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Transportation Economy
Review
Accepted: Mar. 12, 2013
Approved: Sep. 24, 2013

LOGISTICS ASPECT OF OFFSHORE SUPPORT VESSELS ON THE WEST AFRICA MARKET

ABSTRACT

With the rapidly increasing global energy needs, offshore oil production has become an attractive source of energy. Supplying offshore oil production installations is a complex logistics problem that hinges on many factors with significant uncertainties. So, it is critical to provide the necessary supplies and services without interruption. In a typical offshore oil production effort, oil companies charter most or all drilling units as well as offshore supply vessels (OSV). The type and duration of charter contract has direct impact on the project budget as vessels market is closely correlated with the world market crude oil price which can have daily significant fluctuations. As the region of West Africa is one of the world's busiest offshore exploration and oil production markets employing 12% of the world's fleet, exploring its issues, was taken to study the relations between daily OSV rates and crude oil price. The research results presented in this paper show correlation between OSV daily rates and crude oil price with broader fluctuations in crude oil price.

KEY WORDS

logistics planning, offshore supply chain, offshore vessel market, vessels day rate, oil production

1. INTRODUCTION

Today's offshore oil and gas industry is one of the most important industries in the world with direct impact on economies worldwide. Approximately 59 percent of all energy consumed worldwide is produced from oil and natural gas [1]. A review of current industry practices and literature suggests that offshore exploration and production activities will move into deeper water further from shore and as a result supply requirements will increase significantly [2, 3]. The offshore environment differs from land-based oil production scenarios as equipment is exposed to water and installations and crew must be supplied by ship or helicopter. Supplying offshore oil production installations is a complex logistics problem that hinges on many factors with significant uncertainties. In logistics chain support to the rigs regardless of deep or shallow water activities OSVs play a major role. The basic logistic support in offshore business reflects through technological, operational and financial planning. While operational planning depends more on onshore region local support, technological and financial planning lies on the duration of the BIMCO Contract (BIMCO- Baltic and International Maritime Council) and project planning demands.

The main factors that affect a vessel's marketability are day rates, mobilization and demobilization fee. As type and duration of charter contract have direct impact on the project budget the oil companies or charterers weigh these factors against budget forecasts prior to vessel selection. The vessels market is closely correlated with the world market crude oil price which can have daily significant fluctuations. In case of oil rig equipment failure, repairs must be made quickly, which puts pressure on the delivery of emergency spare parts. In addition, an offshore oil production platform requires routine deliveries of a number of supplies. Offshore activities can be broken down into drilling and production. In general, production is a long-term endeavour with facility lifetime of 30 years and steady-state demands. Drilling and exploration, on the other hand, involve much more dynamic and uncertain demands as well as a greater variety of marine services and equipment [4].

The charterers pay a daily rate to keep rigs and vessels on charter, but commit to longer periods on the order of years at the time of charter although vessels are also available for short-term charter on the spot market. Responsibilities for rigs and vessels scheduling lie on the charterers, and as daily rates can be very high, even up to $400,000 per day, it is in the best interest of the charterers to keep drills supplied 100% of the time. Because it can take a significant amount of time to hire a vessel on long-term charter the charterers must plan for future supply requirements and make sure that it has on charter a fleet capable of meeting any expected and unexpected demand. Specialized offshore vessels help oil companies achieve their budget projections throughout the entire process of exportation of crude oil.

This paper presents research on offshore oil and gas vessel market in a West Africa region and logic of logistics decisions for bonding drilling and production project budgeting.

2. OFFSHORE SUPPORT VESSEL

OSVs come in a variety of sizes, shapes and designs, and are the basic elements in crude oil supply chain. As many OSV designs are meant for specific roles or purposes, OSVs are generally classified into one of several common groups: Anchor Handling Tug Supply (AHTS), Platform Supply Vessels (PSV) and Fast Supply Vessels (FSV). Further in the text the basic purpose and working characteristics of each group are explained.

