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Commercial and strategic aspects of the offshore vessels market

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Abstract

The offshore oil & gas industry is one of the most important industries in the world and has a direct impact, either positive or negative, on the global economy. In order to ensure continuous exploration and production, various offshore installations must be supplied with all the necessary materials and cargo on a regular daily basis. The most convenient way to do this is by using different types of offshore supply vessels, which constitute one of the most expensive factors in the logistics supply chain in the offshore oil and gas industry. Reliable, cost-efficient, environmentally friendly transport and technically "fit for purpose" offshore vessels are the goal of any oil & gas company. This article presents a review of the offshore oil & gas market and the business strategy which includes offshore supply vessels. The research includes SWOT analyses to emphasize the advantages and challenges in the oil & gas industry and presents the correlation between the crude oil price and the daily rate of offshore vessels and aims to predict future movements in the market.

Introduction

Offshore supply vessels (OSV) play a major role in the logistics support chain. OSVs are usually chartered rather than owned by the oil companies; however, the oil companies decide if an OSV is to be hired, as well as the type and duration of the contract, the use of the vessels and the size and type. Also in practice, activities such as scheduling and routing are the responsibility of the oil company. In the oil & gas industry, there are two types of logistics which are related to exploration and production. One of these is „downstream logistics", which is defined as bringing oil and gas to onshore customers. „Upstream logistics" is defined as supplying offshore units, production, and drilling, with the necessary liquid, bulk, and deck cargo. The important issues in upstream logistics, which OSVs are a part of, are supporting offshore oil & gas activities so that these can be carried out as per the drilling and production schedule and in a cost-efficient way. So that they can operate in remote offshore locations, offshore drilling and production units need different types of support services that are provided by specialized offshore vessels.

The daily rate for such offshore drilling and production units depends on the purpose, size and duration of the contract; shallow or deep water utilization can vary, and the rate can go up to $400,000. The charterer controls the movement of the vessel, the planning schedule and routing and they try to keep the OSVs busy and keep the offshore units supplied 100% of the time.

The main task of the charterer is to make sure they have a fleet that is capable of meeting any planned or unplanned demand, regardless of whether it is for short or long term projects. One day of lost production or drilling activities usually covers several days or months of the daily rate for a particular OSV.

This paper presents a literature review and research on offshore oil & gas installations and vessel types, as well as utilization and day rate, contracting and marketing strategy (charterer vs. owner), and a SWOT analysis.

Literature review

Scientific research in the planning of the structure of a fleet of vessels can be divided into two groups: Vessels working offshore and vessels engaged in the shipping industry. Research on the offshore vessel industry is a relatively new discipline and there have not been many articles published in scientific publications or books.

The first research related to OSV fleet modeling appeared in 2000 for oil & gas installations in the Norwegian Sea, where the authors (Fagerholt & Lindstad, 2000) investigated the effectiveness and the expenses of the supply of those units as well as an optimal weekly routing plan for the vessels.

Aas et al. (Aas, Halskau & Wallace, 2009) searched for the "ideal offshore vessel" and described OSVs in the offshore oil & gas industry as the most important and most expensive factors in the logistics chain. Taking into consideration the total vessel capacity in the field, the voyage duration and the time for cargo manipulation (loading & offloading), the authors calculated the total vessel expenses for operators in the Norwegian Sea. Utilization of OSVs can be increased by using a better routing plan but there is no mathematical model to confirm these statements.

For his Master's degree thesis, Rose R.S.K (Rose, 2011) researched the development and future design of offshore vessels and the possibility of minimizing the total expenses of the vessels while fulfilling all of the requirements of the offshore units; he assumed that future drilling and production activities will move to deeper water. His scenario and mathematical calculations are based on supplying two drilling platforms and three production platforms. For fleet modeling, Rose used the Mixed Integer linear Program (MIP).

Halvorsen-Weare et al. (Halvorsen-Weare et al., 2012) studied the optimal offshore vessel fleet size and type. They also studied weekly sailing schedules for the constraints set by Statoil, a Norwegian oil & gas company. With the constraints that offshore installations are closed at night and vessels do not depart from port on Sundays, the mathematical model that they developed shows the possibility of a reduction in the fleet as well as significant savings over a year.

