American University Kyiv

IMPROVING COMPETITIVE ADVANTAGE USING VALUE CHAIN ANALYSIS: CASE OF UKRAINIAN DEEPWATER OUTER CONTINENTAL SHELF EXPLORATION AND PRODUCTION.

(ПОКРАЩЕННЯ КОНКУРЕНТНИХ ПЕРЕВАГ ЗА ДОПОМОГОЮ АНАЛІЗУ ЛАНЦЮЖКА ВАРТОСТІ: РОЗВІДКА ТА ВИДОБУВАННЯ УКРАЇНСЬКОГО ГЛИБОКОВОДНОГО ЗОВНІШНЬОГО КОНТИНЕНТАЛЬНОГО ШЕЛЬФУ)

by **Lemesh Valeriy**

A Capstone Project

Presented in Partial Fulfillment of the Requirements

for the Master Degree 2025

APPROVED BY:

Yuriy Bots, Ph.D., Dean of School of Management

Table of Contents

ABSTRACT **4**

1. INTRODUCTION **5**

2. LITERATURE REVIEW **7**

3. THEORY **10**

4. DATA DESCRIPTION **15**

4.1 OUTER CONTINENTAL SHELF: GENERAL ECONOMIC LANDSCAPE, TENDERS, AND CONCESSION 15

4.2 MARITIME ASSETS AND SHORE INFRASTRUCTURE 17

4.2.1 Maritime component of offshore drilling and support operations *17*

4.2.2 Shore support facilities – size and composition of the existing port terminals *17*

4.2.3 Shore support facilities – available ship construction and repair yards *18*

4.3 HUMAN RESOURCES AVAILABILITY AND LEVEL OF EDUCATION 19

4.4 MATERIALS REQUIRED TO SUPPORT OFFSHORE DRILLING OPERATIONS. 21

5. DATA ANALYSIS **23**

5.1 TENDERS AND CONCESSIONS 23

Dolphin Gas Project as a front-runner *24*

5.2 AVAILABLE MARITIME ASSETS AND SHORE INFRASTRUCTURE 25

5.2.1 Maritime component of offshore drilling and support operations *25*

5.2.2 Upstream marine logistics simulation *27*

5.2.3 Shore support facility selection and fit *27*

5.2.4 Ship repairs and construction yards *28*

5.2.5 Internatonal Airport and Heliport *28*

5.2.6 Region prevailing weather data. *29*

5.3 HUMAN RESOURCES 30

5.3.1 Odessa National Maritime Academy *30*

5.3.2 Odessa National Maritime University *31*

5.3.3 Ivano-Frankivsk National University of Oil and Gas *31*

5.4 Procurement 36

6. OUTER CONTINENTAL SHELF UPSTREAM CYCLE POLITICAL AND ECONOMIC LANDSCAPE: UKRAINIAN PERSPECTIVE, NATURAL GAS CASE. 39

7. CONCLUSIONS AND FUTURE RESEARCH 40

Areas for future research 42

APPENDIXES 43

Appendix A – Ukrainian Deepwater Oil and Gas Licence Areas (Bugriy, 2014). 43

Appendix B – Porter's Firm-level Model 44

Appendix C – maritime offshore drilling units, platforms, and supply fleet 47

Appendix D – weather factor at Black Sea 49

Appendix E – Simulation based on monthly offshore oil rigs material demands 51

Appendix F – Fishing Port of Sevastopol and Automotive terminal 56

Appendix G – Offshore Oil Field Development Economic Landscape 58

Appendix H – PEST and SWOT analysis 60

REFERENCES 64

Abstract

The main idea of the research is to carry out a strategic analysis to improve the competitive advantage of upstream cycle hydrocarbon exploration and production (E&P). The analysis will be based on Porter’s Value Chain framework augmented by PEST and SWOT strategic analysis models.

The industry-specific Porter’s Value Chain Framework explained the necessary primary and supportive activities for carrying out offshore upstream cycle oil and gas E&P activities.

Ukraine has a developed infrastructure (ports, airports, shipbuilding, and repair facilities), expertise, and human capital to fulfill demand in supportive activities as per industry-adjusted Porter’s Value Chain Framework. The research results show that Ukraine lacks the technologies and assets like seismic surveying vessels, drilling ships or rigs, pipe and cable laying vessels, to carry out upstream cycle primary activities at the deepwater part of OCS, which is common for all developing nations, and these activities are given for outsourcing to the world industry leaders.

1. Introduction

The world is experiencing a growing population trend, accompanied by increasing energy needs. The lagging development of green technologies, combined with nations' political drive for energy independence and the ever-growing demand for fossil fuels, compels states to seek solutions to close the gap between energy supply and demand using local resources. Governments are exploring hydrocarbons – primarily as a source of energy – not only onshore but also offshore, particularly for countries with access to oceanic waters.

Advancements in technology have extended the reach of offshore hydrocarbon extraction to deeper waters. Areas that were inaccessible 30 years ago are now providing the economy with "black and blue gold," boosting local and international industries, and generating positive social and economic impacts.

The newly discovered offshore oil and gas reserves from the past decade account for 60% of the world's total newly found reserves. Of these, approximately 62% are located in deepwater (up to 1500 m) and ultra-deepwater (greater than 1500 m) offshore fields (Zhixin, 2023). Turkey, the country with the biggest portion of the outer continental shelf (OCS) of the Black Sea, has recently started the development of their ultra-deepwater Sakarya and Akcakoca gas fields with the newest available equipment and technologies (Worldoil, 2021; Offshore Technology, 2020).

Ukraine has significant resources at the outer continental shelf of the Crimean peninsula. According to Bugriy (2014), Prykerchenske natural oil and gas deposits include an estimated 180 billion cubic meters (BCM) in deep-water natural gas reserves as well as 83 million tons of oil; Skifske deep-water natural gas deposit, with an estimated investment of $12 billion, could lead to extraction of 200 billion cubic meters (BCM) of natural gas reserves; other estimated natural gas resources in the Black Sea, amount to 1.5 trillion cubic meters (TCM), while the oil resources are estimated around 1 billion tons (Bugriy, 2014).

This paper focuses on finding ways to enhance Ukraine's competitive advantage by reducing full-cycle exploration and production (E&P) costs. Value Chain Analysis is used as a theoretical framework for finding ways to leverage locally available resources and technologies for upstream hydrocarbon exploration and production activities in the deepwater portion of the Crimean Peninsula's outer continental shelf (key license areas include Skifska, Forosa, Prykerchenska, and Tavriya (see Appendix A, Figure 1).

The main findings were that Ukrainian drilling and maritime companies lack the technology and expertise to carry out marine offshore exploration and production (E&P) activities at a depth greater than 100m. On the other hand, Ukraine has the infrastructure (ports, shipyards, airports) and highly qualified human resources prepared and trained by major local universities and world-class training centers.

The findings are important because the resources available in Ukraine reduce full-cycle exploration and production (E&P) costs, which is a unique competitive advantage for both the government and a company or contractor involved in E&P operations. Considering the volatility of the hydrocarbon market, every hryvnia saved during operations will contribute to the profitability of the whole venue. The overall effect is augmented by the economic term "multiplication", when one currency unit invested in the base activity is followed by creating an additional sub-industry contributing to overall economic performance and workplace creation.

This research provides a comprehensive understanding of the country's benefits and competitive advantages in the offshore hydrocarbon exploration and production (E&P) process. This understanding allows policymakers to design and negotiate product-sharing agreements (PSAs) with major oil companies to maximize the benefits for all stakeholders.

2. Literature Review

It has often been said that laziness drives progress, but the same holds true for competition. Various entities compete for essential resources, including those provided by suppliers, a skilled workforce, customers, and governmental concessions or favors. These activities are integral components of a firm's complex process—typically referred to as *strategy*—which contributes to competitive advantage.

Michael Porter defines competitive advantage as *"the way a firm can choose and implement a generic strategy to achieve and sustain competitive advantage. It addresses the interplay between the types of competitive advantage—cost and differentiation—and the scope of a firm's activities. The basic tool for diagnosing competitive advantage and finding ways to enhance it is the value chain, which divides a firm into the discrete activities it performs in designing, producing, marketing, and distributing its product"* (Porter, 1985).

A competitive advantage that is observed during the long-term period can be referred to as sustainable competitive advantage (SCA). It consists of two categories – superior skills and superior resources (Day and Wensley, 1988). To achieve SCA, a firm's resources must meet the VRIN criteria: valuable, rare, imperfectly inimitable, and non-substitutable (Barney, 1991). Additionally, firms must combine resources and skills in unique and enduring ways to succeed (Prahalad and Hamel, 1990).

The broader offshore oil and gas industry's full-cycle development consists of three primary segments: upstream, which involves the exploration and production (E&P) of fossil fuels from the underground; midstream, which involves the transportation of oil and gas from the field (gas and oil separation plant—GOSP) to refineries; and downstream, which involves the distribution and sale of processed products (Roslyng Olesen, 2015).

The area of this research – the upstream cycle of offshore oil and gas field development consists of exploration and appraisal, development, production, redevelopment, and decommissioning phases (Kaiser, 2015; Roslyng, Olesen, 2015). Looking in detail at the mentioned phases, exploration, and appraisal comprise of processes like geophysical surveying, exploratory drilling, and commercial evaluation. The development includes building, logistics, and installation of production platforms, and drilling of production wells. Production is presented by extraction operations, equipment maintenance, supply service and logistics, and safety standby service. Field abandoning occurs after 20 to 40 years of production and well stimulation, and consists of well plugging and decommissioning (Roslyng Olesen, 2015).

When it comes to costs, drilling operations are the most cost-consuming activities and should be streamlined as much as possible (Kaiser, 2015). On the other hand, any operational downtime caused by equipment breakdown, lack of consumable materials, or unfavorable weather conditions that delay delivery can significantly increase costs. Assessment and optimization of Offshore Supply Vessel (OSV) fleet type and size and proper routing planning, augmented by prevailing seasonal weather conditions factor could reduce unforeseen downtime and collateral expenses while reducing risks connected with well control (Aneichyk, 2009).

Compared to oceanic waters, the Black Sea offers relatively favorable weather conditions for offshore operations. However, seasonal restrictions—particularly during winter—affect the western and northwestern areas, where significant wave heights (above 2.5 m) occur with a probability of 12%, and mean wind speeds reach 7.89 m/s (Onea and Russu, 2018–2019).

Every entity engaged in hydrocarbon E&P is affected not only by an internal or operational factors, but also by set of various external factors like political, economic, social, technological, environmental, and legislative (which fall under the PEST-EL framework) (Crosson, 2009). These external factors are influencing the industry and, in many ways, serve as an early warning for changes in the industry. A combination of political will, economic prospects, social benefits, technological availability, and environmental concerns can become game-changing factors influencing executive decisions (OG21, 2020).

Available open-source literature does not provide comprehensive insights into the activities that precede the establishment of offshore hydrocarbon E&P operations. Existing studies predominantly cover established projects and operational cases but lack guidelines for decision-making on initiating activities in undeveloped regions.

Furthermore, offshore oil and gas production data is not reported in open sources, except for a few countries with a transparent and competitive industry landscape (Norway, the UK, US). Specialized commercial services are assessed and evaluated in detail on a field-by-field basis to build a country profile (Kaiser, 2020). Thus, information available to the public is very brief and limited in detail.

The subject of offshore hydrocarbon exploration and production is not widely researched in Ukraine. There is a handful of publications with the subject of Ukrainian offshore hydrocarbons covering legal frameworks (Zhukov, 2015), problems of maritime geology at the Black Sea shelf (Bodiyk, 2013), problems for marine transportation of natural gas from offshore fields (Kryzhanovskiy, 2013), available marine drilling units (Stetskiv, 2013), marine offshore logistics methodology (Akymova, 2017). When it comes to my point of view, the best paper showing the complexity of offshore oil and gas exploration and production on the Ukrainian outer continental shelf is prepared by Gorbova (2012), giving prospects for oil and gas production on the Ukrainian shelf of the Black and Azov Seas.

This research addresses the identified gap by providing a strategic analysis of the competitive advantage for hydrocarbon exploration and production in the **deepwater section of the Ukrainian Outer Continental Shelf (OCS) of Crimea**. The study incorporates logistical simulation scenarios to determine optimal quantities of OSVs (size and number) based on a certain number of offshore drilling units, and coherence with existing ports, terminals, supportive industries, and available human capital.

3. Theory

Michael Porter, in his book "Competitive Advantage: Creating and Sustaining Superior Performance" stated that "*competitive advantage cannot be understood by looking at a firm as a whole. It stems from the many discrete activities a firm performs in designing, producing, marketing, delivering, and supporting its product. Each of these activities can contribute to a firm's relative cost position and create a basis for differentiation*" (Porter, 1985). Porter has introduced the Value Chain framework, dividing a firm's value activities into two types: primary activities and support activities (Porter, 1985).

The firm's primary activities can be divided into five generic categories: inbound logistics, operations, outbound logistics, marketing and sales, and service. Support activities include firm infrastructure, human resource management, technology development, and procurement (Figure 1, Appendix B).

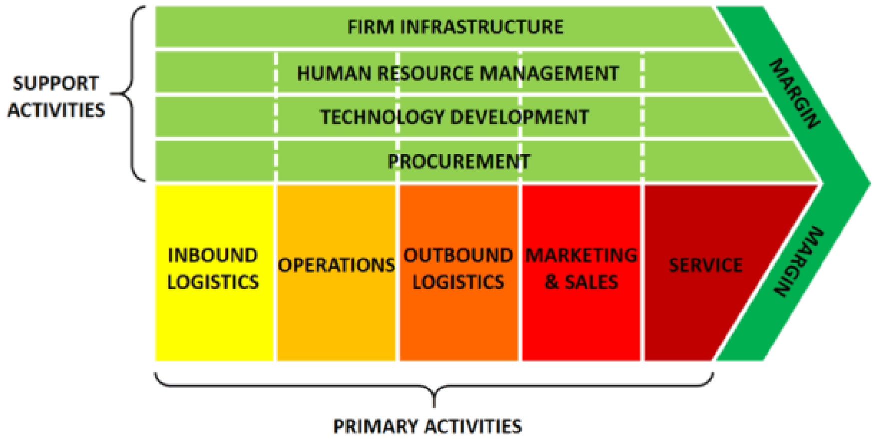


Figure 1 – Generic firm-level value chain model

Porter's Value Chain Framework was developed to consider the firm's perspective. The proposed framework below considers the industry-level upstream E&P cycle. This perspective describes how multiple stakeholders (oil majors, related companies, and governments) can cooperate to create value.