2.1. Anchor Handling Tug Supply Vessels

The AHTS has three main roles in the oil industry. It is equipped with a winch and work wire that enables the vessel to run anchors for semi-submersible oil rigs, pipe laying barges, accommodation barges, FSOs, FPSOs, as well as to tow rigs, barges and tankers during export operations. Moreover, the AHTS vessel has a cargo deck and below deck storage space similar to the PSV as supplying required cargo. On today's market, most charterers require fire fighting, oil spill containment and Emergency Rescue and Recovery Vessel (ERRV) capabilities on the vessel. The AHTS vessels demand higher day rates due to the specialized equipment fitted on their decks such as the mentioned winches and work wires. The utilization of these winches requires an open stern to allow the passing of towing and work wires. The work wires deploy and recover buoys, pennants and anchors over a stern roller. The AHTS vessel requires more horsepower than the traditional PSV to ensure there is sufficient bollard pull to complete the towing and anchor handling operations. The reference load used in the design and testing of the towing winch is twice the static bollard pull.

2.2. Platform Supply Vessels (PSV)

The PSVs are specialized in cargo delivery and have more cargo space as they do not carry anchor handling and towing winches. The larger deck capacity is favourable at the beginning and end of a production or drilling campaign as more cargo is required during these phases of the campaigns. PSVs carry similar types of below deck cargo as AHTS vessels, but in slightly larger quantities. Common below deck cargos carried on an AHTS and PSV are fuel, drill water, potable water, liquid mud, brine and dry bulk (cement, mud base products, etc.). The PSVs are known as the workhorses in the offshore oil and gas supply chain. Powerful and designed to maximize cargo capacity, they are capable of transporting everything used on offshore facilities. They carry large volumes of marine gas oil, bulk products, drilling fluids, potable water, drill pipe, chemicals, tools, food supplies and repair parts. The PSVs deliver tons of supply products as far as 200 nautical miles offshore and are built to work in extreme weather conditions. These vessels generally range from 45 meters to as much as 105 meters in length and can accommodate as many as 36 offshore workers.

2.3. Fast Supply Vessels

Fast Supply Vessels (Crew boats) are the shuttle buses of the offshore oil industry, carrying workers to and from offshore facilities. They are used primarily for their fast speed to carry passengers and smaller cargoes in a hurry. A typical Fast Supply Vessel can carry 36 to 149 offshore workers. These light, powerful vessels are often built of lighter aluminium and can travel at up to 40 knots. They range from 33 to 66 meters in length, and are built to carry limited amounts of cargo on a just-in-time basis. The use of the FSV helps to minimize the cost of transporting passengers, via helicopters, which are quite costly in comparison. The faster response time of the FSV minimizes costs of downtime when drilling and production campaigns are shut down due to the sudden requirement for urgent cargo that cannot be otherwise loaded on a helicopter due to weight restrictions. Fast respond of this type of vessels can save millions of dollars. In many cases, one day of production loss or a drilling rigs day rate can be justified by an entire month's hire rate of an FSV. Vessel marine crew rotations for all three types of vessels depend on the working area. Usual rotations in the West Africa area are equal time of two months on board and with two months of leave.

3. COMPOSITION AND ROLE OF OFFSHORE VESSELS IN LOGISTICS CHAIN

Although it is difficult to count every ship in service the existing OSV world fleet stands at 2,990 vessels and 4.1 million gross tons (*Table 1*).

Table 1 - World fleet size by vessel type

Vessel type	Number of vessel	GRT
AHTS	1,800	2,797,399
PSV	1,100	1,338,806
Crew boat	90	21,915
Total	2,990	4,158,120

Source: [2]

As can be seen AHTS and supply boats dominate the fleet in terms of gross tonnage. *Figure 1* also indicates that anchor handlers and supply are typically larger than crew vessels.

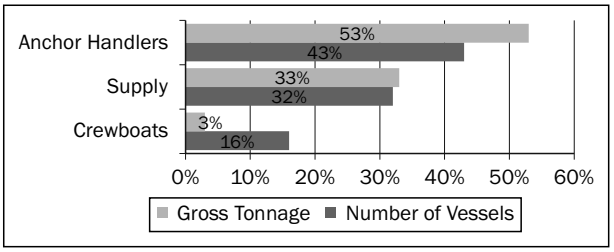

Figure 1 - OSV fleet composition by number of vessels and Gross Tonnage

Charterers rarely own their own marine vessels or drilling rigs so they outsource most of the equipment as well as logistic support and supply. That is the main reason why on today's market there are numerous different offshore vessel owners. The basic elements of offshore supply chain and the role of OSV, as well as cycle variable are shown in *Figure 2*.

