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TRAINING, CERTIFICATION, AND WORK EFFECTIVENESS: THE EMPIRICAL EVIDENCES OF THE CARGO BACKLOAD OPTIMIZATION IN THE REGION OF ARAMCO SAUDI ARABIA

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ABSTRACT

Limited cooperation and communication among the departments in the ship was the main problem in this research, especially Dynamic Position Operator and technical personnel like chief engineer and electronic technician, due to unmastered experience and knowledge. This research was to know the direct and indirect influences of training, certification mediated by the work effectiveness of dynamic position operator on the optimization of Supply Vessel's backload in the offshore operation in Aramco Region of Saudi Arabia. This research used the approach of Partial Least Square based Structural Equation Model with research sample as many as 100 Dynamic Position Operators as respondents. The result of this research showed that training, certification and mediated by the work effectiveness of Dynamic Position Operator directly and indirectly influence the optimization of cargo backload significantly. The work effectiveness of dynamic position operator was able to mediate the influence of training and certification of the dynamic position operator on the optimization of supply vessel's cargo backload in the Region of Aramco Saudi. The work effectiveness of Dynamic Position Operator directly and significantly influenced the optimization of cargo backload.

KEYWORDS: cargo backload, certification, supply vessel, training, work effectiveness

1. INTRODUCTION

The Region of Aramco Saudi Arabia becomes one of the main operational centers of oil and gas industry, especially in the offshore operational activity. The type of offshore operation commonly carried out in this region includes the exploration, drilling, production, and transportation of oil and gas. The operation of exploration aims to find a new resource of hydrocarbon, while the drilling is

carried out to extract oil and gas from underground reservoir. In addition, production activity includes oil processing and refining as well as gas production. The operation of transporting oil and gas is performed using tanker ships, including specialist vessels like Supply Vessel which is responsible for transporting various types of cargo and equipment needed for offshore operation. However, although the region of Aramco Saudi Arabia has abundant potential natural resources, the ship performance management of Supply Vessel in the midst of offshore operation may be faced with various special obstacles. One of the main obstacles is the dynamic and frequently tough sea environment, with the weather condition that can change suddenly. High wave, strong wind, and ocean current become the factors that can influence the ship operation of Supply Vessel. Besides, the logistic complexity to ensure the supply and cargo shipment on time are also the challenges necessary to be overcome, enabling ships to operate in the location difficult to reach or in the extreme sea condition. [1] add that the offshore exploration and exploitation of hydrocarbon have opened the era of dynamically-positioned ships. Needless to depend on anchors, ships can stay stable and do their job even in the area with limited depth or in bad weather. This provides a great flexibility to carry out various types of operation, including cargo loading and unloading, subsea improvement, or the operation of oil and gas drilling [2]. [3] also explain that the ship's operation hours depend on the weather, and good knowledge of existing weather condition can ensure a cost-efficient and save operation.

Some problems are found at the initial observation of this research. Various challenges are faced in designing and implementing the effective performance management strategy of Dynamic Position Operator (DPO), less understanding or support from related parties for the proposed strategy. There are obstacles in the process of cargo backload optimization in the Supply Vessel; less understanding of DPO that can influence the efficiency and safety of cargo backload operation carried out based on training and certification; environmental factors can also contribute to imperfection in the performance management [4]. The concept and importance of performance management include not only the technical aspects of operation but also managerial and strategic aspects to ensure the smoothness of DPO's various jobs and responsibilities [4]. Furthermore, [5] mention the increasing importance of Dynamic Position System because of the increasing number of offshore construction locations that need DPS for their operation. DPO's less effective performance needs certification and training, including basic and advanced, to support the effectiveness of DPO performance as well as the optimization of cargo backload. They must be able to overcome the challenges that appear quickly and efficiently, keep the ship stable and safe without sacrificing the effectiveness of operation [6]. Limited cooperation and communication among the departments in the ship, mainly between DPO and the technical personnel like chief engineer and electronic technician are caused by limited experience and unmastered knowledge. In turn, the poor work effectiveness can affect the cargo backload optimization in the supply vessel in the Region of Aramco Saudi, requiring training and certification for DP operators.