The upstream cycle of offshore oil and gas exploration and production (E&P) is a complex set of activities that represents a significant portion of the cost and affects the competitiveness and profitability level of the E&P process in general. The volatility of the market, political uncertainty, technological complexity, and policy ambiguity compel decision-makers to assess the necessity to apply techniques concerning adaptability, stability, and cost efficiency of the entire operations, in other words, looking for areas and ways where the competitive advantage could be achieved.

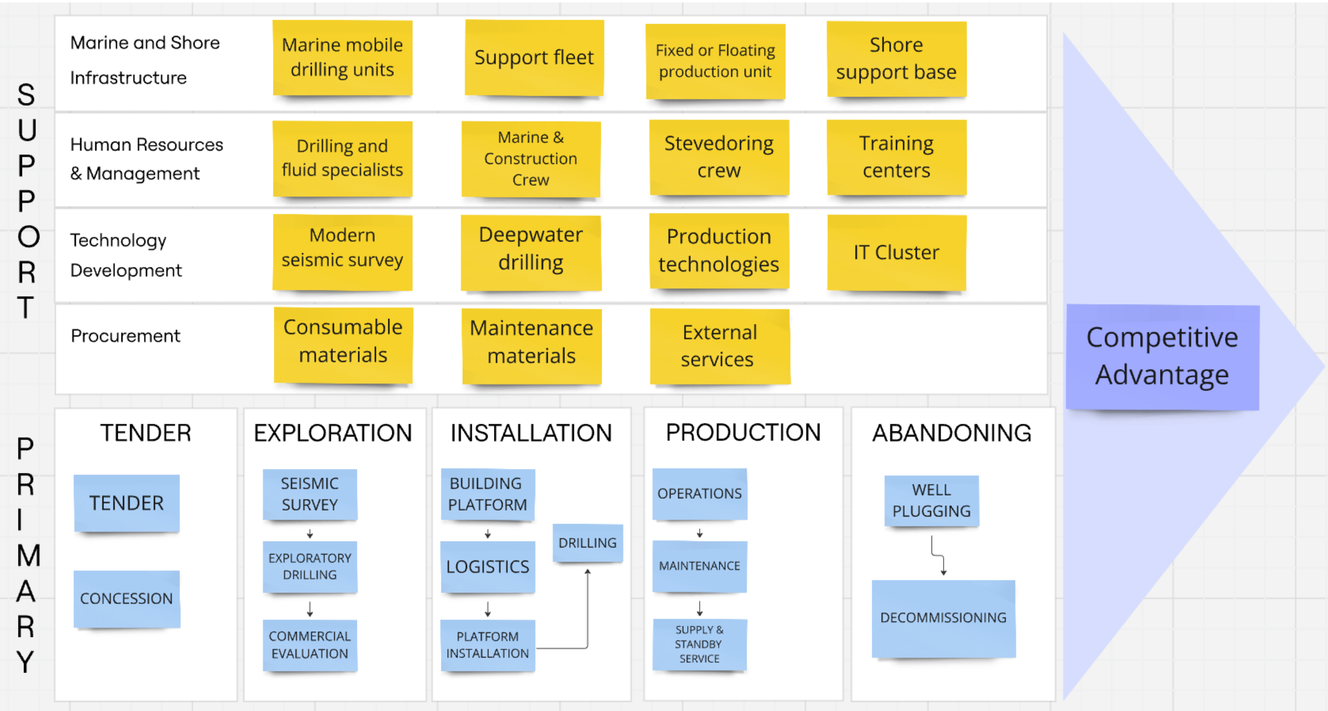


Figure 2– Industry-specific upstream E&P cycle value chain model

Primary Activities are represented by the following five domains:

Tender & concession activity is driven by the fact that all natural resources belong to the states, which are interested and responsible for granting permission for exploration and rights to extract raw materials. There are mainly three main strategies for granting rights: concession, state-controlled national oil company, and product sharing agreement. There are two ways to obtain the rights for E&P: tender and open-door applications.

Exploration phase consists of three phases: seismic survey(is done to map the underground resources and identify the potential presence of hydrocarbons), exploratory drilling (underground samples are being obtained with consequent analysis by geologists), and commercial evaluation (based on seismic survey and exploratory drilling the decision is made whether this field is commercially viable with a certain technology and funds available).

The installation phase consists of (1) building of the production platform (preceded by a survey of the installation location to choose the platform design and type); (2) transportation and logistics (require a fleet of specialized vessels and proper onshore support base); (3) installation of the production platform (depending on the chosen type of a production platform the specialized vessels are required to locate, install and secure the platform to the seabed); (4) drilling of production wells (depending on the depth and type of production platform chosen, a set of mobile drilling units can be utilized).

Production includes operations (extraction of the oil and gas from the underground); maintenance (planned, preventive, and predictive maintenance scope and plan); supply service (delivering a wide variety of materials to the offshore location by specialized vessel fleet); standby service (evacuation, fire fighting, safety, and security patrols).

Field abandoning is the final step done by well plugging (removing the jacket and production platform) and decommissioning (final utilization or scrapping of used production equipment).

Primary activities are augmented by Support activities in the following domains:

Marine and shore infrastructure. Before commencing any project with deepwater hydrocarbons E&P, the firm must evaluate the available resources needed for the project's performance. Usually, companies that obtain development rights for a certain block use specialized subcontractors with unique expertise, such as seismic surveys or well jacket installation.

When it comes to the deepwater hydrocarbon E&P project, the marine fleet is the most utilized and valuable asset. This includes Marine Mobile Offshore Drilling Units (whether drillships or semi-submersible drilling rigs), towing and supply vessels, construction barges, cable/pipe layers, and ROV vessels.

Vessels are handled using a Port infrastructure, which should have deepwater berthing facilities and ample warehousing spaces for transshipment, augmented by customs and border crossing authorities. Offshore field development requires a substantial amount of materials to be handled in and out, most of which are delivered either from local suppliers (rail, or highway) or exported from overseas using maritime transportation or airfreight.

Human resources and management. Any machinery or technological process cannot run without professional operators or engineers involved; thus, human resources are an integral part of any operation. International contractors may be obliged by the state to hire a certain percentage of local personnel, and this percentage may rise each following year; these principles were successfully applied in Brazil and Mexico. When it comes to the marine and drilling crew, some management positions are in huge demand and very scarce supply, meaning, they have to be sourced worldwide, while ratings with a certain level of English language knowledge can be hired locally. To make the hiring of foreigners easier, the state should establish a special system for foreign employment permits granted based on relaxed legislation.

Technology Development. Seismic surveys, deepwater drilling, platform installation, and pipe/cable laying require state-of-the-art technologies that are developed and probed during a long, tedious, and costly R&D process. Oil majors, to save costs and time instead of acquiring additional assets, prefer to outsource the most rarely used technological services and activities, such as seismic surveying, pipe/cable laying, deepwater drilling, and platform installation, as these are to be considerably rarely used throughout the project's lifespan.

International companies usually establish their local operations support base, establishing the market and stable demand for materials and services. Local entrepreneurs can then compete and boost R&D processes in cooperation with universities or other research centers.

Procurement can be divided between materials and services. Maintenance and consumable materials can be found locally or shipped from overseas. Local industries can adopt their production lines to accommodate materials required by oil companies. Nevertheless, original equipment manufacturers (OEM) require only original and certified spare parts to be installed on their machinery so that it can operate safely and according to the designed specifications.

Many oil companies that obtain rights to develop certain oil fields, especially offshore, are looking for a 10-20-year horizon. Oil majors prefer to outsource many activities to minimize the sunk costs of establishing full-scale single-owned bases and operations. For example, Saudi Aramco is not doing any offshore drilling with their equipment, everything is done by contractors; even Saudi Aramco-owned vessels are manned by third-party crew. For oil majors performing activities abroad, this format allows them to withdraw from certain locations in a matter of weeks, with minimal losses in case of political or security downturns and nationalizations. This is why oil majors are using Floating Production and Storage Outler (FPSO) vessels at various locations in Africa instead of building processing plants onshore.

Combination of primary and support Activities will lead to a strategic fit that will result in decreased costs, higher profit margins and as a result - improved competitive advantage.

4. Data Description

4.1 Outer continental shelf: general economic landscape, tenders, and concession

A clear understanding of the benefits that a certain activity, operation, or project can bring determines whether people or enterprises proceed with or decline an opportunity. Healthy competition and clear rules of the game are the underlying principles of common benefits.

Oil and gas E&P operations offshore start with choosing a prospective area for development. The Outer Continental Shelf (OCS) area is divided into a series of leasing blocks, which are released in a bid-for-lease auction.

Based on one of the best block lease practices from one of the most competitive OCS operations areas at the US OCS in the Gulf of Mexico, 5-year lease bids are proposed to meet five-year planning for national energy needs. Primary lease terms vary with the water depth; thus, the five-year lease is for a depth less than 400m, eight years for a depth between 400 and 800m, and ten years for a depth greater than 800 m (Kaiser, 2015).

Governmental revenue from US OCS is derived from bids bonuses (cash payment for exclusive rights for exploration, drilling, and production), rent payments, royalties, and product sharing (Figure 3). Rent is paid annually to maintain the lease during the primary term until it expires or production is commenced. By the time a production is started, rentals cease, and royalties are paid during the secondary term. Royalty is derived to the landowner's share of production paid on the gross value of production, according to concessional agreements.

Table 1 – US OCS Oil and Gas revenue streams and rates (US Natural Resource revenue data, 2024).

Securing a lease or claim	Before Production	During Production
Bonus	***Water depth 0–200m:*** Years 1–5 rent is \$7/acre, year 6 rent is \$14/acre, year 7 rent is \$21/acre, year 8+ rent is \$28/acre. ***Water depth 200–400m:*** Years 1–5 rent is \$11/acre, year 6 rent is \$22/acre, year 7 rent is \$33/acre, year 8+ rent is \$44/acre. ***Water depth 400+m:*** Years 1–5 rent is \$11/acre, years 6+ rent is \$16/acre.	***12.5%*** for leases located in water depths less than 200 meters. ***18.75%*** for leases located in water depths of 200 meters and deeper.

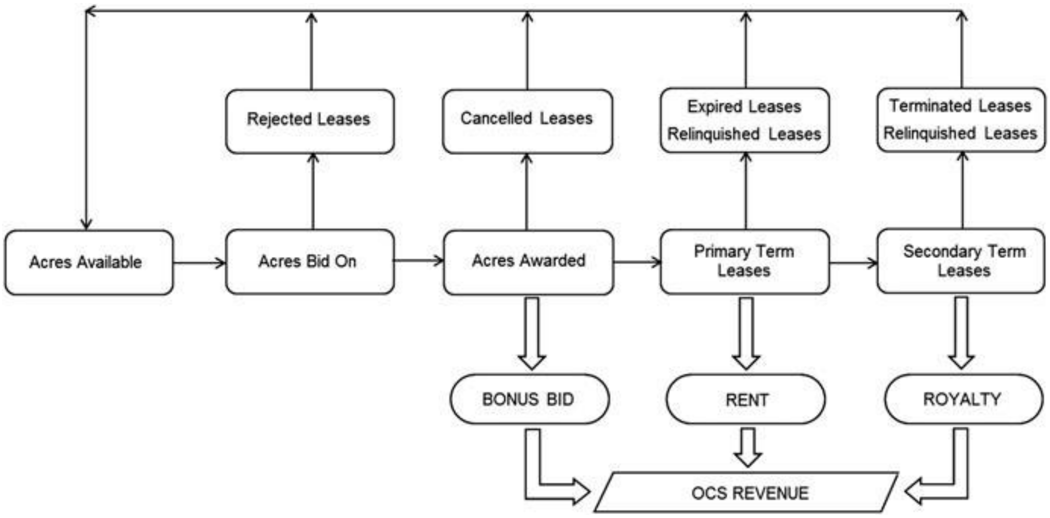


Figure 3 – US Government revenue from OCS activity (Kaiser, 2015).

The offshore E&P process (especially for deepwater hydrocarbons) is lengthy, and first production can start years after the "cutting the ribbon." For instance, ExxonMobil initiated exploration in Guyana in 2008, while the first exploration well was drilled in 2015, and the started production started in December 2019, with a 17-well FPSO (floating storage and production outlet unit) located 190 km offshore at 1750 m water depth, resulting in 11 years development phase before the first product extraction (Kaiser, 2022).

4.2 Maritime assets and shore infrastructure

4.2.1 Maritime component of offshore drilling and support operations

As per the proposed industry-specific value chain, primary activity domains include operations like seismic surveys, field exploration, drilling, construction, and production, which are carried out by a number of different specialized vessels or platforms. For instance, Mobile Offshore Drilling Units are technically advanced drilling that are designed to accommodate platforms or decks containing heavy machinery and sophisticated drilling equipment and is mounted on either submersible pontoons with columns or located on a specialized vessel. Construction and pipe or cable laying vessels are used for the installation of the production platform and connecting it to the hydrocarbon transportation network.

Offshore Support Vessel (OSV) – specialized vessel type that is designed to carry and handle a wide variety of cargo like dry bulk (barite, cement, bentonite), liquid bulk (fuel oil, fresh/drill Water, base oil, drilling fluids) and break bulk cargoes (pallets, drilling pipes, other general cargoes). Platform supply vessels (PSV) are the most advanced OSVs with increased holding capacity. See Appendix C for maritime offshore units and supply fleet descriptions and examples.

4.2.2 Shore support facilities – size and composition of the existing port terminals

The fleet of vessels cannot exist without bases where they are built, supplied, and maintained. Shore support bases as a supportive activity corresponding to industry-specific Value Chain are an integral part of primary domain operational support.

Choosing the right location and type of operational base could be a competitive advantage for the full cycle process. The geographical location of Sevastopol is unique, as it provides 30 ice-free bays and is located almost equally distant from all four crimean offshore fields, which makes it the most preferable choice for the offshore supply base.

There are three major ports in Sevastopol: (1) Sevastopol Marine Trade Port (SMTP); (2) Sevastopol Sea Fishing Port; and (3) Marine Terminal "Avlita" (Table X).

Table 2 – Port terminals in the Sevastopol Bay area.

Port	Description
Sevastopol Marine Trade Port (SMTP)	Located in the central part of Sevastopol City and in the vicinity of Inkerman City, SMTP has only one berth for break-bulk cargo and is limited to 112,5m in length. Open storage facilities cover 3600 square meters (Ukrport, 2012).
Sevastopol Sea Fishing Port	Located at the Kamyshovaya Bay, the Port has at its disposal 12 berths, 1,771 m total in length, with berthing draft varying from 5.5 to 9.1 meters, including one oil berth and six berths for general cargoes. Closed unheated warehouses of 6 000 square meters area and heated warehouses of 2 000 square meters area, open storage areas of 30 000 square meters (Ukraine Today, 2008). See Appendix F for port outlay and navigational maps.
Marine Terminal "Avlita"	Located in the northern part of Sevastopol, Marine Terminal Avlita is the terminal that opened in 2006 and has two berth 240 and 260 meters in length with berthing drafts of 9,5 and 8 meters. Open storage covers 20,000 square meters, covering 1200 square meters (Byzantrans, 2008).