Offshore supply chain elements are shore bases, supply vessels, drill rigs, production rigs and storage tankers. OSVs load and unload cargo in the port of convenience, where from shipments are then dispatched to the drilling and production facilities. The transit time to and from platforms and shallow water drilling rigs is generally less than deepwater locations. Due to extended transit time into deepwater areas the drilling and production facilities may require more support vessels to prevent interruption in operations.

The largest companies by quantity and quality of vessels as well as by logistical infrastructure operating in West Africa region in the offshore marine industry are Seacor Marine, Tidewater, Sanko and Bourbon Offshore [2]. These four companies hold nearly 80% of the offshore vessel in West Africa market. Most of the major International Oil Companies (IOCs), such as Total SA, ExxonMobil Company (ExxonMobil), Eni SpA, Royal Dutch Shell Plc (Shell), Chevron and BP Plc, have presence in the offshore West Africa region [2]. The West African National Oil Companies (NOCs) of various African countries are increasing their involvement in exploration and production activities. Sonangol E.P. (Sonangol), Nigeria National Petroleum Corporation (NNPC) and Ghana National Petroleum Corporation (GNPC) are some of the major NOCs with offshore operations in West Africa. In West Africa, Sonangol E.P. is one of the leading companies among IOCs and NOCs in terms of the number of exploration blocks it holds. The company had 31 active offshore exploration blocks in Angola in 2011 [5]. The average distance from onshore to the offshore operating blocks is 100 Nautical miles. In general, IOCs are dominant in the exploration activities of deep water offshore operations in West Africa, though NOCs are steadily increasing their presence. Both IOCs and NOCs are involved in the produc-

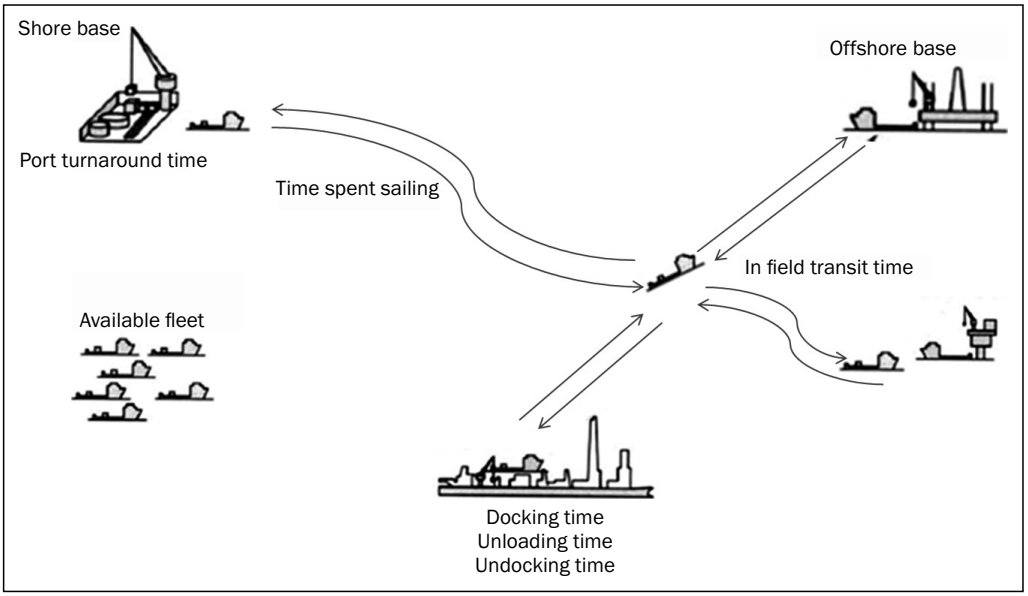

Figure 2 - Offshore supply chain elements

tion of crude oil and natural gas offshore West Africa. NNPC, a major NOC, recorded one of the highest crude oil and natural gas productions offshore West Africa at 185.9 MMboe in 2011 [6]. ExxonMobil Corporation, a major IOC, is a leading producer of oil and gas in Nigeria and Angola. The company recorded production of 221.1 MMboe across the whole of offshore West Africa [6]. In general, IOCs dominate in oil and gas production in offshore West Africa, though NOCs are also steadily gaining ground.

