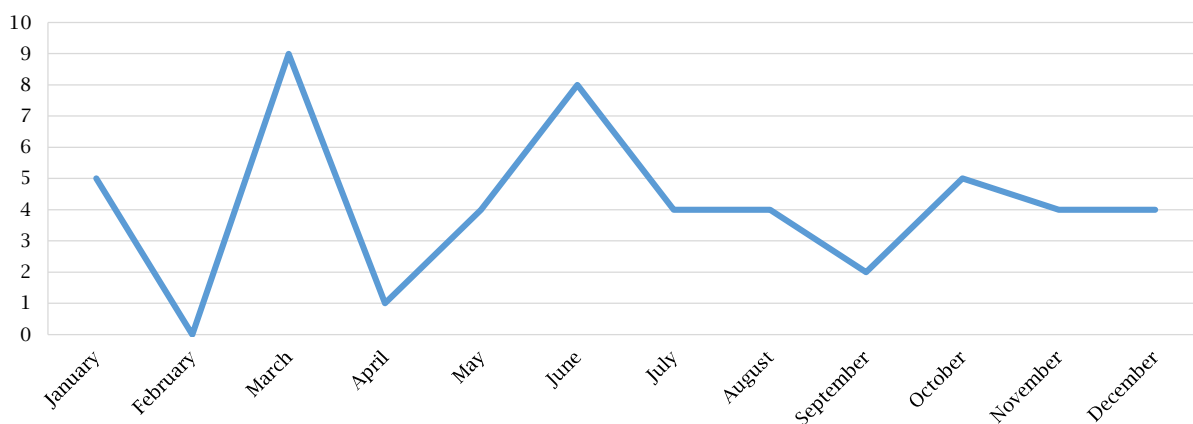


It can be seen from the Figure 1 above that March 2020 was the culmination of the COVID-19 pandemic. It is where charters began to tighten regulations for the onboard process, along with restrictions on mobilization by the government. So, to maximize vessel crew rotation, make massive vessel crew changes in March to avoid overstaying on board the ship. Then in April-July 2020, there was a decrease in the rate of vessel crew turnover due to policies from charterers and the government. In August-December 2020, the number of vessel crew changes stabilize again because Oceanindo Crewing Services, as the ship operator, adjusts to government regulations and charters. Its purpose is to maximize the rate of vessel crew turnover.

The discussion supports previous research conducted by Jansson (2021), Shan and Neis (2020), and Slišković (2020).

### 4.2. Crew sign-off

Vessel crews' sign-on and sign-off are inseparable units. So that if there is a change in the rate of vessel crew sign-on, it will affect the rate of vessel crew sign-off (see Figure 2). Time series data for January-December 2020 and March 2020 periods showed several vessel crew sign-offs. This aligns with the number of vessel crew sign-on because the charter parties have begun to tighten regulations.

**Figure 2.** Crew sign-off rate chart January–December 2020 period

Based on the restrictions on mobilization by the government, Oceanindo Crewing Services anticipates maximizing vessel crew rotation by conducting rotations in March to avoid overstay. Then in the April–July 2020 period, the number of crews who signed off is relatively more than the number of crews who signed on; this is intended to reduce overstayed vessel crews. During the August–December 2020 period, the number of vessel crew rotations stabilized again because Oceanindo Crewing Services, as the ship operator, adjusts to government regulations and charters. This is meant to maximize the rate of vessel crew replacement. This discussion on signs-off supports previous research (Gander et al., 2008; Riethmeister et al., 2018). They explained that significant sleep quality and sleepiness parameters require sign-off on staff rotation. Other studies also incorporated another substitution with signing off (Ghosh & Bowles, 2013; Slišković, 2020).

#### 4.3. Interview result

*How do you respond to government regulations regarding travel restrictions during the COVID-19 pandemic?*

The informants were charterers' representatives, vessel crews, and the crewing department. This interview shows that government regulation has positive and negative impacts on ship operations. The positive effect of this restriction on mobility is minimizing workers being infected with the COVID-19 virus. On the other hand, the negative impact of this regulation is the delay in mobilizing vessel crews to the operating area. Business conditions have been impacted during the COVID-19 pandemic. There is much uncertainty in many things because they have to adjust to the dynamic environmental conditions.