4.2.3 Shore support facilities – available ship construction and repair yards

By the time of occupation in 2014 and until now in Crimea there are two major civil shipyards specialized in ship repair, maintenance, and construction – "Sevamorzavod" in Sevastopol and shipyard "Zaliv" in Kerch. At present moment, these facilities are under the control of occupant state-owned corporations working mostly for the military sector.

Sevastopol Shipyard "Sevmorzavod," established in 1783 and located at the southern bay of Sevastopol, is a major industrial complex that provided thousands of workplaces during the Soviet Union. The shipyard operates two dry docks, which are currently in operation and are 170 and 150 meters long and 25.7 meters wide.

The current state of shipyard facilities can be considered operational and ready to maintain sophisticated marine equipment; this assumption is based on the fact that the Ukrainian Armed Forces carried out a strike on the submarine (B-237, Rostov-on-Don) and the landing ship (BDK Minsk) located in the mentioned dry docks.

The shipyard “Zaliv” in Kerch is one of the most modern in Ukraine. It belongs to Kraz Group and, before 2014, built sophisticated vessels in cooperation with Norwegian customers.

The Zaliv shipyard is equipped with one of the largest dry docks in Europe, measuring 360 meters in length, 60 meters wide, and 13 meters high. The size of the dry dock and other shipyard facilities allows the construction and repair of most oil production platforms, including so-called “spar platforms.” According to Wikipedia and the russian versions of the website, the shipyard is in operation and thriving.

4.3 Human resources availability and level of education

Human resources are a backbone for operations of any kind and complexity; every value chain’s domain, be it primary or support activities, is affected by the quality of human resources.

The majority of personnel, estimated in thousands, will be involved in the following activities within industry-specific Value Chain primary activities domains distributed between maritime and drilling sectors and in support domain – employed at shore base infrastructure (ports, ship-repair, and construction).

Maritime personnel, usually called a crew, consist of the ranks shown in the figure below. This diagram is generic and applicable to most types of vessels, differing only in the number of low-ranking officers and ratings.

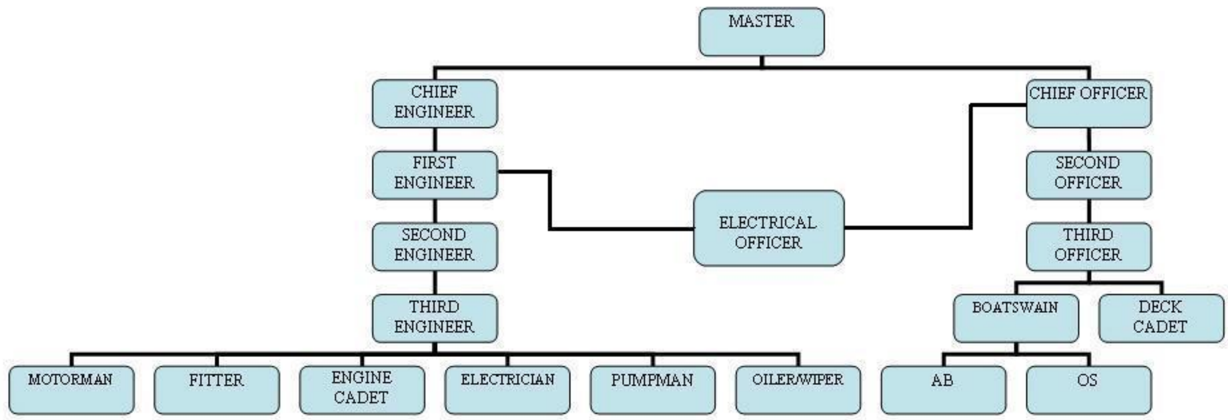


Figure 4 – maritime crew personnel (source: Nedcon.ro).

The organizational order of offshore drilling rig personnel is similar to that of rigs located onshore; the diagram below shows a common rig organizational chart. However, depending on the scale and complexity of operations, some position numbers can be increased.

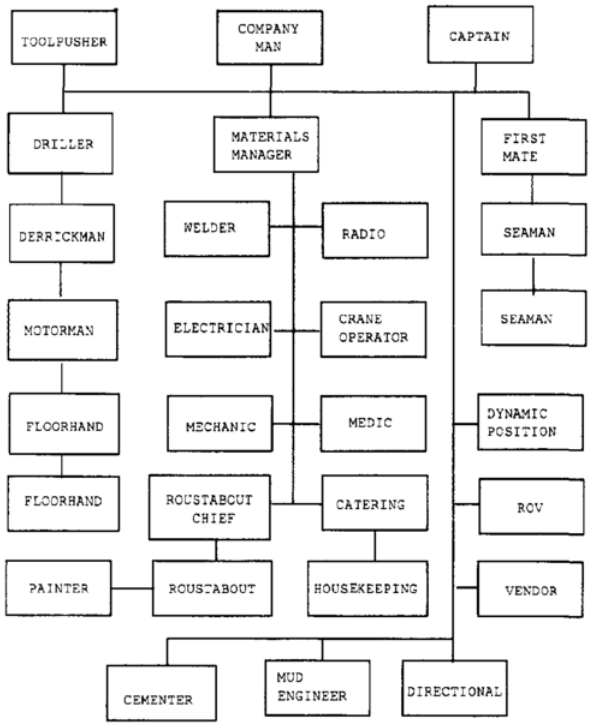


Figure 5 – drilling rig personnel organization chart (source: AAPG Wiki, 2014).

When it comes to shore support bases, ports are operated by two structures: harbor master (responsible for safe navigation and berthing within the port's inner and outer limits) and port terminal manager (responsible for cargo terminal operations).

Shipyards are much more complex industrial bases. The number and ranking of personnel are wide and include the following as per the template example below:

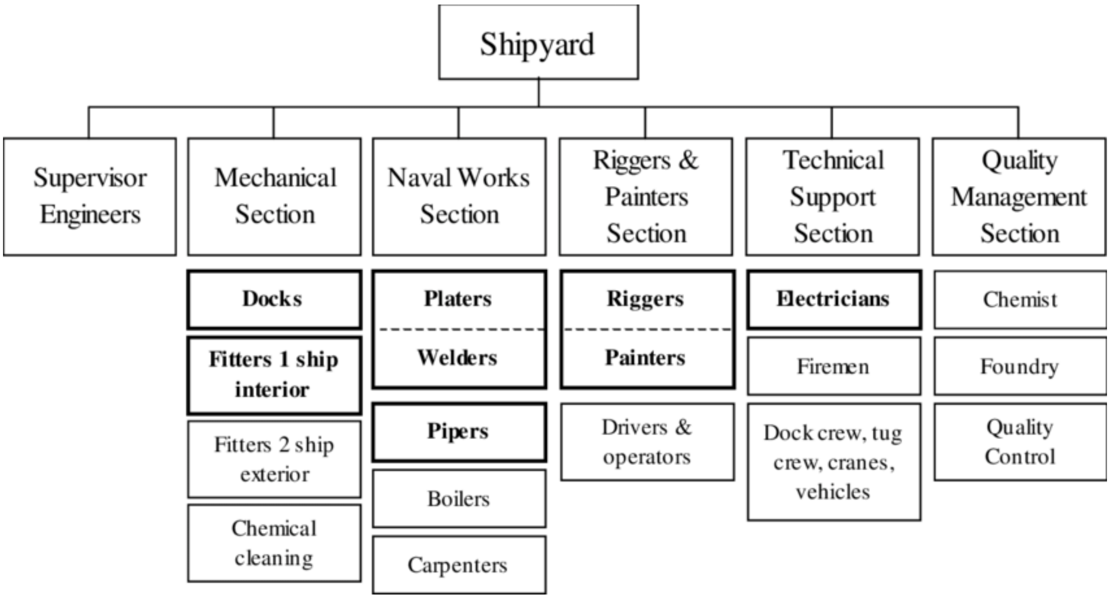


Figure 6 – shipyard personnel organization chart (Chryssolouris, 1999).

A number of universities in Ukraine prepare professionals for the maritime, shipbuilding, port operations, and drilling sectors. These include Odesa National Maritime Academy, Odesa National Maritime University, and Ivano-Frankivsk National Technical University of Oil and Gas. Several colleges and specialized industry training centers also prepare hundreds of specialists every year.

4.4 Materials required to support offshore drilling operations.

Upstream E&P offshore field development activities require sourcing, acquisition, supply, transportation, and distribution of a significant amount of materials. Based on a real-case scenario of four drilling rig operations in the Gulf area, the one-year monthly cargo demand covers a wide variety of materials (Table 3). This data will be used for logistical simulation and the procurement section of the data analysis section.

Table 3– Monthly materials demand for four drilling rigs.

Month	Palettes, pcs	Dry Bulk, mt	Diesel, m3	Fresh Water, m3	Drilling Fluid, Barrels	Drilling Casings, pcs
January	177	5,503	3,720	2,735	3,516	948
February	158	1,261	3,360	985	1,221	1,200
March	188	4,497	3,720	2,506	3,588	1,026
April	390	14,378	3,600	6,802	11,438	1,070
May	460	17,356	3,720	8,229	11,727	958
June	147	2,871	3,600	4,048	2,570	1,010
July	196	1,556	3,720	2,732	2,554	1,004
August	247	10,427	3,720	5,054	8,671	940
September	300	11,589	3,600	6,660	8,502	650
October	186	9,721	3,720	6,026	7,647	1,066
November	242	8,156	3,600	4,072	5,501	1,081
December	174	10,839	3,720	4,942	7,362	1,021

Note: ***Pallet*** is a form of cargo unit packing for a wide range of chemicals used in the production of drilling fluids and other supportive operations like cementing, well control; ***Dry bulk*** includes Barite with Bentonite – materials used in drilling fluid production, and Cement – used for well formation and cementing; ***Diesel and Fresh Water*** as consumables are lifeline of any operation; ***Drilling fluids*** – either Water or Oil Based Mud, and Brine – multifunction fluids, engineered for drilling bit lubrication and cooling, and hydrocarbon release pressure control; ***Drilling casings*** – pipes that connect drilling rig with a drilling bit in the subsoil.

The transition from data description to data analysis marks a shift from summarizing the raw characteristics of the dataset to extracting meaningful insights and patterns. In the data description phase, the focus is on organizing, summarizing, and presenting the data. Once the data is described, the analysis phase begins, where analytical frameworks are applied. This shift enables deeper exploration of the relationships within the data and helps inform decision-making by revealing underlying patterns or strategic fit matches that were not immediately obvious.

5. Data analysis

5.1 Tenders and concessions

Referring to the industry-specific value chain, the first domain in primary activities is the tender and concession process.

While there are no successful and transparent examples of major concessions in Ukraine between a government and major world corporations, there are a few examples of transparent multi-billion (in hryvnias) tenders during the privatization of state-owned enterprises and assets, for instance, sell of hotels “Dnipro” and “Ukraina”.

Kyiv School of Economics research has evaluated a recently introduced system for public purchasing – Prozorro. The paradigm of the system is a combination of two principles: the first one – is the design of auctions and procedures that correspond to OECD best practices; the second one – is the digital platform Prozorro. In 2021, public purchases through the Prozorro system were estimated at 1,1 trillion hryvnas, which is equal to 18% of GDP. The Prozorro system as a marketplace includes 40 thousand consumers and 260 thousand suppliers. KSE research has shown that new Prozorro market procedures allow to save 10% and above compared to procurement procedures outside the system (Hrybanovskiy, 2022).

With proper political will and pressure from society, transparent tenders could be performed, and major world corporations would establish their operations in Ukraine. This move will be a direct signal for other corporations and could become a clear competitive advantage for Ukraine as a state.

Dolphin Gas Project as a front-runner

Some actions to commence the development of offshore fields were taken recently; for instance, at the end of 2020, the Cabinet of Ministers of Ukraine granted to the state-owned company Naftogaz exclusive rights for exploration, appraisal, and development of 36 blocks in the North-Western part of the Black Sea, in the area not under control by russian federation. This project is called the Dolphin Project. The blocks are distributed between shallow water (below 150 m), slope (below 1000 m), and deep water (below 2000m) sections, with estimated total gas initially in place (GIIP) estimated at 1.6 TCM and estimated ultimate recovery (EUR) of 200 BCM (majority concentrated in deep water), at geology similar to Turkish and Romanian offshore fields.

It was estimated that the Dolphin project will start production by 2026 and reach a production peak by 2031 (see Appendix G, Figure 3), with a total CAPEX of $10,7 billion.

The Dolphin project's government profits just from royalties and income tax (excluding PSA agreement profit share from product sale), based on estimated ultimate recovery volume of 200 bcm, are estimated to be equal to $20,2 billion (not adjusted for inflation), over the lifespan of the project. The overall governmental profit could be multiplied in time depending on the price of natural gas in the global markets, which is subject to political factors. See Appendix G for tables and figures describing the Dolphin Project.

Considering the abovementioned information and estimates as a template and the Dolphin Project preparations and estimates as a frontrunner, if applied to another four oil and gas fields in Crimea, final government profits could reach a hundred billion dollars. Estimates based on available data for the resources lying in the subsoil of Crimean OCS cannot be exact, as modern 3D seismic surveys using the latest technologies will be conducted, resulting in a reviewed estimated ultimate recovery oil and gas quantity.

Looking at the product sharing agreement (PSA) contractor perspective, assuming that there may be 50-50 product share between the contractor and a state, considering the price of natural gas of $300 for a thousand cm, deducting proposed full cycle E&P costs of $148 for a thousand CM, the contractor may look for roughly $15,2 billion extracting 200 BCM of gas throughout the length of the project.

In summary, the Ukrainian outer continental shelf contains sufficient resources to achieve the state's energy independence and even sell excessive resources via the existing gas transportation network, bringing billions of dollars to the economy. This is a clear benefit for a postwar country. A strong political will based on clear benefits for all stakeholders could become a competitive advantage for the State and contractors involved.

5.2 Available maritime assets and shore infrastructure

5.2.1 Maritime component of offshore drilling and support operations

A primary activities in the domains of exploration, installation, and production, as per the industry-specific value chain, can be carried out by the fleet of specialized vessels and platforms only.