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In the performance management of Supply Vessel, such factors should be considered to optimize the cargo backload operation. So, a deep understanding of the operational condition in the Region of Aramco Saudi Arabia, along with the identification of special obstacles, becomes essential in designing an effective strategy of DPO performance management. The efforts to understand and cope with this challenge will help improve the efficiency, security, and sustainability of the ship operation of Supply Vessel in the context of offshore operation in the Region of Aramco Saudi [7]. The cargo backload optimization in the ship operation of Supply Vessel has great urgency and significance in the context of operational success in the maritime sector, especially oil and gas industry in the Region of Aramco Saudi Arabia. The increasing efficiency of loading capacity utilization, according to [8], becomes crucial, considering that the Supply Vessel is responsible for cargo and equipment transportation to support the offshore operation. By maximizing the loading capacity during on the way home (backload), the Supply Vessel can reduce the number of trips carrying empty cargo, so that the overall logistic efficiency will increase.

Operators can easily compensate the changes of wind direction and speed, ocean current, and ocean wave without being dependent on the conventional equipment [9]. According to [10], increased productivity also becomes the key factor in this context. By ensuring that the Supply Vessel can bring back as many cargo as possible in each trip, the overall operational productivity can be increased. Compliance with the standards of safety, environment, and operation is a must. The operator should well understand the regulations prevailing in the Region of Aramco Saudi and ensure that the implemented strategy is in line with the regulations. One of the DPO's main roles is maintaining and controlling the DP system to operate optimally [11]. An agreement on the term of transportation period and other requirements must be matched to ensure that the transaction is profitable and sustainable [2].

2. THEORETICAL REVIEW

2.1 Training

This section describes the theoretical basics and the previous researches that have been conducted. Related to the first variable, i.e. training, employees can be trained and developed continuously to be more effective, maximize their achievement to reach the organizational goals. Theoretically, training is a process of teaching the skills needed by new employees to perform their jobs [12], [13]. Training can be improved by equipping it with the practice of decision making to analyze complex situations like the scenario of early warning of lost position [14]. Regular trainings including technology renewal, deep understanding of Dynamic Positioning (DP) equipment, and simulation on emergency situations can help hone their skills and knowledge. A realistic arrangement of training is needed to ensure that DPO understand the scenario and able to anticipate incidents in better ways, increase the

awareness of the whole situation, and build experiences with such an emergency scenario. Without optimum field experiences, it is unlikely that DPO will function as the last barrier for the safety of DP operation [14].

2.2 Dynamic Position Operator (DPO) Certification

Related to the second variable is Dynamic Position Operator (DPO) certification. Theoretically, [15] explains that certification for someone will help the company adapt to the changes of labor market and retain the talented employees to contribute to the company's sustainable development. The International Nautical Institute regulates the seafarer certification stipulated in International Convention of STCW 2010 in Manila.

2.3 Work Effectiveness

The third variable is work effectiveness as the intervening variable. Through the implementation of an effective strategy of performance management it may involve improving technical skills, periodic performance monitoring, as well as making individual development plans [6], [16]– [18]. In order to be effective, the involvement of employees and the mechanism of their participation must be the parts of the organization and become the part of daily work life [19]. [20] emphasize the central role of goal achievement as the criterion to evaluate its effectiveness. The findings by [21] reveal the significant correlation between the benefits and effectiveness of direct superordinates and the external cooperation, especially among lower-level managers.

2.4 Cargo Backload Optimization

Cargo backload optimization as the fourth variable in this research, through speaking ability, is related to the capacity of a Dynamic Position Operator (DPO) to perform their jobs and activities in the DP system. The success of ship operation, mainly in the optimization of cargo backload, much depends on the effective implementation of DP operational procedure [22]. The implementation of stress management theory can help manage the stress and stay focus on their jobs [23]. According to [24] in the context of shipping, the process of backload involves a number of steps that must be performed carefully. The ship operation of Supply Vessel has a great urgency and significance in the operational success of maritime sector, particularly oil and gas industry in the Region of Aramco Saudi.