*What is your opinion regarding the company's procedures for preventing COVID-19?*

The procedures set by the company and the charterers have been made based on government regulations. According to the charterer representative, vessel crew, and crewing depart, the procedures are by the present situation. In implementing vessel crew rotation, each crew has a self-isolation facility and a polymerase chain reaction (PCR) test before

entering the work area. All seafarers have agreed to this procedure and are responding positively.

*What is your opinion regarding the change in vessel crew rotation procedure?*

The results of interviews with vessel crew representatives are that the changes to the vessel crew rotation procedure cause discomfort for vessel crews both who are on and off signed, the uncertainty of the information causes overruns budget and a waste of time for the vessel crew to be dispatched, also expired and must be renewed health certificates or supporting documents for onboard purposes. From the charterers' perspective, several policies have been implemented to actively participate in preventing the transmission of COVID-19. Based on the government regulations, it includes:

- Implementing quarantine control followed by a PCR test before the ship's crew boarded the ship. This quarantine control period's length adjusts to government regulations considering the pandemic's current condition-emic. In this case, the company operates a five-day quarantine control before boarding the ship. The company determines this activity's location.

- Prohibiting vessel crew from interacting directly with outside parties. If it is unavoidable, it must be done with a strict process.

- Prohibiting the vessel crew from coming to the shore when the ship is in the port or berth.

- Implementing a health protocol on board with massive and continuous control.

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- Providing facilities to support programs that have been issued by the company, as an effort to prevent the transmission of COVID-19 in the work environment.

*How does the vessel crew rotation procedure during a pandemic affect the performance of the vessel crew on board?*

The change in the vessel crew rotation affects the performance of the vessel crew on board. It admitted that its performance has decreased even though it is not significant. The main goal of the shipping business company in this pandemic is to survive and ensure the vessel crew remains in working condition.

*Suggestions regarding vessel crew rotation procedures during a pandemic*

Some suggestions regarding vessel crew rotation procedures during a pandemic include:

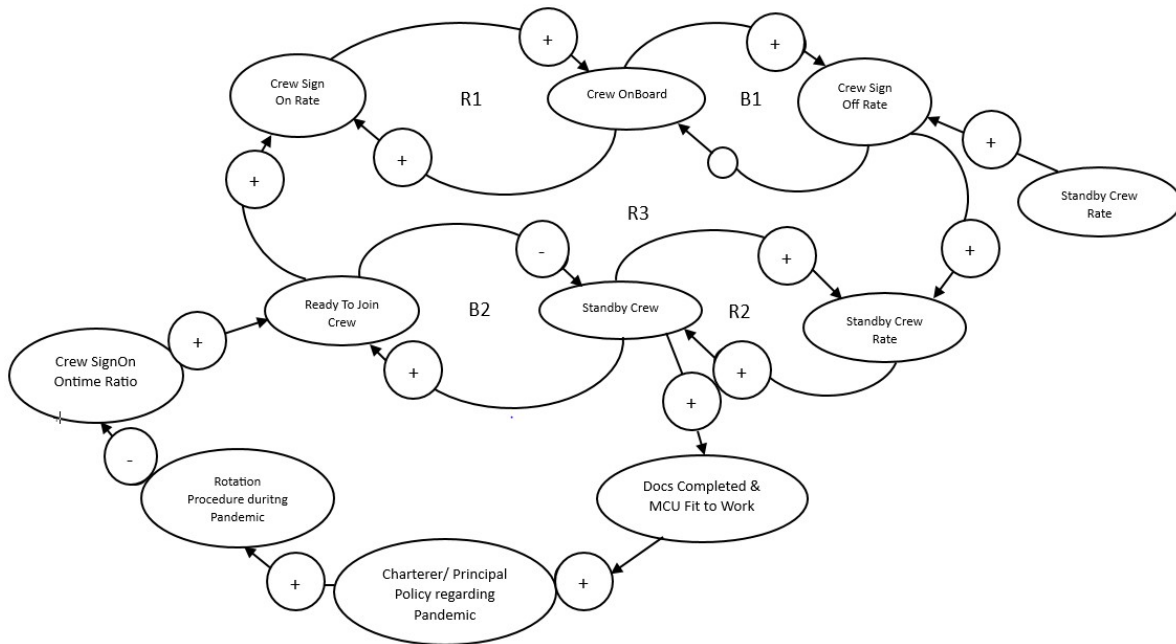
- Keeping the vessel crew rotation on schedule. This means that the company is trying to ensure that no vessel crew overstays on the ship, considering the mental condition of the vessel crew.
- Providing facilities to support company programs.
- Sharing knowledge on various occasions to provide mental support to all vessel crews amid the ongoing pandemic conditions.
- As far as the implementation of company policies, keeping the business running, maintaining compliance with regulations- government regulations, and reducing the impact of COVID-19 transmission in the work environment, there are no significant obstacles. Because as an entity, companies and workers understand each other with the existing pandemic conditions.