There are seven major oil companies that were the first to be engaged in deepwater oil and gas exploration – ExxonMobil, Chevron, Eni, Shell, BP, Total Energies, and Equinor. These companies directly participated in 50% of the exploration wells drilled in waters deeper than 400m around the globe between 1990-2022 and were operating 38% of these exploration wells (Zhixin, 2022).

The only Ukrainian company historically engaged in offshore oil and gas (mostly gas) E&P—Chornomornaftogaz, a subsidiary of state-owned Naftogaz—lost most of its assets and operations with the occupation of Crimea in 2014 (investigator.com.ua, 2020). By then, the company operated two modern jack-up drilling rigs, two modern medium-sized supply vessels, and several other supporting vessels. These assets were nationalized by occupational authorities, and their condition and operational readiness remain unknown.

The Ukrainian Register of Shipping has closed its database due to war in Ukraine, meanwhile looking through other open-source online web-resources like vesselfinder.com, marinetraffic.com, and equasis.org, results show that none of the Ukrainian-based oil and shipping companies have assets for E&P at waters deeper than 100m.

Assuming an option to acquire a fleet of drillships or deepwater drilling rigs could cost billions, as the price varies from $250-300 million for a drilling rig up to $850 million for a drillship (Yun Yun Teo, 2024). Daily hire rates were up to $650 thousand for a drillship in 2024 (Snyder, 2024). Outsourcing may be considered as an option for asset acquisition; for instance, Transocean, a world-leading company in deepwater drilling, had secured a $232 million one-year contract to perform activities in the Gulf of Mexico (Steinhausen, 2024). The above pricing should be properly assessed before making a decision to either order and build a drilling unit or hire it from a specialized contractor for a fixed term with an option of contract extension.

The industry-wide practice is based on outsourcing, which involves contracting specialized vendors for services such as seismic surveys, drilling, platform construction at the open sea, and materials supply.

To summarize the abovementioned, unfortunately, considering the industry-specific value chain, Ukrainian companies do not have the assets and expertise to perform operations in primary activity domains like exploration, installation, and production. Costs of acquiring and maintaining required equipment are sky-high, and final delivery terms may be in years. Considering the abovementioned and an industry-wide practice, outsourcing between specialized contractors may be the optimal strategy for the offshore block license holder.

5.2.2 Upstream marine logistics simulation

To clearly envision and understand whether available infrastructure is sufficient to support offshore activities, we have to define the scale of logistic operations and the number of supply vessels involved according to the available materials demand. For the purpose of the well drilling phase, considering one drilling unit located at each of four fields offshore Crimea, logistic simulations were conducted to understand the number and type of supply vessels to be engaged, followed by the choice of port cargo terminal.

Based on real-life case data of drilling materials demand, see Table 2, from drilling operations in the Gulf area, the Simulation, using online software "SCM Global Supply Chain Simulation Tool" (https://www.scmglobe.com/), was done for two scenarios – with minimal and maximal monthly materials demand.

The simulation aims to define the optimal number of OSVs required to transport materials from the port to offshore locations, maintaining the necessary stock at each rig throughout the month.

Based on real case data, we ran consecutive simulations for two major scenarios of drilling unit demands ranging from minimum to maximum. We can conclude that the optimal number of Offshore Supply Vessels (OSVs) is three. This number covers the maximum demand scenario and provides additional redundancy for operational capability in terms of breakdowns and substitute use.

5.2.3 Shore support facility selection and fit

One of the domains for support activity within the industry-specific Value Chain refers to shore infrastructure, primarily ports, shipyards, and other relevant supportive bases.

Based on the logistic simulation described above, the Fishing Port of Sevastopol, berth 237 (former "Black Sea automotive terminal") could be a perfect fit for prospected offshore operations logistic support terminal, having the length of the berth equal to 250 meters with minimal depth of 7.5 m at the Chart Datum (lowest tide level), which will allow to accommodate three 72 meters long OSV (DWT 3200) vessels at the same time.

The terminal at berth 237 is located away from residential blocks and has a paved basement. However, it lacks liquid bulk storage, a rail track, and dry bulk pulverization facilities. A rail track leads to the oil terminal in the adjacent territory (see port outlay and plans in Appendix F).

The availability of infrastructure that can accommodate the fleet of support vessels is a clear competitive advantage for entire industry-specific Value Chain activities, as it reduces full-cycle costs and terms for operations commencement.

5.2.4 Ship repairs and construction yards

Zaliv shipyard, with its huge dry dock, is perfectly suited for building oil platforms and well jackets and maintaining massive equipment like drillships and semisubmersible drilling rigs. Meanwhile, shipyard Sevmorzavod could maintain and routinely dock support vessels.

Thus, a local services proposition can meet the demand for offshore field E&P fleet maintenance. This reduces the overall costs for ship owners and contractors, as vessels and offshore structures don't have to be sent overseas for maintenance. It also reduces operational downtime, which is a clear competitive advantage.

5.2.5 Internatonal Airport and Heliport

All primary activities, as per the industry-specific value chain, require regular transportation for a significant number of personnel who are working on a rotational basis. Aviation services are the most convenient means of offshore personnel transportation and are less affected by adverse weather. There are two major airfields in the Sevastopol area – Belbek and Hersones, located to the north and the south of the main Sevastopol Bay. Both airfields are currently in use by occupation military bases: Belbek for all kinds of aircraft, and Hersones – as a backup base.

The Hersones airfield could be used for helicopter passenger and cargo services, delivering materials and crew to offshore locations. This would require minimal investments in passenger terminal infrastructure.

The shore support facilities described above are part of the infrastructure domain of Value Chain support activities. Locally available infrastructure is comprehensive, developed, operational, and in service. The presence of the abovementioned facilities locally is another competitive advantage for companies, resulting in operational cost savings and reducing the price of oilfield full-cycle development.

5.2.6 Region prevailing weather data.

Weather conditions could hinder any operation carried out by sea-surface units; thus, proper planning, taking into account the estimated weather factor coefficient, should mitigate the risks of delays. Generally, weather conditions in the Black Sea are less severe and more favorable for offshore operations compared to other regions, as the Black Sea Basin is closed and comparatively small.

Onea and Rusu in the paper "Long-Term Analysis of the Black Sea Weather Windows" (2019), and Onea, Rusu, and Raileanu in the paper "A Comparative Analysis of the Wind and Wave Climate in the Black Sea Along the Shipping Routes" (2018), had described the prevailing weather conditions in terms of significant Wind and Wave effects. The probability of significant waves above 2,5 meters in height that could suspend marine supply operations is limited to 12% in winter time. The wind criteria are favorable and should not hinder operations significantly (see Appendix D – weather factor at Black Sea).

5.3 Human resources

Human resources can be a focal point for industry-specific Value Chain both primary and support activities, thus special consideration is to be made for this domain.

The analysis below assesses and describes the educational level of maritime, drilling, and shipyard specialists and the availability of candidates on the market.

Ukraine is a leading state providing maritime professionals for a deep sea and offshore industry.

5.3.1 Odessa National Maritime Academy

Table 4 – Odessa National Maritime Academy specialties and specializations

University	Speciality	Specialization
Odessa National Maritime Academy	***271*** – Sea and inland water transport	- Navigation and ship-handling. - Operation of ship technical systems and complexes. - Operation and maintenance of ship's electrical equipment and means of automation.
	073 – Management	Management in the field of sea and river transport

Below is a number of graduates with Master's degrees, detailed data as per specialization is available from 2021; prior to 2021, data is cumulative as per whole specialty and not distinguished for specializations.

Table 5 – Odessa National Maritime Academy, number of graduates with a Master's degree (source: https://registry.edbo.gov.ua/opendata/graduate/).

	Number of graduates, Master degree		
Specialization	2021	2022	2023
Navigation and shiphandling	180	187	231
Operation of ship technical systems and complexes	51	61	64

Operation and maintenance of ship's electrical equipment and means of automaiton	8	4	14
Management in field of sea and river transport	30	9	22

5.3.2 Odessa National Maritime University

Odessa National Maritime University prepares a wider range of maritime industry professionals as follows:

Table 6 – Odessa National Maritime University specialties and specializations

University	Speciality	Specialization
Odessa National Maritime University	***135*** – Shipbuiding	- Mechanical engineering.
	275 – Transportaton technologies	- Transportation, management of ports and terminals

Below is a number of graduates with Master's degrees:

Table 7 – Odessa National Maritime University, number of graduates with a Master's degree (source: https://registry.edbo.gov.ua/opendata/graduate/).

	Number of graduates, Master degree					
Specialization	2018	2019	2020	2021	2022	2023
Shipbuilding	32	14	9	3	6	10
Transportsation technologies	94	101	113	64	103	90

5.3.3 Ivano-Frankivsk National University of Oil and Gas

Ivano-Frankivsk National University of Oil and Gas specializes in preparing professionals for the oil and gas industry with the following disciplines:

Table 8 – Odessa National Maritime University specialties and specializations

University	Speciality	Specialization
Ivano-Frankivsk National University of Oil and Gas	***185*** – Oil and gas engineering and technology	- Well drilling.
	184 – Mining	- Drilling of oil and gas wells

Table 9 – Ivano-Frankivsk National University of Oil and Gas, number of graduates (source: https://registry.edbo.gov.ua/opendata/graduate/).

	Number of graduates					
Specialization	2018	2019	2020	2021	2022	2023
Well drilling – Master	204	280	288	194	123	71
Well drilling - Bachelor	114	101	285	233	159	121
Drilling of oil and gas wells - Master	141	137	141	91	53	14
Drilling of oil and gas wells - Bachelor	78	79	139	161	69	87

The data in Tables 5, 7, and 9 show a tendency toward an increase in the number of onboard maritime specialties graduates, steady numbers of port facility operation and management graduates, and a steady decline in drilling and shipbuilding specialties graduates.

The State Maritime Administration (MARAD) has approved 26 training centers throughout Ukraine. These centers provide specific training for marine offshore personnel in accordance with the international Standards for Training, Certification, and Watchkeeping (STCW Code). Training centers Lerus and KMSTC are licensed by world-renowned organizations like the British Nautical Institute(NI) and OPITO (Offshore Petroleum Industry Training Organization).

When it comes to maritime crew, a university degree, augmented by relevant sea-going experience and compulsory competency certification, after licensing by the state maritime authorities, if no limitations apply, allows professionals to be employed on any kind of vessel, including those involved in offshore drilling, construction, and supply operations.

A specialized web resource, ukrcrewing.com.ua, is a platform where maritime professionals can upload their CVs and search for available vacancies. Using this resource, we can source professionals by rank and filter for relevant vessel-type experience.

Based on Figure 4, below is a table with a number of Ukrainian professionals in various ranks whose profiles are available on the mentioned web resource:

Table 10 – number of CVs available on ukrcrewing.com.ua web resource for Ukrainian maritime professionals (source: Ukrcrewing.com.ua).

Rank	Total available CVs	Type of vessel			
		Supply	Drillship/rig	Construction	Pipe/cable lay
Master	2689	167	3	16	4
Chief Officer	3497	194	9	13	6
Second Officer	4093	193	5	12	7
Chief Engineer	2538	223	7	12	6
Second Engineer	3526	227	7	11	20
Third Engineer	4159	165	11	14	17
Electrical officer	1210	103	8	6	13
Engine ratings	2976	178	31	124	31
Deck Ratings	4754	218	27	155	19

Need to point attention to the fact that the above web resource reflects only registered professionals with completed online CVs. In reality, the number is higher as some professionals are not using particular web resource for CV posting and searching for employment via specialized crewing companies.

Table 10 shows a tendency to lack professionals with experience in Drillships, rigs, and ripe and cable-laying vessels. This may be caused by the limited number of these types of vessels in operation. For instance, according to the upstreamonline.com website, by February

2024, there were only 144 drillships and semi-submersible rigs, employing around 1500 maritime officers worldwide.

When it comes to oil and gas specialized training centers, the Drilling Training Centre, a subsidiary of Ivano-Frankivsk National Oil and Gas University, is licensed to prepare professionals in the Drilling Well Control program at three levels: level 2 (basic), level 3 (driller), and level 4 (supervisor).

Looking for potentially available drilling personnel, the online web resource work.ua was used for searching for professionals looking for employment at the positions of:

Table 11 – Drilling sector job candidates.

Position	Number of candidates
Drilling engineer	31 candidates
Driller, assistant driller, toolpusher	104 candidates
Drilling fluids engineer	5 candidates
Crane operator	267 candidates
Rig mechanic	2 candidates

We need to point out that these are only job seekers at present, and many professionals are currently employed locally. For instance, according to the web resource nefterynok.info, in the first quarter of 2024, there were 46 drilling rigs in operation in Ukraine, and skilled personnel, such as mechanics, turners, and fitters, were serving in the armed forces.

When it comes to drilling professionals, the proficiency level in the English language may become an obstacle for the hiring process.

Offshore maritime drilling and supportive projects require experienced and educated personnel in management positions, usually called Project Managers (PM) or Offshore Installation Managers (OIM). Web resource LinkedIn defined 35 Ukrainian professionals with experience as PM and OIM. Common profile for PM and OIM – former Masters on crude tankers or advanced offshore vessels, making a pool of professionals for potential promotion quite big. According to the Ukrcrewing.com.ua web resource, there are 251 Ukrainian Master (Captain) CVs available in the system with experience suitable for promotion to PM and OIM.

If a concession-winning contractor wants to employ foreigners, special rules may be established on the number and ranks of local citizens. For example, in Saudi Arabia, a country where millions of expats are employed throughout all sectors, the so-called Saudization process obliges employers to hire local nationals and is derived to reduce the unemployment of the local population. As per centuroglobal.com web resource, there are 26 professions reserved for Saudi nationals only. Each company with over 100 employees should have a 30% quota for local nationals, but this may vary on a sector basis. Saudization certificate is issued based on the percentage of locals employed, and the Saudi Aramco IKTVA initiative encourages local contractors to establish and increase local hiring, operations, and production.

Similar incentives of the Ukrainian government could bring additional benefits to society and the economy.

Taking a look at port and shipyard facilities, establishing offshore E&P operations will not reshape port operations and ship-repair industry dramatically, and those professionals currently employed could fulfill the growing demand in ship repairs and construction, as we are looking for 5-10 repair and construction operations per year, based on the amount of fleet involved at the initial stage of the offshore project development[1].

---

[1] Number of employees in port and on shipyard is very dynamic, due to nature of operations, have cargoes and we build ships – hiring as is there is not tomorrow, otherwise 2 working days week and lay offs.
There is no clear data on how many personnel is employed now in ports and shipyards either in Crimea or Ukraine

Looking at the human resources available in Ukraine's maritime and drilling sectors, we may conclude that there is a sufficient number of crew and personnel to be employed on vessels and drilling platforms. Additional offshore operations will boost competition for employees, resulting in an industry-wide salary increase. The only level of English proficiency among local drilling workers may affect the hiring process.