This research aims to know and analyze the influence of training and DPO certification to the backload optimization of the Supply Vessel in the offshore operation in the region of Aramco Saudi Arabia with the mediation of DPO work effectiveness. Thus, based on some theories and previous researches related to the four variables studied, namely training, Dynamic Position Operator certification, work effectiveness, and cargo backload optimization, the hypotheses and conceptual model can be formulated (see Figure 1).

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H1: Training directly influences cargo backload optimization
H2: Dynamic Position Operator certification directly influences cargo backload optimization
H3: Effectiveness directly influences cargo backload optimization
H4: Training directly influences work effectiveness
H5: Dynamic Position Operator certification directly influences work effectiveness
H6: Training indirectly influences cargo backload optimization through work effectiveness
H7: Dynamic Position Operator certification indirectly influences cargo backload optimization through work effectiveness

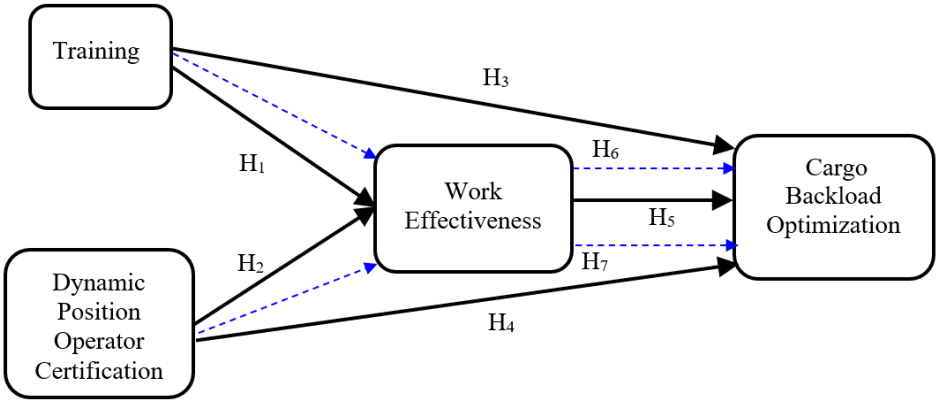

Figure 1: Conceptual Model

3. METHODS

In the context of this research, the focus is on analyzing the work effectiveness of Dynamic Position Operator (DPO) to enhance the cargo backload optimization of Supply Vessel in the offshore operation in the region of Aramco Saudi Arabia. This research explains the relations both influencing and influenced by the related variables in the context of DPO performance management. The first variable, training, uses two operational dimensions, namely DPO's ability and knowledge. The variable of DPO certification uses three operational dimensions, namely DP's real-time ability and insight, deep analysis, and continuous renewal. Work effectiveness as the intervening variable uses two operational dimensions, namely the overall productivity of the ship operation of Supply Vessel and the level of success in achieving operational goals. Whereas the fourth variable, cargo backload optimization, uses four operational dimensions, namely the efficiency of cargo backloading process, the level of cargo capacity utilization, the speed of cargo backload process, and the accuracy of cargo backload schedule management. By using a quantitative method, this research measures how far the effectiveness of DPO performance management strategy contributes to the cargo backload optimization of the Supply Vessel in the offshore operation in the Region of Aramco Saudi Arabia. The population in this research is 100 people consisting of DPO Master, DPO Chief Officer, and DPO Officer. The samples in this

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research use saturated sample, that is all the research population yang is 100 respondents in total. The data analysis technique in this research uses Partial Least Square based Structural Equation Model approach. This analysis uses Smart PLS 3.0 application.