Another research study by Pantuso et al. (Pantuso, Fagerholt & Hvattum, 2014) investigated the total expenses of supplying offshore units that are closed overnight to evaluate the optimal policy of OSV routing. Taking into consideration six various scenarios, the authors calculated the working hours and the amount of supplies needed during a week; the algorithm was constructed for such a calculation.

The optimal model for supplying offshore installations has been described in the literature (Maisiuk & Gribkovskaia, 2014) where the main issue was bad weather and the OSVs could not be utilized and routed as previously planned. In such cases, the need for more vessels is compulsory and replanning is required. The location of the installations, the number and the frequency of vessels visiting the installations and the total cargo will determine the requirements. The capacity of the vessels, the sailing time, and the operating hours of the offshore installations will determine the constraints. The authors recommend a weekly planning schedule with a few routing options for all of the vessels in the field, due to restrictions caused by the weather conditions, but with an acceptable cargo delivery time.

A vessel engaged in supplying several offshore installations with different types of cargo coming from the same location was the topic of the research carried out by Sopot, E. and Gribkovskaia, I. (Sopot & Gribkovskaia, 2014). Any installation could be visited a maximum of two times during a single voyage; there was no option of transferring cargo between offshore installations. In their mathematical model, the authors presumed that all of the cargo loaded onshore satisfied the demands of the offshore installation until the vessel returned to port. The authors insisted that all of the cargo loaded in the port must be offloaded during the first visit to the offshore installations.

As reviewed briefly above, most of the published articles are from Norwegian authors and Statoil made a huge contribution to those studies. It is very important to mention that most of the demands were set by Statoil and the calculations in the studies were mathematically processed based on the demands and constraints that were set by the oil Company.

Offshore supply vessels and offshore installations

Offshore supply vessels (OSV) come in different types, sizes and designs and are the most important factor in the offshore logistics supply chain. As per the type, the main classifications of OSVs are Anchor Handling Tug Supply vessels (AHTS), Platform Supply Vessels (PSV), Fast Supply Vessels

(FSV) and Multi-Purpose Supply Vessels (MPSV) (Sarthy & Ham, 2005).

AHTS vessels (Figure 1) play the main role in the offshore oil & gas vessels industry and, in general, are multipurpose vessels. The vessel is equipped with a work wire and winches to run anchors for jack up rigs, semi-submersible rigs, accommodation barges and Floating Production Storage and Offloading units (FPSO), they also carry out rig moves, barge moves and tanker lifting during crude oil offloading operations, as well as towing and any other job that may be required from this type of vessel. A jackup rig or a self-elevating unit is a type of mobile platform that consists of a buoyant hull fitted with a number of movable legs, which is capable of raising its hull above the surface of the sea (ABS, 2008). A semi-submersible rig is a column-stabilized floating offshore structure, which consists of a deck structure with large diameter support columns that are attached to submerged pontoons (ABS, 2008). Like PSVs, an AHTS can carry deck, bulk (cement and barite) and liquid cargo (mud, potable water, drilling water, brine, and fuel) for offshore installations. Due to the additional equipment and the very expensive maintenance, AHTS vessels have a higher daily rate then PSVs. There is a difference in design between an AHTS and a PSV, which is that an AHTS has an open stern to allow the transfer of towing and work wires. AHTS vessels require more horsepower (HP) to ensure there is sufficient bollard pull (BP) for towing and anchor handling operations. BP is a conventional measure of the pulling or towing power of a towing vessel. AHTSs come in different sizes and can be summarized into four categories depending on the vessel's HP; small 4,000–9,999 HP, medium 10,000–14,999 HP, large 15,000–19,999 HP and extra large 20,000 HP and over (Daleel – Oil & Gas Supply Chain Portal, 2018).

Figure 1. AHTS "Lewek Petrel" in tow (EMAS, 2015)

PSV (Figure 2) is a broadly defined term that includes vessels specifically designed to carry supplies to and from offshore installations (Rose, 2011). PSVs do not carry anchor handling equipment and have a large deck area to accommodate large drilling cargo such as casing and drilling pipes. PSVs can carry similar types of bulk and liquid cargo but in slightly larger quantities in below deck storage tanks. PSVs can be grouped into three size categories based upon deadweight or cargo deck area: small, medium and large. PSVs generally range from 45 m to 105 m in length and can accommodate as many as 36 passengers.