The presence of established educational facilities like universities, colleges, and specialized training centers, as well as the availability of qualified and experienced professionals locally, are significant competitive advantages for both contractors (less resources are needed to hire and repatriate foreigners) and the government, as the local economy will benefit from taxes and other social benefit payments.

5.4 Procurement

Primary activities, as per the industry-specific Value Chain, require sourcing, contracting, purchasing, delivering, and distributing materials among consignees.

The procurement process can be divided into purchasing materials and services. As described in Table 3, six groups of materials must be supplied for drilling rigs during operations. Sourcing the mentioned materials locally in bulk could benefit drilling contractors, oilfield service companies, and suppliers.

Ukraine has a developed steel production complex, and Interpipe Group is one of the leading global companies supplying drilling pipes (casing) to the world market. The company operates two factories – Interpipe Niko Tube and Interpipe NMPP, and production nomenclature includes seamless drilling pipes and oil and gas trunk pipes of various diameters, end-finishing, and profile thicknesses. In 2018, Interpipe Group manufactured 560 thousand tons of seamless pipes. As per Table 3, the annual consumption of drilling pipes of four drilling rigs equals 11974 pcs, with an average estimated weight of 9 thousand tons, the amount that can be easily covered by the mentioned local producer.

Diesel oil and fresh water are consumables readily available at a local market, so they can be easily contracted and supplied.

For the purposes of a well case cementing, a special “G class” cement is used. Company Dyckerhoff Ukraine, which operates the Volyn Cement factory, has provisions and technology to produce the mentioned class cement and is successfully cooperating with UkrGazVydobyvannya. Volyn cement factory has a capacity to produce 2.1 million tons of cement per year; this amount could cover any prospected needs of the oil and gas industry.

When it comes to drilling fluids, the situation is more complex due to the wide range of formulations used for various applications. Drilling fluid consists of a base liquid (water, diesel, or safra oil), chemicals, and a weighting agent (barite, marble, or similar). The formulations of drilling fluids are confidential and the intellectual property of oilfield service companies, making it impossible to research the amount and type of chemicals used.

Barite, the main weight agent for drilling fluids (except brines), is the most bulky product used in mud production. For instance, to produce 1600 barrels of WBM with a density of 2150 kg/m3, 320 tons of barite are used. Referring to Table 3, four drilling rigs produced 73,3 thousand cubic meters of drilling fluid (WBM), which is equal to 461 thousand barrels, resulting in the consumption of 92,2 thousand tons of Barite. Barite is not extracted in Ukraine but is considered a prospective mineral for import replacement as per the mining industry development road map issued by the Ukrainian Geological Survey Administration. The biggest Ukrainian oil and gas E&P company, Ukrgazvydobyvannya is contracting barite through the Prozorro system from companies that import a product from Bulgaria and Turkey. Increased demand on the local market may push the development of barite extraction in Ukraine.

According to Ukraine's National Gas Production Guide, dated 2020, Ukraine has the biggest fleet of onshore drilling rigs in Europe, and four world's major oil service companies, Schlumberger, Halliburton, Baker Hughes, and Weatherford, already have their operations established in Ukraine. Also, Ukrainian companies like OFS (Oilfield services of PJSC Ukrnafta), Nadra Services, and others are providing various oil field services and competing with international giants. The public data for the oilfield service market is very brief, which does not allow proper analysis to be carried out.

Ukraine has the biggest onshore rig fleet in Europe, but sophisticated production methods are barely used (Ukraine's National Gas Production Guide, 2020). International and local oilfield service companies have established operations with an integrated supply chain, and a developed steel and cement industry provides most of the required materials.

We may conclude that the drilling and oilfield service industry and supply chain in Ukraine are developed and integrated with local suppliers. The introduction of marine drilling operations will not require the establishment of the industry and supply chain from zero, as done in other developing countries (Guayana, Mozambique, Tanzania) during operations commencement, which will be the additional competitive advantage for contractors to commence offshore drilling operations in Ukraine.

6. Outer Continental Shelf Upstream Cycle Political and Economic Landscape: Ukrainian Perspective, natural gas case.

As the owner of all subsoil reserves, a state should clearly understand the benefits of resource development. The greater the benefits, the greater the political will to approve and encourage the process.

Considering a governmental perspective, PEST and SWOT analyses were carried out (see Appendix H) and indicate benefits and positive outcomes for all stakeholders involved – state, government, society, contractors, economy, technology, and human development. The security paradigm in the Black Sea region could be changed dramatically once international companies, backed by their governments, establish operations in the Ukrainian maritime EEZ. Former Ukrainian Prime Minister Yuriy Yekhanurov mentioned in his interview with Dmytro Gordon, mentioning that no occupation of Crimea would take place if an American company, as was agreed in 2008, would be engaged in E&P operations in Crimean waters.

The Strategy for the Reintegration of Crimea after the Deoccupation (2023) estimates that Ukraine has 2.3 trillion cubic meters (TCM) of natural gas reserves, which will be accessible once the security situation allows. According to the strategy, exploration preparation and production would take 5-8 years, with the involvement of world oil majors like BP, ExxonMobil, Shell, Total, and Chevron. The demand for investment is estimated to be $14.6 billion.

Ukraine Oil and Gas Industry Guide (2021) estimates the whole cycle of cost in the case of project success for Black Sea Offshore fields at $148 per thousand CM of natural gas, where the distribution is the following: $101 in government benefits (royalties and taxes), $47 – operational full cycle cost (including the cost of capital), at the same time without specifying a field to which these estimates refer, but we may assume this is for Dolphin Project (see Appendix G, Figure 1).

The rights to use the subsoil are granted through a licensing process. However, a license holder does not own any mineral resource until it is extracted from the subsurface, where various product sharing agreement (PSA) schemes can be pre-agreed upon. See Appendix G, Figure 2, for types of licenses for oil and gas operations issued by the Ukrainian Geological Survey.

7. Conclusions and Future Research

The Ukrainian Maritime Exclusive Economic Zone, especially around the Crimean Peninsula, contains hydrocarbons worth dozens of billions of dollars. Before the occupation of Crimea, international Oil Majors were interested in exploring and producing (E&P) oil and gas offshore. Some agreements and memoranda were signed, but the political situation prevented these plans from becoming reality.

Most of the offshore hydrocarbons are located at the deepwater blocks, and no Ukrainian company has the assets, technologies, and expertise for the E&P upstream cycle to survey (seismic), explore, extract, and produce oil or gas at this depth, this situation is common for every developing nation with proven offshore hydrocarbon reserves. Chornomornaftogaz, the state-owned company, is the only contractor that was engaged in hydrocarbon E&P at a depth less than 100m, mostly at the North-Western Part of the Black Sea, but all of its assets were lost with the occupation of Crimea.

Considering the above-mentioned, any company that gains the right to explore hydrocarbons from offshore blocks should either use its own expertise and assets or engage specialized contractors to carry out parts of the industry-specific Value Chain primary activities.

Global experience shows that a tiny number of specialized contractors are engaged in certain high-tech activities, such as 3D seismic surveys, deepwater exploratory and production well drilling, installation of production platforms, engagement of floating production and storage outlet vessels (FPSOs), pipe and cable laying, underwater ROV (remote-operated vehicles), and well maintenance services.

On the other hand, Ukraine, including Crimea, has the necessary infrastructure, including ports, airports, ship repair yards, and construction yards, to support any kind of offshore construction and drilling activities.

Available human capital presented by marine and drilling personnel, port and shipyard professionals, universities, and training centers could prepare prospective talents for current and future operations.

Ukrainian offshore hydrocarbons offer considerably lucrative perspectives. Given the political will for the reintegration of Crimea, the demand for direct foreign investment, the thirsty local and international hydrocarbon market, the availability of means of hydrocarbon transportation to Europe and other parts of the world, the availability of the workforce, and the developed critical infrastructure, and the engagement of international contractors, a whole industry for upstream hydrocarbons E&P could fit into the competitive advantage paradigm.

If the oil and gas E&P project in Crimea is realized, it would dramatically change the economic, political, and security landscape of Ukraine and the entire Black Sea region.

Areas for future research

Only a few states worldwide—the US, UK, and Norway—publish hydrocarbon production data, making any data not publicly available for the other 50 regions where offshore hydrocarbon E&P activities are carried out.

Once the political and security situation in the Crimean Peninsula has settled, a series of modern 3D seismic surveys will be carried out. The amount of resources needed for ultimate recovery will be reestimated, providing additional data. This will, consequently, allow a proper economic and technical evaluation, considering available upstream cycle industry-specific Value Chain supportive domains like infrastructure, human capital, and outsourced specialized contractors that could provide the expertise and technologies for hydrocarbon E&P primary activities.

Appendixes

Appendix A – Ukrainian Deepwater Oil and Gas Licence Areas (Bugriy, 2014).

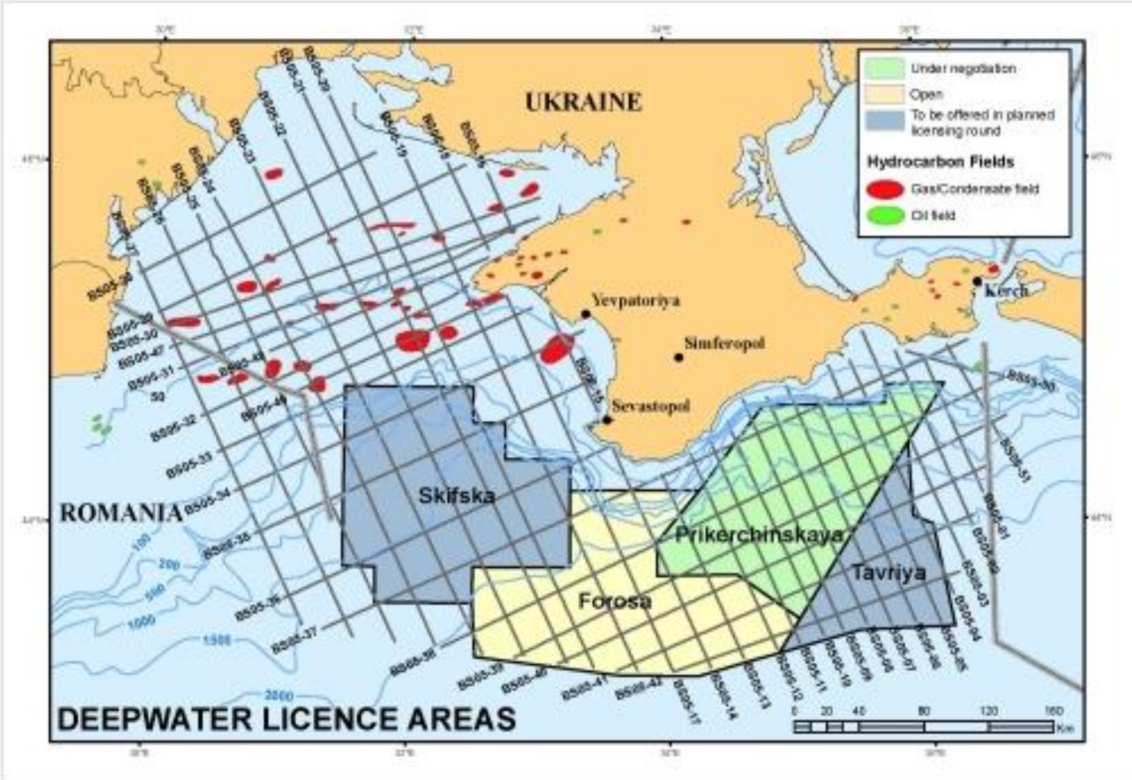


Figure 1 - Ukrainian Deepwater Oil and Gas License areas (source: the Jamestown Foundation).

Appendix B – Porter's Firm-level Model

PRIMARY ACTIVITIES

- **Inbound logistics** involve receiving sourced materials and locating them in a proper storage or warehousing facility. This is followed by inventory management and controls (for example, FI-FO or LI-FO), incoming materials quality control, carrier delivery scheduling, and returns.
- **Operations** represent the main company's set of activities for converting the input materials to the final product (service), including manufacturing, assembly, packaging, testing, and quality compliance and controls.
- **Outbound logistics** include collection at the factory or specific production lines, temporary warehousing and storage, stock order compiling, and scheduling delivery via carrier distribution.
- **Marketing and sales** activities involve aligning buyers with the proposed product through advertising, promotion, and sales force. Because buyers may differ in importance and priority from sellers, pricing and quoting are very sensitive activities.
- **Service, warranty, and post-purchase maintenance** are dedicated to keeping the product in the state when characteristics are close or equal to initial and may include installation, equipment launching, repair, operator training, and spare parts supply.

SUPPORT ACTIVITIES

- **Firm infrastructure** comprises various activities, ranging from overall management to administration, quality control and planning, accounting and finance, legal, government affairs, and other legal services. Typically, infrastructure supports the entire company value chain rather than a specific set of activities. Sometimes, infrastructure activities are distributed between various corporate levels.

- **Human resources management** consists of the following activities: scouting, interviewing, assessing, recruiting and hiring, performing task-based training, development, and remuneration of personnel. Human resource management is directly influencing both primary and support activities, occurring in different parts of a firm, similarly to other support activities. The overall costs of human resource management and basic concepts such as salary compared to the cost of recruiting and newcomers training are usually misunderstood. Proper human resource management could hold a key to a competitive advantage in any firm. Inhouse industry specific training and personal development workshops could improve working culture and increase employees efficiency.
- **Technology development** refers to a range of activities to improve either product or manufacturing process, adding value through the application of know-how, procedures, or technology applied through the equipment. Technology development is a wider domain compared to the Research and Development (R&D) process and is typically associated with the engineering department, and may occur in various parts of the firm. The variety of technologies used is very wide, ranging from those used in document control to technologies presented in the product. Meanwhile, many value activities use a technology that consists of a number of different sub-technologies. Technology development is vital to competitive advantage in all industries.
- **Procurement** is the function of sourcing and obtaining inputs used to produce the firm's value chain. Purchased inputs could be in the form of raw materials, consumables, and assets (machinery, office equipment, and buildings). Purchasing provides the services and materials and is deeply embedded in the firm’s activities, both primary and support. Procurement is the function through which a firm spends money to ensure continuity of their internal activities, making spending control procedures an integral part of any

business, for example, a multi-level approval process is used for fraud prevention. Customized purchasing practices can strongly affect the ability of the business to perform its activities, especially when it comes to raw materials sourcing practices and spending for equipment maintenance.