Crude oil prices are exposed to various speculations and geopolitical issues. These issues make oil futures difficult to predict. Oil companies create a 5-year plan for drilling campaigns. The outcomes of the drilling campaigns determine future production plans. The Marine Department as part of oil company logistics department works closely with both the drilling and production departments to ensure vessel requirements meet their intended efficiency and cost effectiveness.

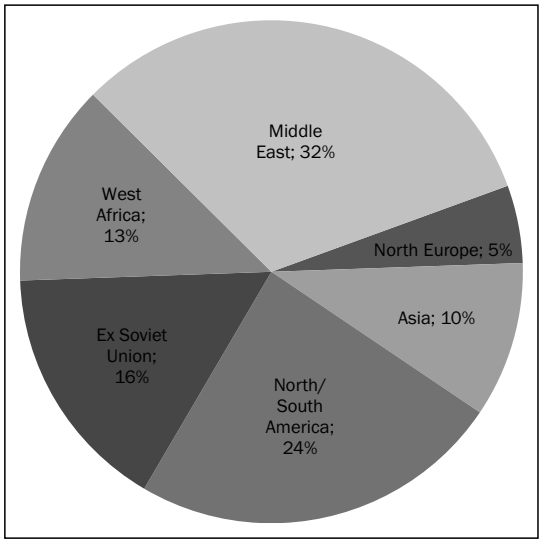

Figure 3 - Daily crude oil productions per regions

Source: [3]

4. WEST AFRICA OFFSHORE MARKET ANALYSIS

As it was said earlier West Africa region plays an important role in oil market with the share slightly more than 13% of world daily production. Today the price for one barrel of oil, which is 159 litres, is around $110. The daily production of crude oil worldwide is around 73,000,000 barrels [1, 2]. The West Africa region accounts for about 9,000,000 of those barrels [3]. At the same time, this region employs 12% of the world vessel fleet. These percentages confirm the level of importance of the West African markets. Other major areas in the offshore industry are North and South America, Mid East, Ex-Soviet Union, Asia and the North Sea (*Figure 3*). These areas show matching levels of production in comparison to the world fleet utilization. *Figure 3* shows daily crude oil productions per region.

The offshore vessels market mirrors the crude oil production market, but does not draw comparison to crude oil prices. Crude oil price history and AHTS day rates since 2001 are noted in *Figure 4*, which is explained later in the text.

In comparison, the rates show some similarity with broader fluctuations in crude oil prices (*Figure 4*). Changes in the AHTS daily rates are not as sharp as those of crude oil prices. The years 2010 and 2011 were difficult for the enormous majority of offshore supply vessel owners regardless of region or vessel type, with major exception of the South American - Brazil market. On some occasions, OSV owners fixed vessel day rates below the breakeven point to mitigate losses. Many experts were predicting that the market

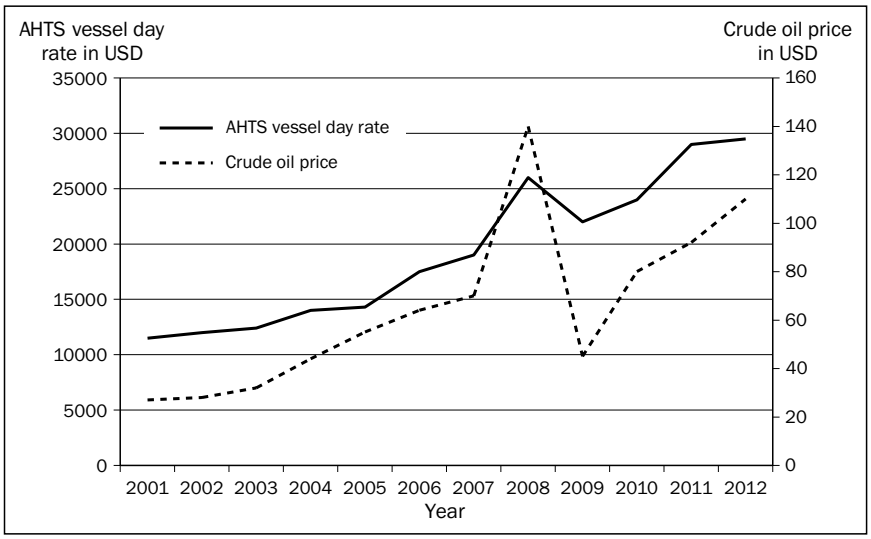

Figure 4 - An average crude oil and AHTS vessel day rate from 2001-2012

Source: Made by authors based on data from [3, 7]