Figure 2. PSV "Seacor Resolute" in navigation (Fleet | SEACOR Marine, 2020)

FSVs or crew boats (Figure 3) are fast boats that carry offshore workers to and from offshore installations. Apart from carrying passengers, they can be used to carry a small emergency cargo as well. A typical FSV is built from lighter materials (aluminum) and can carry between 36 and 149 passengers. The speed of such vessels can exceed 40 knots and are from 33 m to 66 m in length. This type of vessel and their speed is very helpful in reducing a drilling or production unit's shutdown time in case of an emergency. The fast response of an FSV during this period can save millions of dollars. The vessel also helps to minimize the cost of transporting passengers by helicopter, as they are quite costly.

Figure 3. FSV "Seacor Cheetah" in navigation (Fleet | SEACOR Marine, 2020)

MPSVs (Figure 4) can be considered to be a subgroup of AHTS vessels. MPSVs are designed with flexibility and versatility in mind; this type of vessel is mostly utilized in construction and subsea jobs, as well as maintenance of offshore platforms, Remote Offshore Vehicle (ROV) activities, diving operations, and well intervention support. ROVs are remotely operated underwater vehicles and are a tethered underwater mobile device used for underwater surveying. MPSVs have a large deck crane and their technology is of a higher level than other offshore vessels. Typically MPSVs operate in deep water or where the scope requires higher capabilities (crane, DP-2/3, ROV, accommodation, and a helideck).

Figure 4. MPSV vessel "Holiday" in navigation (ECO | Offshore Service and Supply Vessels, 2020)

The structure of the worldwide offshore fleet is shown in Tables 1 and 2 for 2011 and 2018 respectively. The total number of OSVs in 2011 was 5650 with a Gross Tonnage of 6,727,115 (GT), (Rose, 2011). The total number of OSVs by 2018 was 4559 with 9,337,700 GT (Clarksons Research, 2019). From the Tables, it can be seen that the number of OSVs had reduced in 2018 but the GT had significantly increased due to a change in the design of the OSVs which are now bigger than before. Offshore exploration and production activities had already moved into deeper water, further from shore, and as a result the supply requirements had significantly increased which consequently increased the size of the OSVs.

Table 1. Fleet size by vessel type (Rose, 2011)

Vessel type	Number of vessels	GT
AHTS	2900	4,276,783
PSV	1829	2,226,070
FSV	921	224,262
TOTAL	**5650**	**6,727,115**

Table 2. Fleet size by vessel type (Clarksons Research, 2019)

Vessel type	Number of vessels	GT
AHTS	2541	4,897,900
PSV	1652	4,276,500
FSV	393	163,300
TOTAL	**4559**	**9,337,700**

Common to all modern types of OSVs is the use of the Dynamic Positioning System (DP). DP is a computer controlled system that automatically maintains a vessel's position and heading using its own propellers and thrusters. The system automatically triangulates signals from Global Positioning System (GPS) satellites and/or other positioning systems, such as Fanbeam, CyScan, Artemis, Taut wire and Acoustics, in order to maintain the vessel's position within a circle with a radius of 1 m to 3 m allowing the vessel to maneuver very near to offshore installations or to carry out subsea jobs. There are three classes of DP systems, DP I, DP II and DP III. The vessel's DP class depends on the installed equipment and the level of redundancy in the DP system.

In addition to the DP system, most of the newly built offshore vessels have diesel-electric propulsion. This type of propulsion differs from traditional propulsion systems in that multiple diesel engines each drive an electric generator producing electrical power that energizes a motor connected to the propellers. This provides efficiency (fuel & emissions) benefits because not all diesel engines will be turned on when the load is low. In addition, even where one engine fails, power can still be transmitted to both shaft lines.

OSVs supply several types of offshore installations (Figure 5) involved in exploration & production and include: 1, 2. conventional fixed platforms (the deepest: Shell's Bullwinkle in 1991 at 412 m, Gulf of Mexico (GOM)); 3. a compliant tower (the deepest: ChevronTexaco's Petronius in 1998 at 534 m, GOM); 4, 5. a vertically moored tension leg and mini-tension leg platform (the deepest: ConocoPhillips' Magnolia in 2004 at 1425 m, GOM); 6. Spar (the deepest: Dominion's Devils Tower in 2004 at 1710 m, GOM); 7, 8. Semi-submersibles (the deepest: Shell's NaKika in 2003 at 1920 m, GOM); 9. floating production, storage, and offloading facility (the deepest: 2005 at 1345 m, Brazil); 10. sub-sea completion and tie-back to host facility (the deepest: Shell's Coulomb tie to NaKika 2004 at 2307 m).