4. RESULTS AND DISCUSSION

4.1 Result of Outer Model Test

Based on the discriminant validity test (cross loading), it is found that all the results of each variable research are valid, ranging above 7 between 0.762 and 0.860 (both are in the variable of certification). While the result of discriminant validity test (fornell-lacker criterion), indicates that the value of Average Variance Extracted (AVE) square root that can be seen from the cross loading of each variable is bigger than the result of an inter-construct correlation. It means that each indicator item of questionnaire statements has been valid, ranging from 0.798 to 0.835. Another method to see the Discriminant Validity is seeing the Square Root value of AVE of each construct with the correlation between one construct and another in the model. It can be said that the AVE value of each construct in this research is above 0.5, ranging between 0.637 and 0.697. There is no problem of convergent validity in the model tested so that the construct in this research model has a good discriminant validity [25]. A composite reliability test aims to test the reliability of instruments in a research model. If all the values of latent variables have a value of composite reliability or Heterotrait-Monotrait Ratio of Correlations (HTMT), it is the alternative method recommended for evaluating the discriminant validity. This method uses multi-trait multimethod matrix as a basic of measurement. The result of HTMT with all variables is below 0.9 ranging from 0.731 to 0.843, and can be said that all the constructs have been valid in term of discriminant validity based on HTMT calculation. While the result of composite reliability test shows the value above Cronbach alpha where all the latent variables both endogenous and exogenous are said to meet the requirements ranging from 0.810 to 0.927, because the value of reliability is between 0.810 and 0.929 ranging “from satisfying up to good.”

4.2 Structural Model (Inner Model) Test

The result of $R\text{-}_{square}$ test shows that $R\text{-}_{square}$ value of DPO work effectiveness is 0.614 or 61.4%. So, the variable of training and DPO certification simultaneously influence DPO work effectiveness as big as 61.4% in the range of 0.50-0.75. Whereas the R-square value of cargo backload optimization variable is 0.681 or 68.1%. So, the variable of DPO training, DPO certification, and DPO work effectiveness simultaneously and strongly influence cargo backload optimization as big as 68.1 percent which is in the range of 0.50-0.75. The result of $Q\text{-}_{square}$ test shows that the values of Q-square predictive relevance are 0.383 and 0.459. So, it can be concluded that the model has fulfilled the predictive relevance because it is > 0. Based on the result of F Square test, having medium size of effect with the criteria of F_{square} 0.15-0.35, the influence of training variable on DPO work effectiveness is 0.285, certification on DPO work effectiveness is 0.310, and certification on cargo

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backload optimization is 0.310. The convergent validity test is presented in Figure 2:

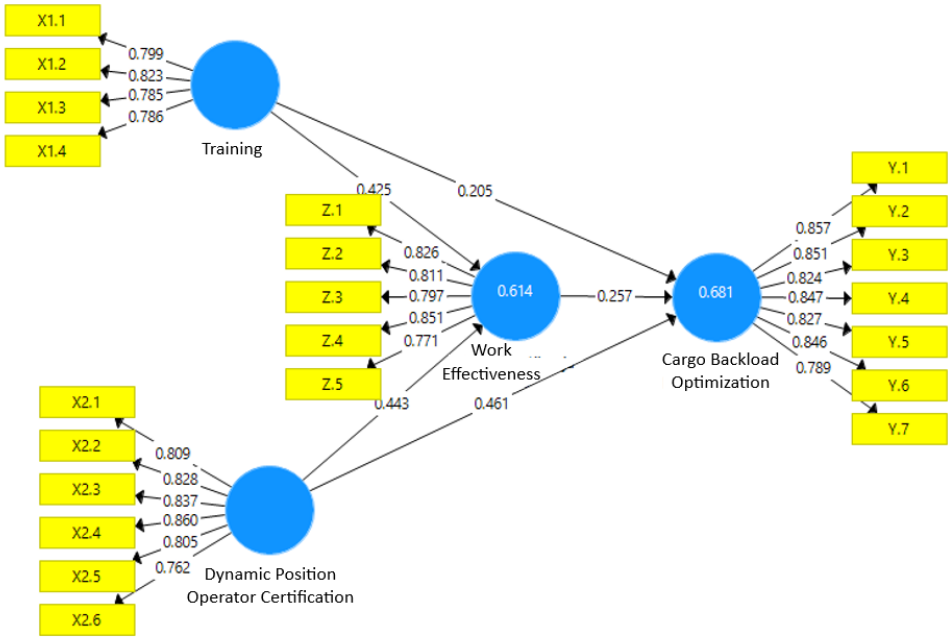

Figure 2: Result of PLS Algorithm

4.3 Result of Direct Influence Hypothesis Test

The direct influence hypothesis test is used to measure the direct influence of independent variable on dependent variable and the influence of intervening variable on dependent variable (Table 1).