The results of the interviews with informants of the shipping company Oceanindo Crewing Services concluded that the COVID-19 pandemic has made vessel crews uncertain. This condition has a negative impact, such as delays in vessel crew rotation and business conditions that have dropped significantly due to adjusting health procedures, government regulations, charter policies, and internal company regulations. This condition must be faced by the shipping company Oceanindo Crewing Services so that the business cycle continues and minimizes the impact of infection of vessel crews during the COVID-19 pandemic.

**4.4. Discussion**

Based on the results of observations and interviews with informants, the new government regulations related to mobility restrictions preventing the transmission of COVID-19 affect the rate of crew sign-on and sign-off for vessel crews. The influence between each of these variables is described in the CLD (see Figure 3).

**Figure 3.** Rotation of vessel crew CLD



It showed in the CLD model (see Figure 3), where the CLD is one of the tools, models, and languages used to describe the structure of complex problems. Using CLDs related to vessel crew performance aligns with several previous studies by Alefari et al. (2020) and Goh et al. (2012). An example of the dynamics of a company's vessel crew rotation is if it is predicted that the vessel crew rotation pattern at the shipping company Oceanindo Crewing Services during 2020. This pattern is called behavior over time due to a series of causes and effects that can be described by the CLD in Figure 3, the rate of crew sign-off is increasing, and the crew on board is decreasing. If the reduction and addition of a balanced number of vessel crews can be used as a benchmark for the on-time crew sign-off rate. The standby crew rate also increases from the increase in the sign-off rates. If the standby crew rate increases, the standby crew will also increase.

The higher the number of standby vessel crews, the higher the vessel crew is ready to be dispatched; in this case, the standby vessel crew stock will automatically decrease. The standby crew rate is influenced by several factors that can increase or decrease the vessel crew that is ready to depart, with the example according to the CLD above that, fit to work is one of the mandatory requirements that vessel crews must own in addition to certification or other documentation.

The higher the standby crew rate with more fit-to-work results, the more vessel crews must follow the COVID-19 procedure or the next stage before departure. At this stage, many vessel crews are delayed due to adjustments to various COVID-19 regulations or procedures that require seafarers to quarantine, PCR, or antigens. It is at this stage that we cannot predict. If the results of the standby crew fit to work are based on a valid medical check-up, it



may not necessarily pass through the COVID-19 procedure because the type of examination differs from the examination outside of the medical check. With more vessel crews detained due to positive covid, the crew sign-on ratio will decrease. If this ratio decreases, the ready-to-go rate will also decrease, which causes the onboard crew to have an increasing service period, i.e., the vessel crew is held on board until the replacement is ready to depart and has passed a series of covid procedures and was declared hostile for COVID-19. This research supports research that has been carried out by Barata et al. (2022), Massey (2018), Riethmeister et al. (2018), Slišković (2020), and Thomas et al. (2003) that excessively long working periods without rotation planning in an isolated ship environment during the COVID-19 pandemic, it threatens mental, physical and social well-being, and has an impact on overall health, work involvement, and vessel crew safety.