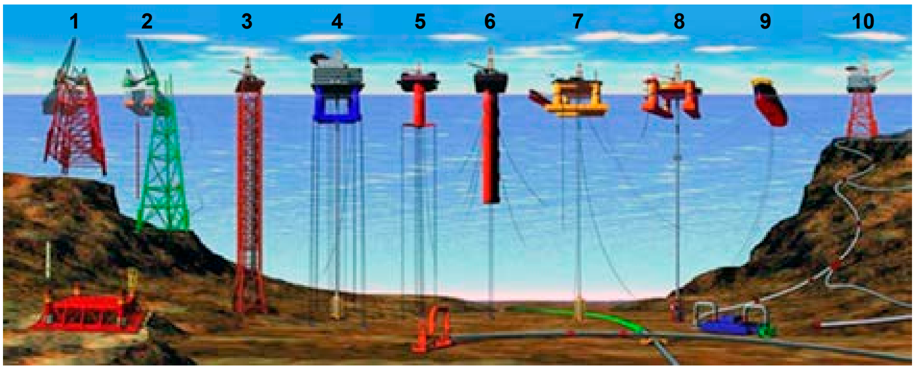

Figure 5. Type of offshore installation (Earthly Issues, 2010)

Offshore market and contract strategy

The offshore vessel market mirrors the crude oil production market and the rates have shown some similarities with the broader fluctuations in the crude oil price per barrel (Skoko, Jurčević & Božić, 2013). The number of chartered OSVs has a close relationship with the chartered offshore units that are engaged in exploration and production. During crises in the oil & gas industry, most of the offshore units are out of work and on standby. Consequently, during this time OSVs will be in lay-up without a job as well. In 2017, the ratio between the number of OSVs and rigs was 8:1 which caused an oversupply of OSVs. This held the daily rates of OSVs and therefore the utilization down at some of the lowest levels ever seen (Daleel – Oil & Gas Supply Chain Portal, 2018). Due to the unpredictability of the crude oil price, for a proper long term strategy, an OSV owner will try to ensure the day rate through a long term charter and BIMCO (Baltic and International Maritime Council) contract.

OSVs on long term charter have a lower day rate than on the spot market; however, with a long term charter, the vessel's contract will be secured for a long period of time. OSVs on the spot market or short contracts are on standby most of the time waiting for a job. Since the crisis in the oil & gas sector started in 2015/2016, the OSV day rate has not shown significant signs of recovery (Figures 6 and 7).

An oversupply of OSVs and a low level of utilization is a major problem that owners are faced with. A lack of jobs and a low day rate will cause a lot of problems for the owner and he will not be able to cover the daily running costs of his vessel. In order to be able to cover a vessel's costs, the owners must react more aggressively to the market. Competition between owners and the business positions between the owner and the charterer are a major factor when planning and hiring OSVs. Five factors must be considered during a negotiation period between the parties (Daleel – Oil & Gas Supply Chain Portal, 2018):

Figure 6. Price of crude oil per barrel (2000–2020) (MacroTrends, 2016)