Table 2 - West Africa average monthly spot availability from Sept. 2011 – Sept. 2012

Type	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
FSV	4.6	5.0	4.25	3.0	2.5	4.0	6.6	6.75	5.4	3	4.25	4.4	2.75
Small AHTS	6.0	5.75	7	7.6	7.75	7.0	7.4	6	7	4	6.5	9	6.5
Medium AHTS	0.8	1.75	1	2.6	2.75	3.5	1.4	1.5	4.8	1.5	1.75	2.8	1.75
Large AHTS	1.4	5	2.25	0.6	2.75	5.5	2.2	0.75	2.2	1	2.25	2.4	1.5
Very large AHTS	0	0.25	0	2	0.75	0	1.2	1.25	1.4	0.75	0	0.8	1.75
PSV	0.2	0.25	3.75	1.3	1.75	2.5	0.6	0.75	2.6	3.5	4.25	5.2	6

Source: [7]

would bounce back in 2012. While some OSV owners have reported a good start in 2012, others talk of a deferred recovery in 2013. In general, the global offshore vessel market is still suffering from a downturn in demand, coupled with increased supply.

The West Africa region is no exception. Continued political instability in the Ivory Coast and general security fears in Cameroon and particularly Nigeria, followed with increased religion violence, Ghanaian presidential elections, the oil workers general strike in Gabon have exacerbated the demand for OSV. While day rate for large sized AHTS vessels generally increased in 2011 and 2012, smaller-sized vessels were left struggling to perform in many regions through these years. The average West Africa spot availability for large and very large AHTSs for the month of September 2011 was 1.4 and 0 respectively (*Table 2*). There were no deepwater PSVs with 3,000 dwt and more with Dynamic Position, computer controlled system that automatically maintain a ship's position, vessels available almost anywhere on the coast during September and October 2011.

In September 2011 a monthly average of PSVs was 0.2 units, but this compromises only shallow water units (*Table 2*). To date, the reduction in availability has not been reflected in day rates, but the market may be at the tipping point whereby even a small uptake in demand for deepwater PSVs, large and very large AHTS could trigger a sudden point in spot rates. Term demand for PSVs appears to be increasing with a number of operators looking for units from the end of July 2011 and 2012, which were closely related to the planned and increased drilling campaign for this period of the year. When factoring in the summer work season in the North Sea, PSV term rates always increased due to higher demands, as well as in West Africa over the following 2 to 3 months, mainly due to seasonal changes.

The availability of modern small AHTSs (3,900 – 6,000 BHP) still remains high, with a monthly average in September 2011 of 6 units and even more availability in August 2012 up to 9 units [7]. The term rates softened slightly in the last quarter of 2012. With such high levels of AHTS availability coupled with 16 Jack-up-rigs and tender barges currently stacked along the coast, it is probable that this sector has yet to hit bottom. Mid-sized AHTSs, with an average availability in May 2012 of almost 5 units, are similarly struggling to hold up rates. The availability of FSV depends on demands for her additional equipment as Dynamic Positioning system, Fire fighting class I or II or III, speed, passenger capacity, etc. The lack of FSVs does not have as much impact as the lack of PSVs because they are primarily involved in crew changes and small cargo. With the newly designed catamaran type of FSV, the operators have turned their focus to the vessels Dynamic Position class, business class seats, internet satellite connection, speed, etc.

The basic factors that affect a vessel's marketability are day rates, mobilization and demobilization fee. While vessels mobilization and demobilization fee depends on delivery distance from vessels origin to the working area, the day rates mostly depend on BIMCO contract duration, where oil company is paying all other costs such as fuel, port fee, lubrication oil and wa-

Table 3. West Africa Spot Rates in USD

Vessel Type	Jan-11	Dec-11	Jan-12	Sep-12
FSV	12,250-13,000	9,750-11,900	9,200-10,000	9,000-9,500
Small AHTS 3,900-6,000 BHP	14,500-16,500	11,250-12,000	11,500-13,950	10,750-12,900
Medium AHTS 7,000-9,999 BHP	16,000-19,450	12,150-15,000	14,500-16,500	12,500-16,900
Large AHTS 10,000-13,999 BHP	18,500-23,500	15,000-16,500	20,250-23,750	19,250-25,000
V.large AHTS 14,000-18,000 BHP	20,000-25,000	19,000-25,000	30,250-33,000	32,000-38,000
PSV < 2,900 DWT	13,500- 17,000	8,000-11,000	25,250-28,000	25,500-30,500
PSV > 2,900 DWT	16,500-20,000	15,000-16,250	28,850-34,500	28,000-33,250