The notation in this causal loop is that the crew on board is the cause, while the crew signs off as the effect. The arrows indicate a cause-and-effect relationship. A positive sign (+) is polarity; positive (+) means adding or accumulating. It can also mean a unidirectional change; for example, the sign-on rate increases, the crew on board increases, and the higher the standby crew rate, the more standby crews will be. As the rate of crew sign-on increases, the crew on board will automatically increase, so that crew sign-off will also increase, and the standby crew rate will also increase. The standby crew is automatically high, whereas the vessel crew ready to be dispatched will also increase if the standby crew is high. While the negative sign (-) is negative polarity, negative means reducing, and it can also mean a change in the opposite direction; for example, the rate of crew sign-off reduces crew on board, and the vessel crew is ready to leave to reduce standby crew.

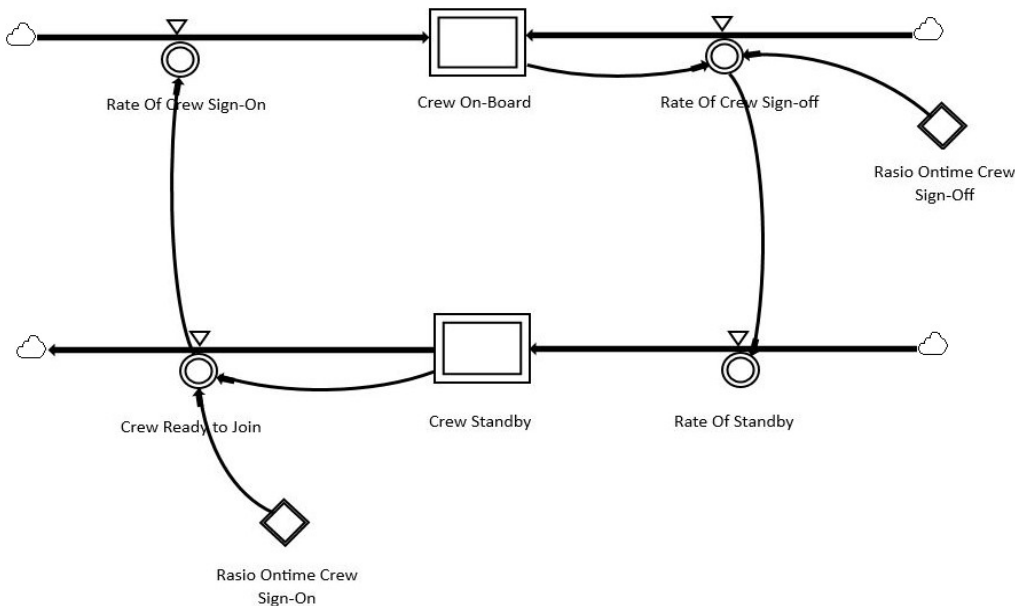
The COVID-19 procedure goes up; the crew sign-on ratio goes down. This causal relationship is

only unidirectional, and it could be feedback. There is a positive causal loop called *reinforcing*, while the negative causal loop is called *balancing*. For example, in R, R1, R2, R3, and R4, causal loop B is balancing, a negative sign (-). In contrast, in examples B1 and B2, many things affect vessel crew rotation, one of which is government regulations related to COVID-19 and procedures from the company to prevent the transmission of COVID-19 in the work area both within the company and on ships.