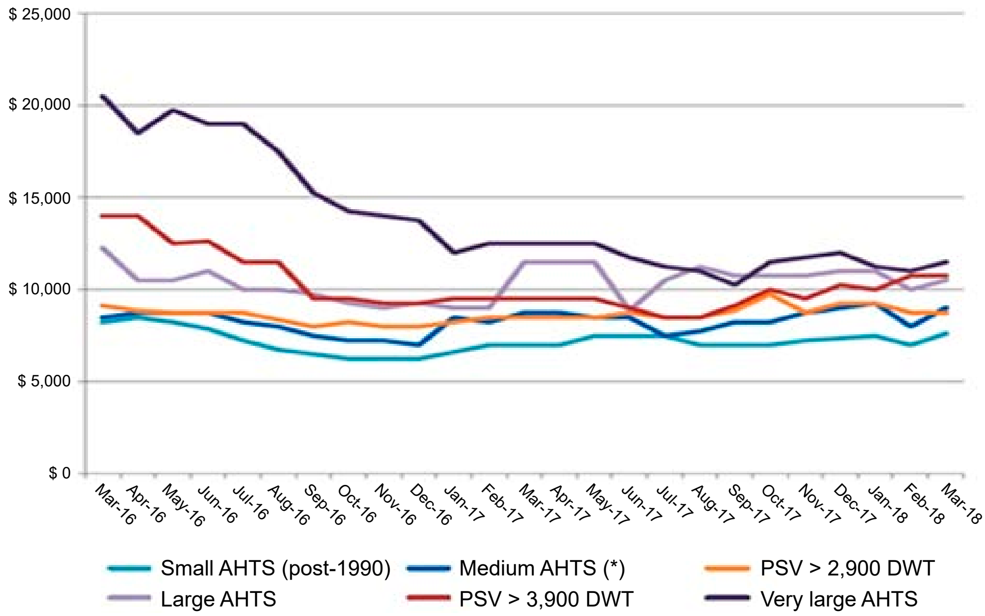

Figure 7. Day rate for AHTS/PSVs in the West Africa market (Riviera, 2018)

1. The threat of New Entry,
2. The threat of Substitution,
3. Buyer's Bargaining Power,
4. Industry Rivalry,
5. Supplier's Bargaining Power.

Due to the competitive nature of the market and the recent crisis in the oil & gas industry, OSVs owners are operating at close to breakeven. The breakeven point of PSVs is $8,000 to $10,000 per day and for an AHTS it is $10,000 to $15,000 per day. As can be seen in Figure 8, for a PSV, 59% of the total cost is the operating costs. The rest of the costs are interest 6%, overheads 12%, and depreciation 23%.

As already mentioned before, the typical contract between an owner and a charterer in the oil & gas industry is a BIMCO contract. In preparation for tender and signing the contract, both parties carry out market research; a typical OSV contract is managed via a Time Charter. Table 3 has shown a summary of the contracting methods and the Owner's & Charterer's liabilities for BIMCO Contracts.

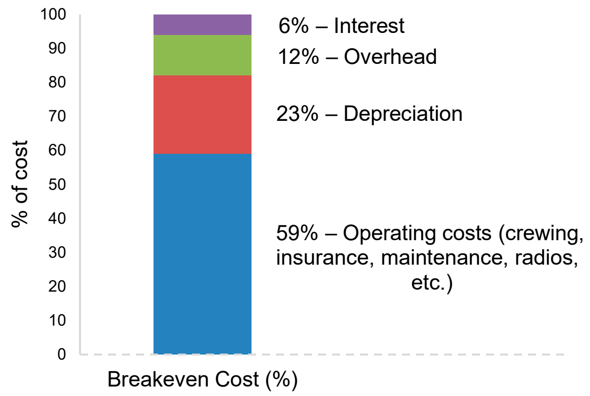

Figure 8. Cost and price analysis (Daleel – Oil & Gas Supply Chain Portal, 2018)

The owner prefers a Supplytime contract and his liability is to provide a vessel, crew, maintenance, dry dock, insurance and everything else that is

Table 3. Contracting methods (Daleel – Oil & Gas Supply Chain Portal, 2018)

Parameter	Time	Voyage	Bareboat
Description	Per day or duration of time	Per trip/voyage	Vessel hull & machinery only
Operational preference	Preferred	Not preferred	Not preferred
Vessel Owner's responsibility	Vessel crewing, maintenance, insurance	Vessel crewing, maintenance, insurance, Port charges, bunkers	Vessel only
Charterer's responsibility	Port charges Cargo loading & discharge bunkers	Cargo loading & discharge	Crewing, maintenance, Insurance, Port charges, Cargo loading & Discharge, bunkers
Calculation of the charges	Daily hire rate	Lump sum per voyage or based on cargo	Monthly lump sum payment
Standard form of the contracts (BIMCO)	SUPPLYTIME	GENCON	BARECON

connected to the vessel's certification and classification. All other costs related to the operating costs such as fuel, port charges, cargo manipulation, pilotage, even towing equipment that been used during the charter, is the charterer's responsibility. The charterer pays a day rate and sometimes, depending on delivery distance, both mobilization and demobilization fees. Some owners will waive the mobilization and demobilization fees if an available vessel is close by.