Appendix C – maritime offshore drilling units, platforms, and supply fleet

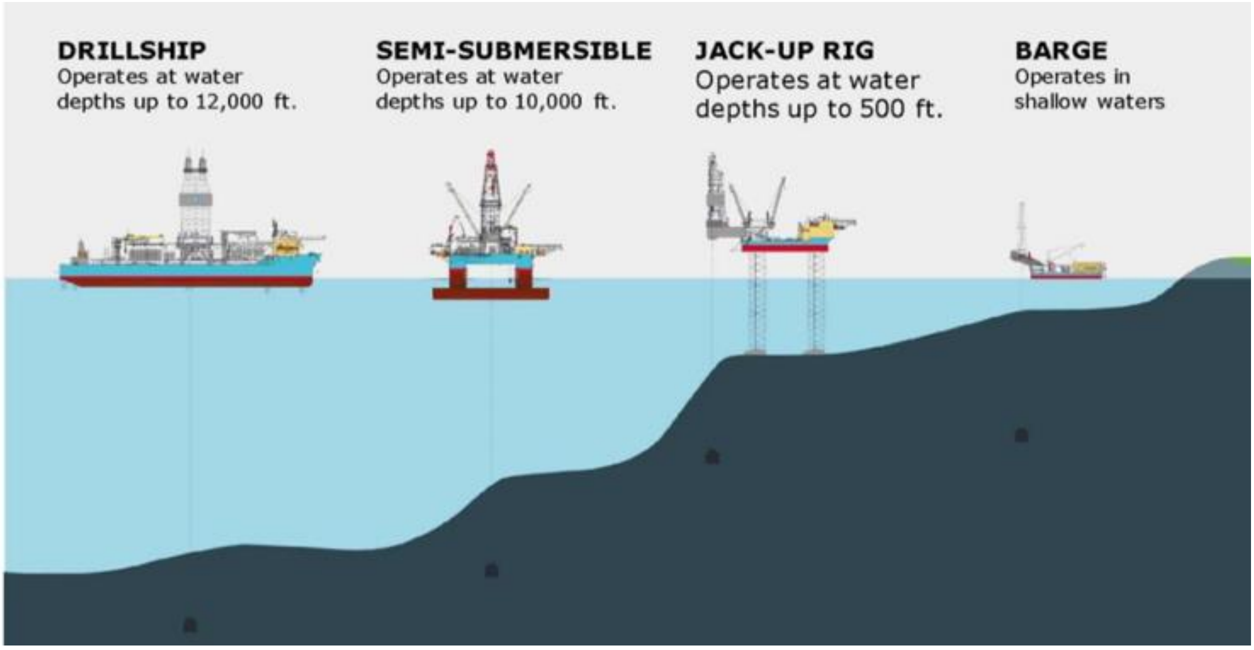


Figure 1 – marine offshore drilling units (source: Maersk Drilling).

Figure 2 – mobile offshore drilling unit Scarabeo 8 (source: Saipem).

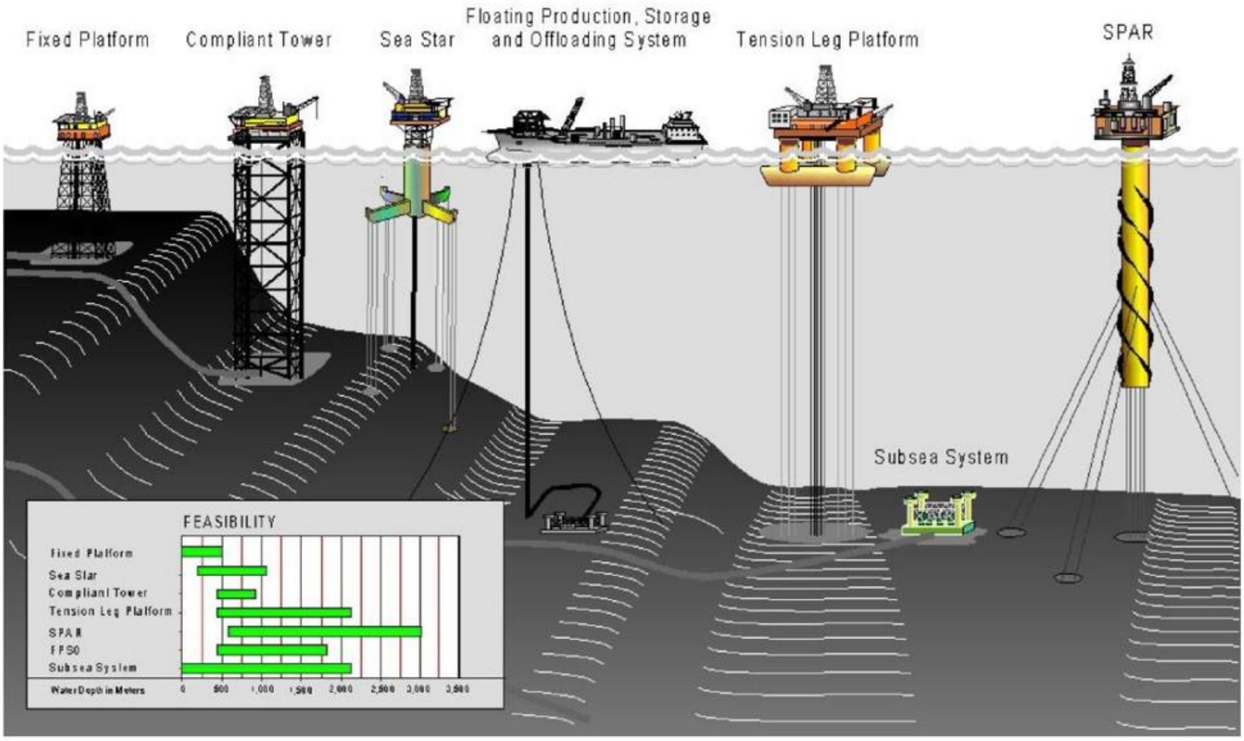


Figure 3 – production platforms types (source: Wikimedia Commons).

Figure 4 – Platform Supply Vessel (source: Wikimedia Commons).

Appendix D – weather factor at Black Sea

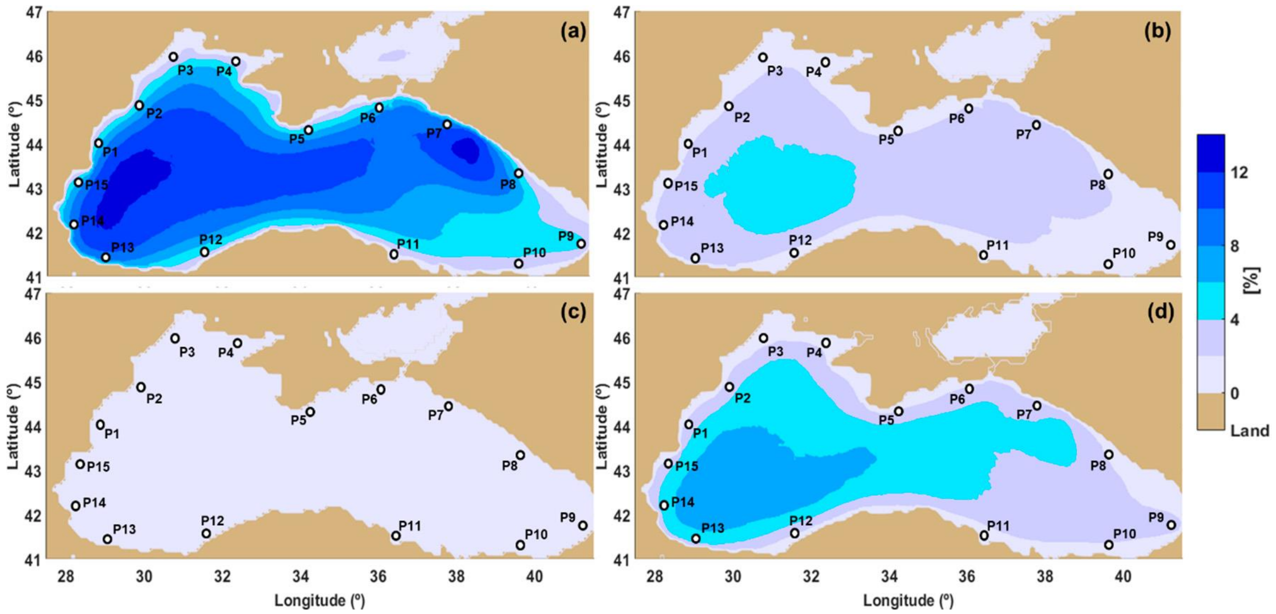
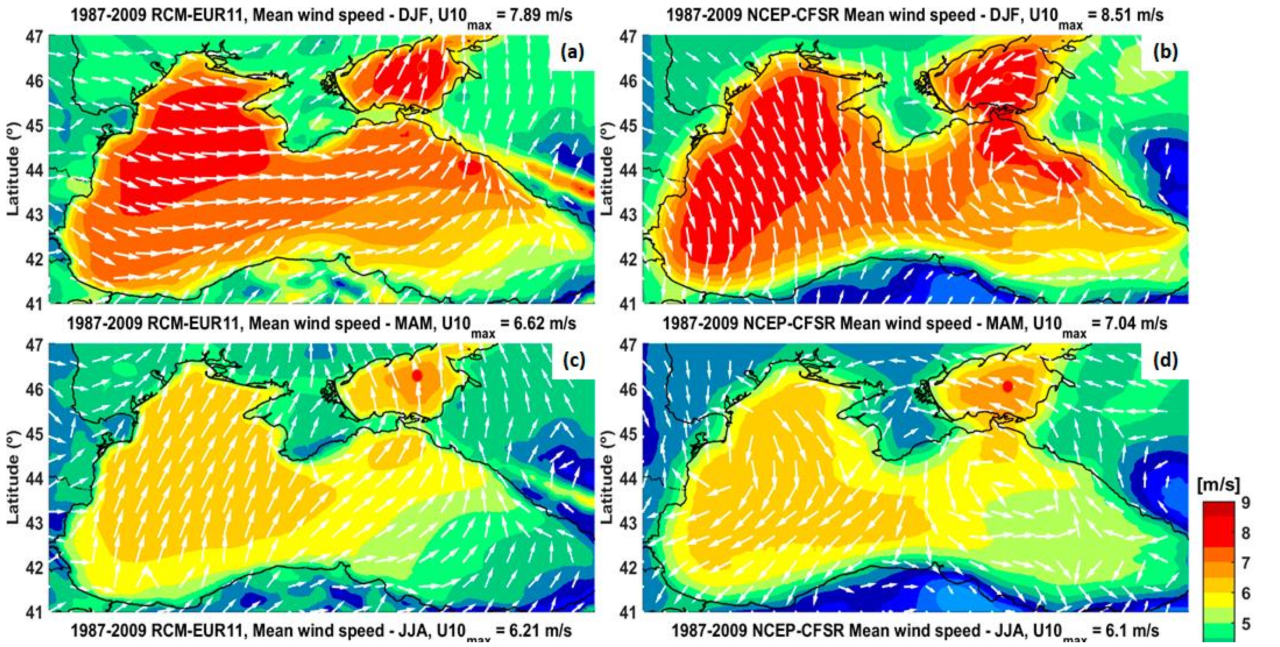


Figure 1 – Seasonal distribution of the Wave height Hs>2.5m parameter over 30-year SWAN simulations (1987-2016), where (a) winter, (b) spring, (c) summer, (d) autumn. (Rusu, Onea 2019).



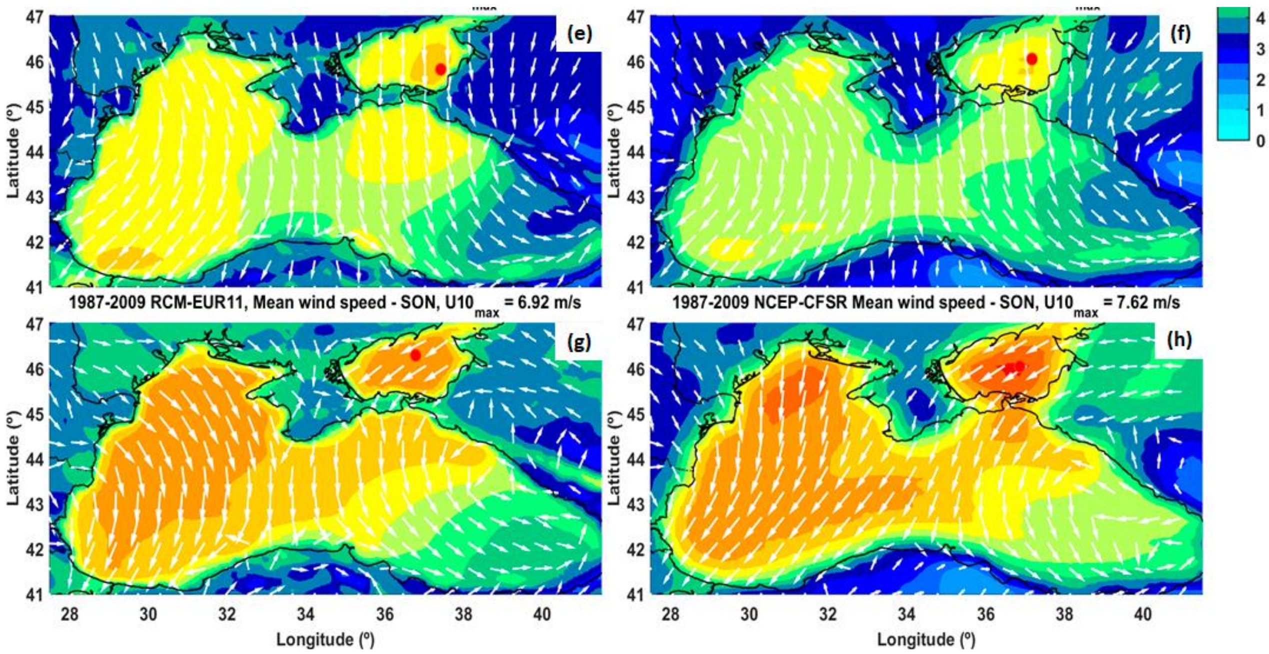


Figure 2 – seasonal average wind speed with the wind vectors indicate the seasonal average wind direction over time interval 1987-2009. Observatons from EUR11 (left) and NCEP(right), winter DJF(December, January, February), spring MAM (March, April, May), summer JJA (June, July, August), autumn SON (September, October, November), (Onea, Rusu, Raileanu, 2018).