Source: [7]

Table 4 - West Africa Long-Term Rates in USD

Vessel Type	Q1 2012	Q2 2012	Q3 2012	Q4 2012
FSV	7,500-8,900	7,250-8,500	7,750-8,500	7,600-8,000
Small AHTS 3,900-6,000 BHP	11,000-13,000	11,500-13,000	11,500-12,800	10,800-12,850
Medium AHTS 7,000-9,999 BHP	12,000-16,000	13,500-16,500	14,500-16,500	13,500-15,000
Large AHTS 10,000-13,999 BHP	18,500-22,000	18,750-23,000	19,000-23,000	18,000-22,500
V.large AHTS 14,000-18,000 BHP	29,500-32,000	30,000-32,500	29,000-33,000	30,000-34,000
PSV < 1,500 DWT[2]	23,500- 25,000	25,000-27,000	25,500-31,000	25,000-29,000
PSV > 2,900 DWT	27,500-32,000	28,000-33,000	29,500-34,000	28,000-32,000

Source: [7]

ter, etc. As opposite to offshore business, in merchant vessels business vessel demand and supply depend on freight rates, voyage costs and running costs [8]. Tables 3 and 4 show spot and long-term rates for West Africa market.

When comparing rates shown in Tables 3 and 4, the spot market prices are always higher than the long term-market prices by 10-15%. In emergency situations a vessel's day rate can increase by 20% or more. Both cases of vessel market show very large AHTS and PSV>2,900 dwt a day rate which are significantly higher than other vessel due to their capacity and abilities. Also, *Figure 5* shows that all types of vessels are following each other in day rate changes. Following the previous conclusion, and in comparison with data from *Figure 4* some similarity has been noticed in day rate changes during one year (2012) and twelve years period in AHTS day rate changes and consequently oil price range during the same period as well.

The decision to seek long-term or short-term vessel contracts depends on a particular project. Drilling campaigns depend on the number of wells to be drilled. The requirements can vary from as little as three months up to a multi-year requirement. Common practice in this case is to take on long-term charter of one AHTS, one PSV and one FSV. In case of additional cargo or emergency requirement, oil companies may elect to go to the spot for vessels. These short-term requirements can be 6 months or less. With two to three years advanced planning, operators can secure favourable day rates by signing contracts for vessels built for specific projects.

Mobilization and demobilization play a major role in decision process when chartering a vessel. Vessel owners bid for contracts and pay close attention to the costs to deliver a vessel form port to port or country to country. Some owners will waive these fees if available vessels are nearby. If vessels are to be mobilized from afar, these costs can exceed 1 million USD. An example can be delivering of Seacor Grant, 10,728 horse power AHTS, from Gulf of Mexico to Angola which had mobilization fee of nearly 1 million USD [2]. Common practice in offshore industry for the demobilization fee depends on the charter duration. If charter duration is more than two years, sometimes the owners will waive the demobilization fee. The owners have to carefully consider the crewing costs, food and supplies, day rates for the voyage period as well as fuel consumption. In some cases, the owners will waive a demobilization fee if market prospects for the area of operation show high demand for future prospects.