SWOT analysis (Strengths/Weakness/Opportunities/Threats) is an appropriate tool to assist the Owner & Charterer during their future business planning. SWOT analysis is a strategic planning technique that can be used to help a person or organization to identify the strengths, weakness, opportunities, or threats to the completion of their business or project planning. SWOT analysis is usually applied to identify the critical internal and external points of an organization to support the best strategies in order to focus on its strengths, minimize its weaknesses, mitigate threats and take the greatest possible advantage of the available opportunities (Balamuralikrishna & Dugger, 1995). Table 4 presents a SWOT analysis for the oil & gas industry based on research and historical data.

Based on the authors' analysis above, it is obvious that the crude oil price is unpredictable and consequently the OSV day rate is as well. For owners, it is better to sign a long term contract to secure employment for a vessel even when the spot rate is higher than the long term rate. Due to political and other non-economic reasons, business in the oil & gas industry is very risky and unpredictable. A recent example and reasons for the collapse in the crude oil price is the COVID-19 pandemic as well as economic and political conflict between OPEC (Organization of the Petroleum Exporting Countries) members and non-OPEC members, which has brought the price down to less than $30 per barrel in March 2020.

Conclusions

The end customers for supply vessels are offshore drilling and production units. Logistics is an important concern for oil companies but it is not a core activity. Consequently, there is a low level of formal knowledge about supply vessels and their properties, particularly outside the industry. A few articles have been published about supplying offshore installations. However, the focus has mainly been on the routing problem, not the supply vessel or the fleet structure itself. Hence, the approach that has been taken thus far has described supply vessels in a simplified way and focused on routing alone. However, a different approach is needed if the aim is to find a vessel that is better suited to the task, or new vessel types and fleet structure contributing to better utilization and lower total fleet costs.

OSVs play one of the most important roles in the offshore oil & gas logistics supply chain. At the same time, they are one of the most expensive links in the logistics chain. As multipurpose vessels, AHTS are

Table 4. SWOT analysis for the oil & gas industry

S – Strengths	W – Weakness
• Experience in deep-sea operations and difficult working conditions • Internationally recognized and very specialized industry with special knowledge required • Very experienced and well educated staff • Cluster character	• High cost of production • Age of offshore installations • Low production • No cooperation between oil & gas companies • No common projects and exchange of knowledge between business subjects • Oversupply of OSVs due to low production and fewer rigs • Lack of logistics competence of the logistics planners within the oil companies • Lack of logistics research with a focus on supply vessels and their routing • Environmental challenges
O – Opportunities	**T – Threats**
• Discovery of a new oil fields • Export of products, equipment and new know-how to the worldwide market • Build new OSVs with new technologies • Build new drilling and production units with new technologies • New exploration and production technologies • New jobs	• Unpredictable crude oil price (falling oil price) • Falling price due to discoveries of crude oil from tar sands and crude slate • growth in the Asian economies • Political instability or war in oil rich countries • Natural or health disasters • Alternative energy sources

the most used and the most expensive vessel in the oil & gas industry; they are specialized for certain jobs such as tanker lifting, rig moves, barge moves, anchor handling, diving, construction, and subsea jobs. PSVs are built for supply only and as such have a lower day rate than an AHTS. FSVs are the smallest offshore vessels and can be used for crew changes and emergency cargo due to their high speed.

The OSV day rate depends on supply and demand, as well as political stability which have a direct impact on the crude oil price, especially in oil rich economies. Long or short term contracts also have a direct influence on the OSV day rate. With a couple of years of advance planning, an owner can secure favorable terms and conditions by signing a BIMCO contract for a particular project. BIMCO Supplytime is the most commonly used vessel contract and is preferable for OSV owners because it protects the vessel owners more than the charterer. Due to the global recession in the oil & gas industry, OSV day rates are at a very low level and are at the breakeven point. The high value of production and the high cost of delaying offshore operations dictate the design of the upstream chain as well as the number and type of OSVs.

SWOT is a strategic planning technique that can be used to help a company to identify its strengths, weakness, opportunities, and threats to business planning and completion of any project. It is a good tool to assist the owners and the oil & gas company in better planning of their future business.

The offshore vessel market is closely correlated with the crude oil market which can experience significant daily fluctuations, and as such is unpredictable.

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