Appendix E – Simulation based on monthly offshore oil rigs material demands

Based on a real case scenario of 4 Drilling rig operations in the Gulf area, below is the annual cargo demand:

Table 1 – four drilling rigs monthly materials demand

Month	**Palettes, pcs**	**Dry Bulk, mt**	**Diesel, m3**	**Fresh Water, m3**	**Drilling Fluid, Barrels**	**Drilling Casings, pcs**
January	177	5,503	3,720	2,735	3,516	948
February	158	1,261	3,360	985	1,221	1,200
March	188	4,497	3,720	2,506	3,588	1,026
April	390	14,378	3,600	6,802	11,438	1,070
May	460	17,356	3,720	8,229	11,727	958
June	147	2,871	3,600	4,048	2,570	1,010
July	196	1,556	3,720	2,732	2,554	1,004
August	247	10,427	3,720	5,054	8,671	940
September	300	11,589	3,600	6,660	8,502	650
October	186	9,721	3,720	6,026	7,647	1,066
November	242	8,156	3,600	4,072	5,501	1,081
December	174	10,839	3,720	4,942	7,362	1,021
Total per year	2,865	98,154	43,800	54,431	74,296	11,974

Based on real-life case data of drilling materials demand from drilling support operations in the Gulf area, the Simulation, using online software "SCM Global Supply Chain

Simulation Tool" (https://www.scmglobe.com/) was done for two scenarios – with minimal and maximal monthly materials demand.

Considering the Appendix D weather criteria at the Black Sea, the weather downtime factor is 15%. This includes a significant wave probability of 2.5 meters high in winter months, with winds not exceeding the operations threshold.

Table 2 – simulation input data.

Input data	
Number of Drilling units	4 units at the distance of average of 100 nm (180 km) from the port of Sevastopol, located at each of license areas (see Annex A, Figure 1 - Ukrainian Deepwater Oil and Gas License Areas).
Number of OSV	2 for minimum scenario (January) , 3 for maximum scenario (May)
Size and type of OSV	Platform Supply Vessel (PSV), Deadweight 3200 mt (DWT), see Annex X
Time spent at each location	January - 6 hours (considering weather downtime factor 1.15), May – 5 hours.
Scenario 1 – January, two vessels	Route 1 – Port – Rig 1 – Rig 4 – Port Route 2 – Port – Rig 2 – Rig 3 – Port
Scenario 2 – May, three vessels	Route 1: Port – Rig 1 – Rig 4 – Port Route 2: Port – Rig 2 – Rig 3 – Port Route 3: Port – Rig 3 – Rig 2 – Rig 1 – Rig 4 – Port (milk run model)
Route distance	Route 1&2 – approx. of 300 nm (550 km) Route 3 – approx. 450 nm (830 km)
OSV Cruising speed	10 knots (18,5 km/h)

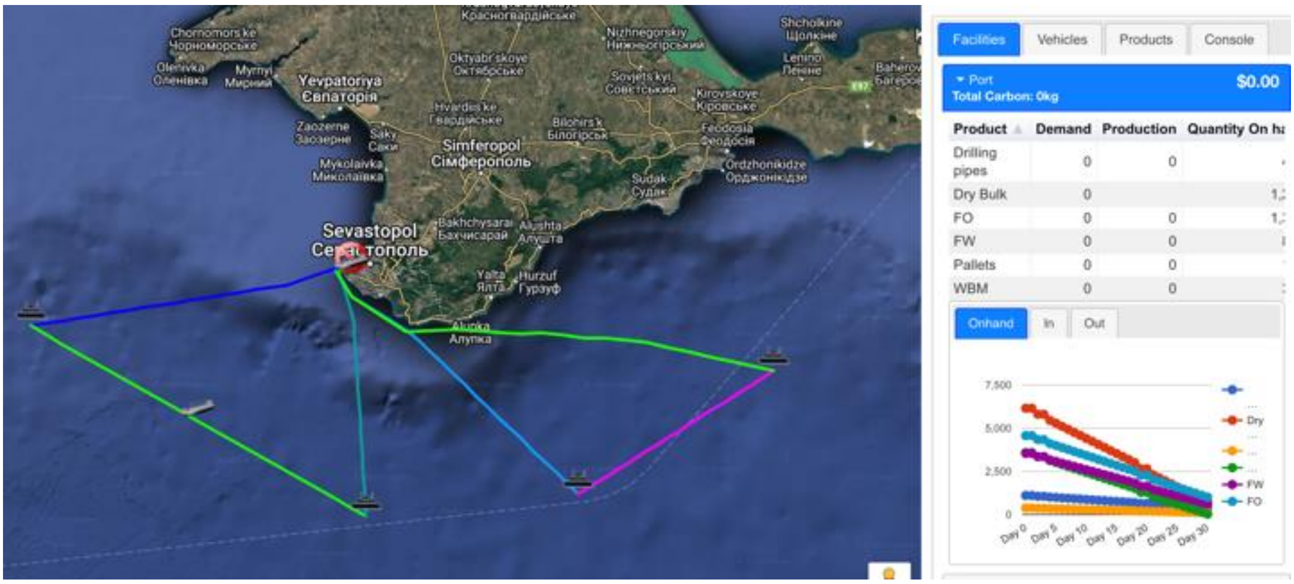
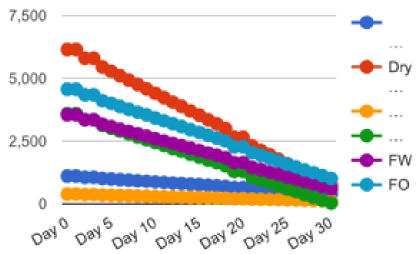


Figure 1 – Scenario 1, two OSV vessels, Port stock perspective (source: SCM Global).

Port
Total Carbon: 0kg
$0.00

Product	Demand	Production	Quantity On ha
Drilling pipes	0	0	4
Dry Bulk	0		1,2
FO	0	0	1,3
FW	0	0	8
Pallets	0	0	
WBM	0	0	3

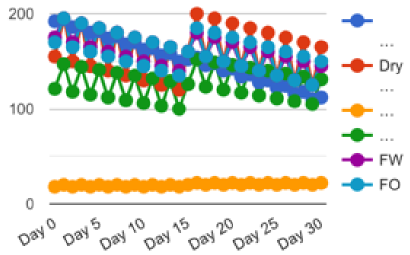
Onhand | In | Out



Rig 1
Total Carbon: 0kg
$0.00

Product	Demand	Production	Quantity On ha
Drilling pipes	8	0	
Dry Bulk	45	0	
FO	30	0	
FW	25	0	
Pallets	2	0	
WBM	29	0	

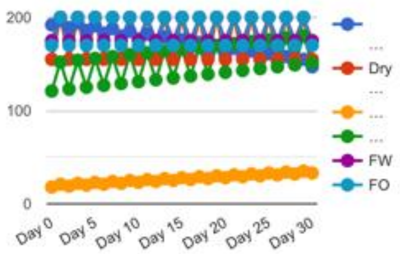
Onhand | In | Out



Rig 2
Total Carbon: 0kg
$0.00

Product	Demand	Production	Quantity On ha
Drilling pipes	8	0	
Dry Bulk	45	0	
FO	30	0	
FW	25	0	
Pallets	2	0	
WBM	29	0	

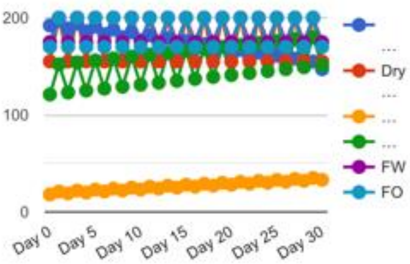
Onhand | In | Out

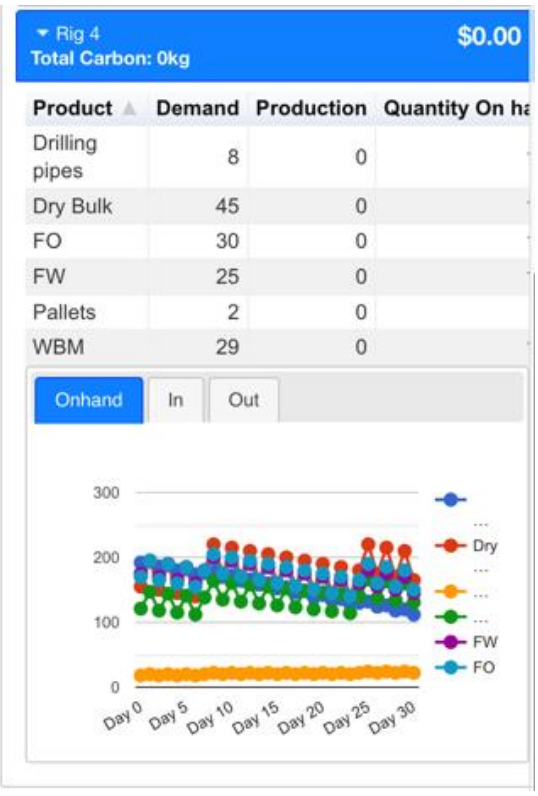


Rig 3
Total Carbon: 0kg
$0.00

Product	Demand	Production	Quantity On ha
Drilling pipes	8	0	
Dry Bulk	45	0	
FO	30	0	
FW	25	0	
Pallets	2	0	
WBM	29	0	

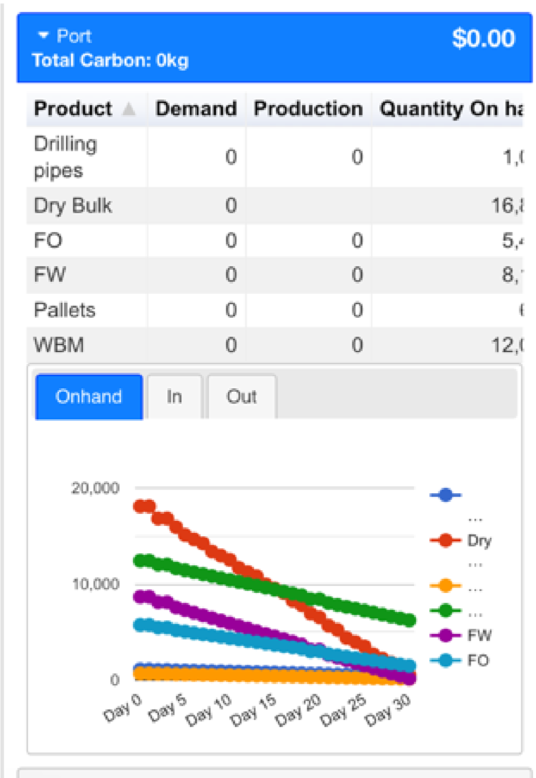
Onhand | In | Out



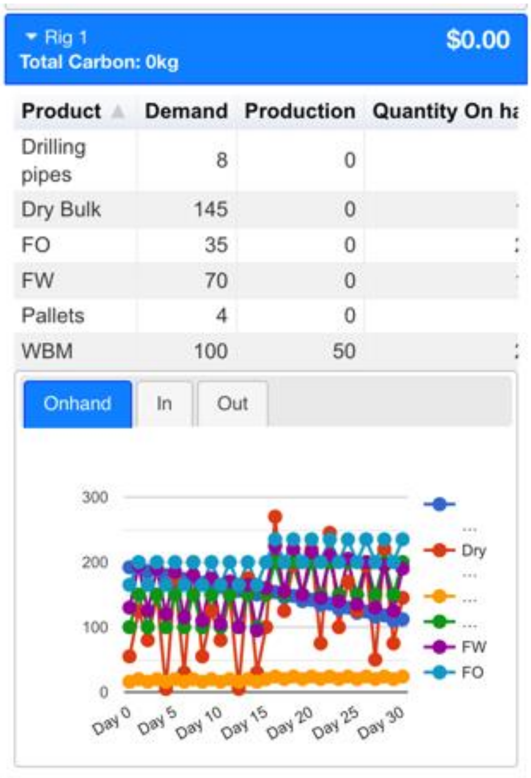


Product	Demand	Production	Quantity On ha
Drilling pipes	8	0	
Dry Bulk	45	0	
FO	30	0	
FW	25	0	
Pallets	2	0	
WBM	29	0	

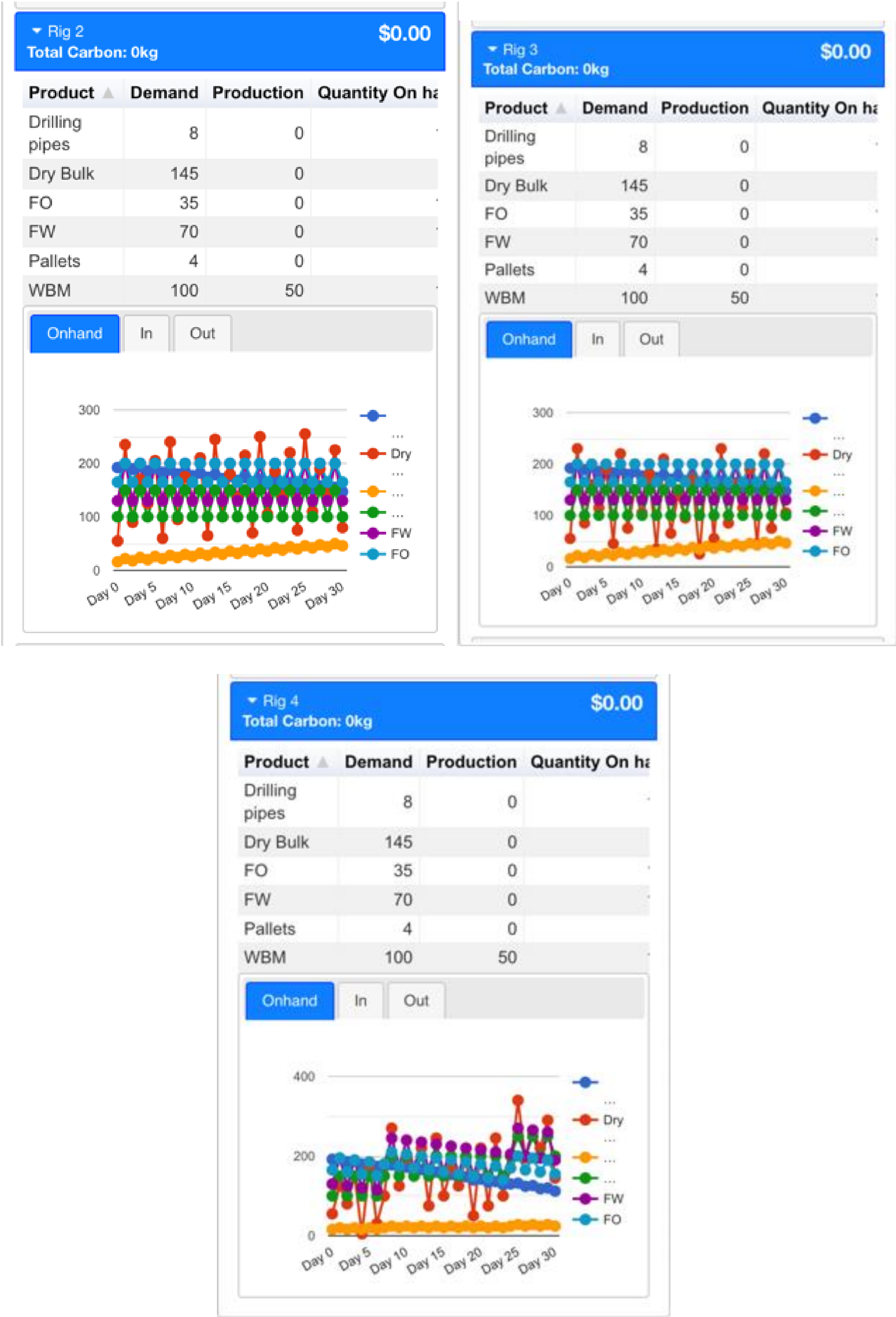
Figure 2 – Scenario 1 Simulation, Facilities stock level (source: SCM Global)