Table 1: Result of Direct Influence Hypothesis Test

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T (|O/STDEV|)	P Values	Conclusion
H1 Training -> Cargo backload optimization	0.205	0.210	0.094	2.175	0.030	Accepted
H2 Certification -> Cargo backload optimization	0.461	0.458	0.119	3.869	0.000	Accepted
H3 Work effectiveness -> Cargo backload	0.257	0.246	0.101	2.553	0.011	Accepted

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H4 Training -> Work effectiveness	0.425	0.419	0.074	5.762	0.000	Accepted
H5 Certification -> Work effectiveness	0.443	0.436	0.089	4.958	0.000	Accepted

Table l presents the direct influence hypothesis test among variables that can be concluded in some points as follows:

Hypothesis 1. Training dan Cargo Backload Optimization

The influence of DPO training variable on cargo backload optimization shows the $t\text{-}_{statistics}$ value as big as 2.175 > 1.662 with the P_{value} as big as 0.030 < 0.05. Then, $t\text{-}_{statistics} > t_{table}$ with the $P_{value} < 0.05$, making the result of this first hypothesis test accepted and DPO training is stated as positively and significantly influencing cargo backload optimization. The result of this research indicates that the training held appropriately by the DPO actors in the SV ship will give a positive impact to cargo backload optimization of SV ship in the region of Aramco Saudi. So, the better the training is held by DPO actors, the better the cargo backload process will be. The result of the first hypothesis test is in line with the opinion of [26] that the existence of training for DPO ensures the cargo backload operation will run better. Thus, based on some results of the previous researches, it can be concluded that the result of the first hypothesis test related to DPO training positively and significantly influences cargo backload optimization.

Hypothesis 2. Certification and Cargo Backload Optimization

The influence of DPO Certification variable on cargo backload optimization shows the value of $t\text{-}_{statistics}$ as big as 3.869 < 1.662 with P_{value} as big as 0.000 > 0.05. With $t\text{-}_{statistics} < t_{table}$ and $P_{value} > 0.05$, the result of the second hypothesis test is accepted and DPO certification is said to influence cargo backload optimization positively and significantly. The result of this research indicates that the existence of DPO certification assures the procedure of cargo backload in the region of Aramco Saudi. The result of the second hypothesis test is in line with the opinion of [27] that the captain assisted by ship officers who have had DP or DPO certificate is very useful for the operation of DP System. A dynamically positioned ship is defined by International Maritime Organization and certification class institute as the ship which maintains its position and direction exclusively by means of active encouragement. Therefore, the certification owned by DPO will make the process of cargo backload in SV ship run well. Thus, based on some results of the previous researches, it can be concluded that the result of the second hypothesis related to DPO certification influences backload optimization positively and significantly.

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Hypothesis 3. Work Effectiveness and Cargo Backload Optimization

The influence of DPO work effectiveness variable on cargo backload optimization shows the value of $t_{\text{-statistics}}$ as big as 2.553 > 1.662 with P_{value} as big as 0.011 < 0.05. So, with $t_{\text{-statistics}} > t_{\text{-table}}$ and $P_{\text{value}} < 0.05$, the result of the third hypothesis test is accepted and DPO work effectiveness is said to influence cargo backload optimization positively and significantly. The result of this research indicates that the higher the level of DPO work effectiveness, the higher optimization of backload positioning will be resulted. This is in line with the research of [1] that good performance of DPO will make the cargo backload process in the SV ship run optimally. Until now, most of the DP system has been used to position a drill ship in the deep water as well as for other offshore operations, such as support for diving and anchor handling. In addition, DP system is getting more implemented in tanker ships during the unloading operation using the units of production, storage, and floating unloading. Operation Safety always becomes the first consideration in the design and operation of DP system. To plan a safe and efficient operation, it is important to know the maximum condition of environment that can be borne by DP ship. During important operation such as drilling, oil production, and cargo discharging, the requirements for the precision of positioning is very high, whatever the environment condition. It is important to know the ship's ability in positioning called DP Capability to plan and implement the operation safely. So, based on the results of some previous researches, it can be concluded that the result of the third hypothesis test related to DPO work effectiveness is said to influence cargo backload optimization positively and significantly.