Restrictions on operational activities in the company also result in limited work processes on working hours by vendors, banks, and government agencies, causing changes to vessel crew rotation procedures and processes that have an impact on vessel crew departure or return rates and result in limited delivery of goods and vessel crew technicians. It is due to following the schedule set for each ship by present regulations. Changes in the rotation procedure affect the performance of both onboard vessel crews and standby vessel crews. This is due to the decrease in the crew sign-on and sign-off. It causes a disturbance in the fatigue management system on the ship. The tentative schedule for vessel crews also causes a decrease in vessel crew performance due to overstayed. To overcome this problem, the company made a vessel crew rotation planning strategy and the right program to avoid a significant decline in business during the pandemic. The strategy is operational by utilizing and optimizing technology for internal coordination and with third parties such as charter parties, local government, and parties related to operational processes. As for operations on ships, the company continues to enforce working hours as usual with health protocols to prevent the spread of COVID-19 and carry out antigen or PCR tests on seafarers on a regular schedule by government regulations.

Stock and flow simulation vessel crew rotation using stock and flow as well as graphs (see Figure 4).

Figure 4. Stock and rotation flow diagram of vessel crew



Source: Zoolfakar et al. (2022).

Stock and flow diagrams are a more detailed description of the CLD. This diagram pays attention to the effect of time on the relationship between

variables so that later each variable can show the accumulated results for the level variable, and the variable system activity for each period is

called the rate. This description with stock and flow diagrams is in line with previous research that has been done (Alefari et al., 2018, 2020).

From the previous explanation and Figure 4, it can be simulated that:

- *Simulation 1:* If the sign-off rate is reduced or less than the standby vessel crews, the number of crew on board will increase. The calculation of the number of vessel crews above is the same, but what increases is that the contract period of the vessel crew that should be able to sign off on time becomes delayed and is extended until the replacement is ready to work on board. The company's strategy is to maintain communication with the vessel crew concerned or overdue, provide understanding and make maximum efforts to keep preparing replacements so that things that are not desirable do not happen. Examples include jump ships, work accidents due to fatigue or boredom, or providing rewards such as promotions and salary increases.

- *Simulation 2:* If the rate of sign-off is the same as the rate of the crew who will sign on or stand by the crew, then the crew on board will be stable, and ship operations can run normally and optimally. In this situation, the company still maintains the performance of the employees who handle the vessel crew rotation to remain optimal and always on time in the vessel crew rotation process.

- *Simulation 3:* If the sign-off rate exceeds that of the standby crew or those ready to depart, this is the opposite of simulation 1. The company's strategy is to reduce it quickly between contract periods; for example, if the vessel crew work contract is two to four months, then the strategy is to decrease the contract to three months or between two to four months.

## 5. CONCLUSION

There was a delay in vessel crew rotation at the Oceanindo Crewing Services shipping company during adjustments to government regulations,

and charter policies, and travel restrictions, whether by land, sea, or air. This limits operating hours at the Oceanindo Crewing Services shipping company and agencies related to the vessel crew rotation process. The charterers' policy on vessel crew rotation during the pandemic requires the preparation of new policies related to situations and conditions so that vessel crew rotation activities can still be carried out following government policies. The limitation of travel restrictions, either by land, sea, or air, causes Oceanindo Crewing Services, the provider of vessel crews, to limit the rotation cycle. This has caused several vessel crews to experience an uncertain schedule, either signing on or signing off from the ship.

Oceanindo Crewing Services shipping company must follow the policies issued by the government and charterers regarding travel restriction regulations, even though this decreases the revenue of Oceanindo Crewing Services shipping company. Oceanindo Crewing Services shipping company minimizes delays by preparing a vessel crew rotation schedule one or two months before the vessel crew signs on and communicating with the relevant agencies to validate documents as a vessel crew departure condition. It is intended that the vessel crew rotation can be carried out safely so that it will produce a good performance and the rotation can run on time. This research is important for the future because it can be one of the mitigation efforts to avoid similar outbreaks that could occur so that crew changes can run effectively, efficiently, and optimally. This research has the limitation of not conducting a qualitative analysis to describe how the COVID-19 pandemic has impacted the crew rotation of national shipping companies. Another end of this study is that the use of causal loop diagram analysis only yielded information to explore the potential impact of each modification in the system but could not provide information to facilitate the selection of possible tools to solve the inventive problems identified in the diagram.

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