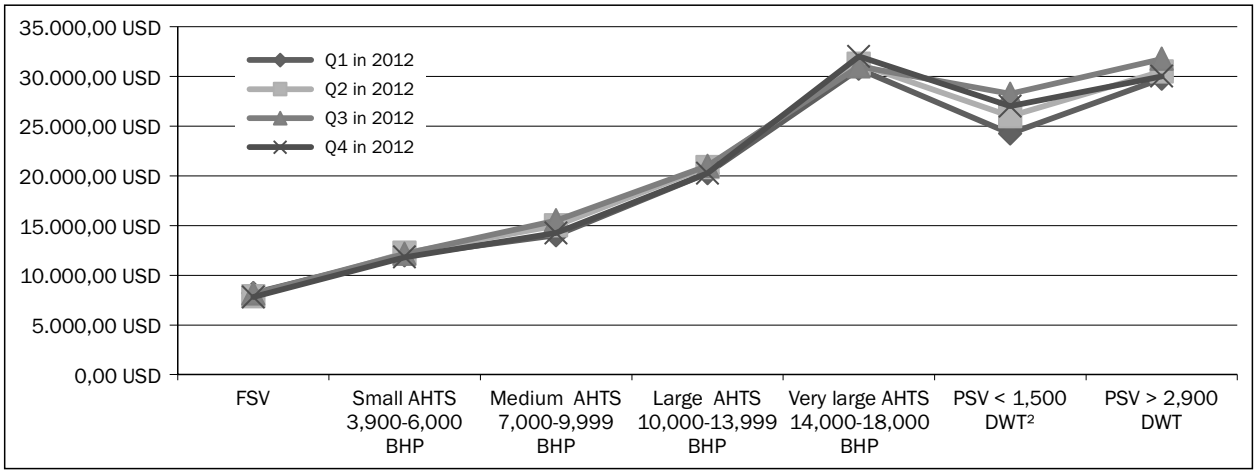

Figure 5 - Average long-term rates for West Africa offshore market

5. CONCLUSION

The availability of vessels is based on regional supply and demand. Vessel rates are dependent on supply and demand as well as political stability, especially in oil rich economies. Speculations and instability in oil rich economies may affect oil prices worldwide and consequently OSV day rate where owner will demand higher rates. The West Africa region employs 12% of the world's fleet which almost matches slightly more than 13% world daily crude oil production in this region.

Also, research results for West Africa region show correlation of oil production and daily rate of the OSVs, which can be taken as one of the presumptions when analyzing the correlation on the world basis. Knowing behaviour and trends in correlations of oil production and daily rate of OSVs can have influence on long and short logistic planning and BIMCO contract provisions. With two to three years of advanced planning, the operators can secure favourable day rates by signing contracts for vessels built for specific projects. The spot market prices are always higher than the long-term market prices by 10-15%. In emergency situations, to prevent unexpected downtime of the rigs and extreme expenses, a vessel's day rate can increase by 20% or more.

There are multiple elements necessary to ensure successful project execution in logistics planning. However, the correlation parameters for oil production and daily rates are the two major elements that influence the creation of the project execution framework. Beside those elements, there are others which also have influence on the project execution, like mobilization fee, demobilization fee, downtime of the rigs, fuel consumption and distance from offshore facilities. In further research it would be interesting to analyze the correlation with them and major elements, which could contribute to precise benefits in project execution.

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SAŽETAK

LOGISTIČKI ASPEKT OPSKRBE ODOBALNIH INSTALACIJA NA TRŽIŠTU ZAPADNE AFRIKE

U brzorastućim svjetskim energetskim potrebama, nafta postaje atraktivan izvor energije. Opskrba odobalnih instalacija je složen logistički postupak na kojeg utječu različiti čimbenici koje karakterizira značajna neizvjesnost. Kako bi se ovaj scenarij izbjegao, važno je opskrbiti naftnu platformu potrebnim zalihama, odnosno održavati kontinuirani i agilni logistički lanac. Kod uobičajenog postupka proizvodnje nafte, naftna kompanija uglavnom iznajmljuje naftne platforme i opskrbne brodove od specijaliziranih kompanija. Ponuda brodskog prostora u odobalnih industriji usko je povezana s cijenom sirove nafte. Cijena sirove nafte ima nepredvidive dnevne promjene, te vrsta i trajanje ugovora o najmu brodskog prostora "offshore" flote imaju direktan utjecaj na kreiranje proračuna odobalnih projekata. Kako je područje Zapadne Afrike jedno od trenutno najzastupljenijih područja u istraživanju i proizvodnji nafte, te zapošljava 12% svjetske odobalne flote, u radu su prikazani rezultati analize dnevnog najma odobalnih brodova s cijenom sirove nafte za navedenu regiju. Rezultati istraživanja pokazuju korelaciju između kretanja cijena dnevnog najma odobalnih brodova i cijene sirove nafte.

KLJUČNE RIJEČI

logističko planiranje, odobalni opskrbni lanac, odobalno tržište brodskog prostora, dnevni najam brodova, proizvodnja nafte

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