Hypothesis 4. Training and Work Effectiveness

The influence of DPO training variable on DPO work effectiveness shows that the value of $t_{\text{-statistics}}$ is as big as 5.762 < 1.662 with P_{value} as big as 0.000 > 0.05. With $t_{\text{-statistics}} > t_{\text{-table}}$ and $P_{\text{value}} > 0.05$, the result of the fourth hypothesis test is accepted and DPO training is said to influence DPO work effectiveness positively and significantly. The result of this research indicates that a good training owned by DPO can enhance its work effectiveness, which is not in line with the findings of the research by [28], that there are no official requirements for DPO training on board the ship. The training held in a different scenario may cause a loss of varied position. Realistic training using simulator, for example, can enhance the ability of operator to detect the lost position earlier, diagnose it appropriately, and improve the decision making by strengthening the mental model owned by the operator concerning the system and operation of DP. Trainings for maritime officers are adjusted to meet the requirements so that seafarers in the future will be able to handle the critical situation in the maritime operation, independently and as a team [29]. So, based on the result of some previous researches, it can be concluded that the result of the fourth hypothesis test related to training DPO is said to influence DPO work effectiveness positively and significantly.

Hypothesis 5. Certification and Work Effectiveness

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The influence of DPO certification variable on DPO work effectiveness shows the value of $t_{-statistics}$ is as big as 4.958 < 1.662 with P_{value} as big as 0.000 > 0.05. With $t_{-statistics < t\text{-}table}$ and P_{value} > 0.05, the result of the fourth hypothesis test is accepted and DPO certification is said to influence DPO work effectiveness positively and significantly. The result of research indicates that the certification for DPO influences DPO work effectiveness in the Region of Aramco Saudi. Thus, with certification owned by DPO, it also impacts the decrease or increase of DPO work effectiveness. The result of the fourth hypothesis test is in line with the research finding by [23], [30], that DP system needs special skills and formal training for years and a number of active service hours at sea to be reliable to operate the system. Big shipping companies have a procedure of internal DP special for the ship and the system within it. This completes the international standard for DP. The result of this research is in line with the study by [31] explaining how the process of DP certification take place, that is how the entry requirements and training are in line with the recommended scheme of certification. All the participants are certified navigators with the rank of junior officers, chief officer, or master in the tanker ship where they work. So, the course participants are skilled seafarers, many of whom have worked as DPO for several years. The instructors are experienced seafarers who have worked in the sea for years and have deep knowledge not only about technology but also the job context. Thus, based on the results of several previous researches, it can be concluded that the result of the fifth hypothesis test related to DPO certification is said to influence positively and significantly DPO work effectiveness positively and significantly.

4.3 The Result of the Indirect Influence Hypothesis Test

The indirect influence hypothesis test in this research is used to evaluate the role of intervening variable in mediating the influence of independent variable on the dependent variable (Table 2).

Table 2: Indirect Influence Hypothesis Test

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T (|O/STDEV|)	P Values	Conclusion
H6 Training -> Work effectiveness DPO -> Cargo backload optimization	0.109	0.105	0.050	2.170	0.030	Accepted
H7 Certification -> Work effectiveness DPO -> Cargo backload	0.114	0.104	0.043	2.672	0.008	Accepted

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optimization

Table 2 shows the indirect influence test to see the role of intervening variable in mediating the influence of independent variable on dependent variable. So, it can be concluded in some points as follows:

Hypothesis 6. Training of Cargo Backload Optimization through Work effectiveness

From the indirect influence test of DPO training on cargo backload optimization through DPO work effectiveness, the value of $t_{\text{-statistics}}$ is 2.170 > 1.662 with P_{value} 0.030 < 0.05. So, the result of the sixth hypothesis test is accepted. Thus, it can be concluded that DPO training influences cargo backload optimization positively and significantly through DPO work effectiveness. The result of this research indicates that the training held by DPO supported by the increasing DPO work effectiveness will increase the cargo backload optimization in the region of Aramco Saudi. It means, the effective performance of DPO is able to mediate the influence of DPO training on cargo backload optimization. The result of the sixth hypothesis test is in line with the study by [31], that the training provided for DPO will increase their work effectiveness and can optimize the cargo backload process. It means, the design of training and learning process needs to be paid attention, not only the design of hardware and software being used [31]. Such a training allows the participants and trainers reflect together what is going on well and what is wrong during the simulator session. Thus, based on the results of several previous researches, it can be concluded that the result of the sixth hypothesis test related to DPO training influences cargo backload optimization positively and significantly through DPO work effectiveness.

Hypothesis 7. Certification on Cargo Backload Optimization through Work effectiveness

The indirect influence test of DPO certification on cargo backload optimization through DPO work effectiveness shows the value of $t_{\text{-statistics}}$ as big as 2.672 > 1.662 with P_{value} 0.008 < 0.05. So, the result of the seventh hypothesis test is accepted. It can be concluded that DPO certification influences cargo backload optimization positively and significantly through DPO work effectiveness. The result of this research indicates that the certification owned by DPO supported by the increasing DPO work effectiveness will also enhance the cargo backload optimization in the region of Aramco Saudi. It means, the effective performance of DPO is able to mediate the influence of DPO certification on cargo backload optimization. The result of the seventh hypothesis test supports the opinion of [30] that DPO certification describes the professional profile of DP operator. Therefore, certification becomes a key for DPO to perform their job. It is very clear that certification is resulted through trainings for DPO. With an effective performance the operational activities in any form, it can optimize one among others is the cargo backload process. So, based on some results of previous researches, the result of the seventh hypothesis test can be concluded that DPO certification influences cargo backload

optimization positively and significantly through DPO work effectiveness. Based on the discussion on the influence of four variables studied, mainly training, certification to enhance the effectiveness of DPO especially on the cargo backload optimization in the Supply Vessel ship, by which this research has been simultaneously considered as a research novelty. In addition, by using some operational dimensions in the variable of optimization, namely cargo backloading process, level of cargo capacity utilization, speed of cargo backload process, and accuracy of schedule management, cargo backload is also a novelty in the use of operational dimension in the Supply Vessel.

5. CONCLUSION

Based on the result of research and discussion described above, this research concludes that DPO training proves directly to influence positively and significantly the cargo backload optimization of Supply Vessel in the Region of Aramco Saudi. DPO certification proves directly to influence positively and significantly the cargo backload optimization of Supply Vessel in the Region of Aramco Saudi. DPO work effectiveness proves directly to influence positively and significantly the cargo backload optimization of Supply Vessel in the Region of Aramco Saudi. DPO training proves directly to influence positively and significantly the DPO work effectiveness of Supply Vessel in the Region of Aramco Saudi. DPO certification proves directly to influence positively and significantly the DPO work effectiveness of Supply Vessel in the Region of Aramco Saudi. DPO work effectiveness can indirectly become the mediator for the influence of DPO training on the cargo backload optimization of Supply Vessel in the Region of Aramco Saudi. DPO work effectiveness can indirectly become the mediator for the influence of DPO certification on the cargo backload optimization of Supply Vessel in the Region of Aramco Saudi. The result of this research proves that all the independeny variables show positive and significant influence on both intervening variable and dependent variable. And the intervening variable is able to mediate the relations in this research.

This research recommends the Supply Vessel in the Region of Aramco Saudi to be able to organize trainings and certification for DPO to enhance effective performance which, in turn, caan optimize the process of cargo backload. The recommendation for further research is to use the variable of training and certification as the predictor influencing the DPO work effectiveness and the optimization of cargo backload process. Operators should be able to implement the techniques of decision making for: (1) evaluating the situation and risk, (2) identifying and considering the resulted options, (3) choosing actions, and (4) evaluating the effectiveness of result. Besides, the recommendation for further research is to develop different research objects and the variables outside this research because it is detected there are other factors influencing the DPO work effectiveness and the optimization of cargo backload process.

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