Product	Demand	Production	Quantity On ha
Drilling pipes	0	0	1,(
Dry Bulk	0		16,8
FO	0	0	5,4
FW	0	0	8,7
Pallets	0	0	(
WBM	0	0	12,(



Product	Demand	Production	Quantity On ha
Drilling pipes	8	0	
Dry Bulk	145	0	
FO	35	0	
FW	70	0	
Pallets	4	0	
WBM	100	50	



Product	Demand	Production	Quantity On ha
Drilling pipes	8	0	
Dry Bulk	145	0	
FO	35	0	
FW	70	0	
Pallets	4	0	
WBM	100	50	

Product	Demand	Production	Quantity On ha
Drilling pipes	8	0	
Dry Bulk	145	0	
FO	35	0	
FW	70	0	
Pallets	4	0	
WBM	100	50	

Product	Demand	Production	Quantity On ha
Drilling pipes	8	0	
Dry Bulk	145	0	
FO	35	0	
FW	70	0	
Pallets	4	0	
WBM	100	50	

Figure 3 – Scenario 2 Simulation, Facilities stock level (source: SCM Global).

Appendix F – Fishing Port of Sevastopol and Automotive terminal

Figure 1 – Kamyshovaya Bay of Sevastopol (source: perekop.info)

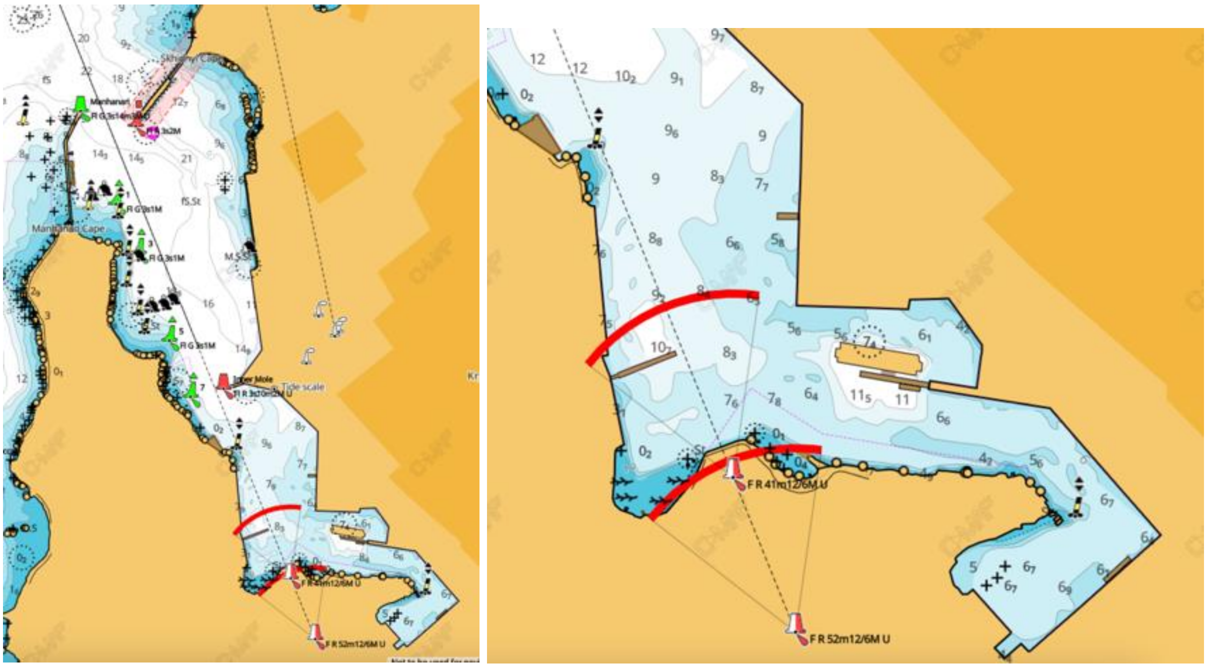


Figure 2 – Navigational Maps of Kamyshovaya Bay (source: C-Maps),

Figure 3 – Former automotive terminal and bay navigational map (source: Openseamap)

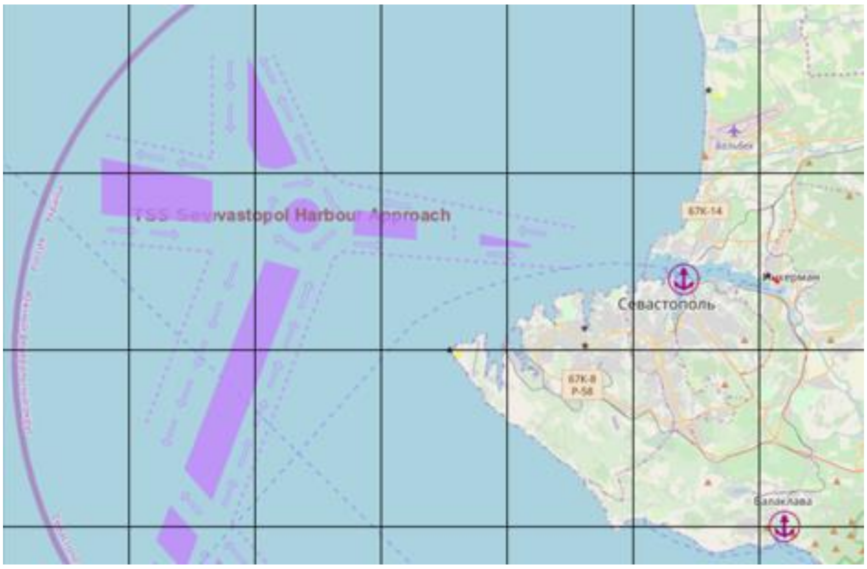


Figure 4 – Traffic Separation Scheme offshore the bay of Sevastopol (source: Openseamap).

Appendix G – Offshore Oil Field Development Economic Landscape

Black Sea offshore gas projects full cycle exploration and production cost are estimated to be at 148$ per thousand cubic meters, where 101$ in governmental transfers (royalty and income tax), and 47 $ in operating full cost cycle (including cost of capital), see Figure 1 below.

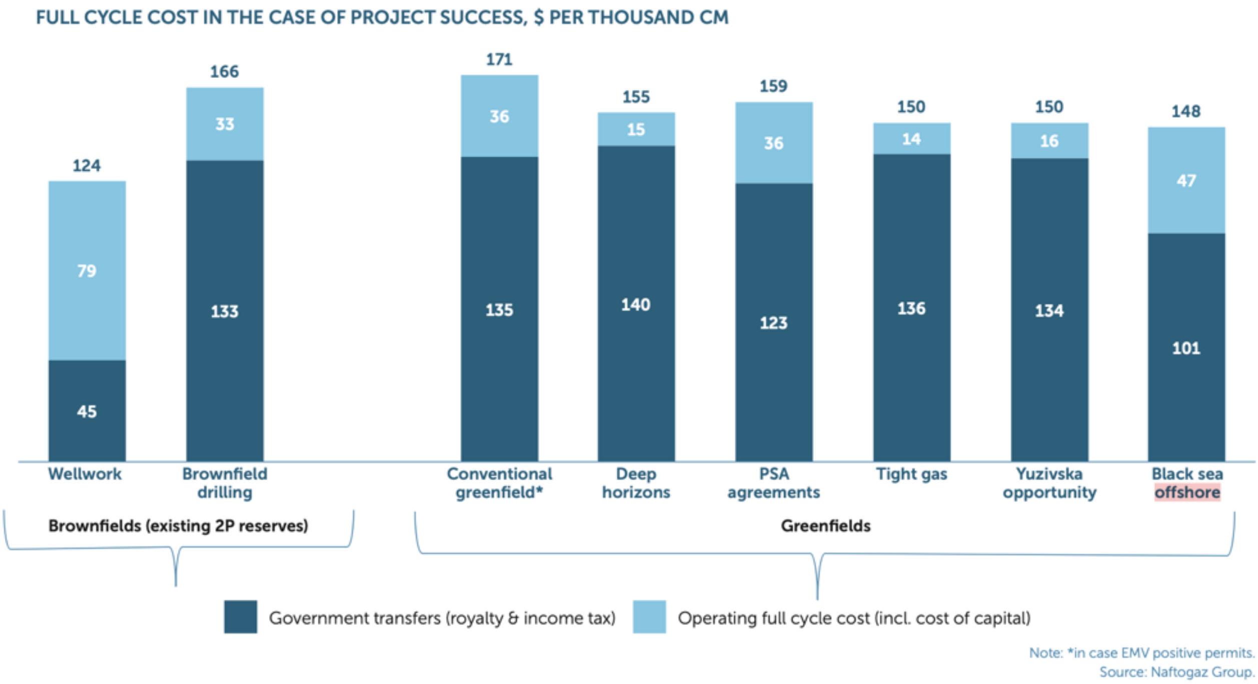


Figure 1 – Full cycle cost in the case of gas project success, $ per thousand CM (Ukraine Oil and Gas Industry Guide, 2021).

The Ukrainian Geological Survey authority has issued guidelines on licensing type and duration. For instance, a license for a combined hydrocarbon exploration and production activities offshore can be issued for 30 years, while Product Sharing Agreement (PSA) can be valid for 50 years, see Figure 2 below.

The Dolphin project is a prospective conventional gas offshore project granted for Naftogaz for 30 years, covers 29 thousands square kilometers, which was supposed to be started in 2023 with the first production in 2026, peaking in 2031. Total project CAPEX was estimated to be 10,777$ billion, see Figure 2 and 3 below.

Activity	Duration
Exploration	Up to 3 years for mineral resources of local importance, and up to 5 years for mineral resources of state importance
Exploration, including pilot commercial production of deposits of state importance (including hydrocarbons)	Up to 5 years for onshore operations and up to 10 years for offshore hydrocarbons
Production	Up to 20 years for onshore operations, and up to 30 years for offshore hydrocarbons
Combined exploration and production of hydrocarbons	Up to 20 years for onshore operations, and up to 30 years for offshore operations
Operations under a production sharing agreement	Up to 50 years

Figure 2 - The types of licenses for oil and gas operations are issued by the Ukrainian Geological Survey (Ukraine Oil and Gas Industry Guide, 2021).

Parameter	Value
Stage	Exploration
License duration	30 years
Acreage, sq.km	~29 000
Gas type	Conventional, both shallow and deep water
Probability of success, %	within 20% to 30% range for different blocks
Year of first production	2026
Peak annual production, bcm	2031
Total number of wells to be drilled	117
Planned 3D seismic, sq.km	20 000
Total CAPEX, $ mln	10 775

Figure 3 – the Dolphin Project parameters (Ukraine Oil and Gas Industry Guide, 2021).

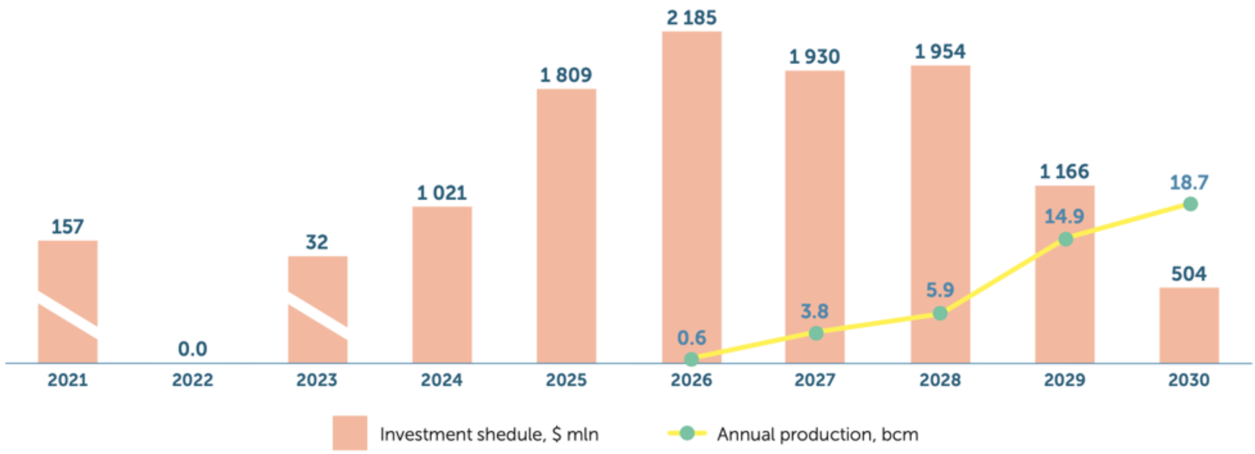


Figure 4 – the Dolphin Gas Project economic perspectives (Ukraine Oil and Gas Industry Guide, 2021).

Appendix H – PEST and SWOT analysis

PEST Analysis – government perspective

<u>Political</u>:

Political factors remain crucial influences on the oil and gas industry worldwide. The government plays a critical role in establishing the sector's rules, issuing license concessions, and setting tax policies. These incentives significantly affect industry profitability and investment decisions in new projects.

Establishing the entire Oil and Gas E&P industry in Crimea would also change the security paradigm in the Black Sea region, shifting the power balance toward the Western Alliance's dominance.

Ukrainian policymakers twice attempted to commence E&P operations on the shelf, but political instability prevented them from proceeding beyond memoranda.

The commencement of operations after the signed concession will send a strong signal to foreign investors about the country's positive political climate.

Economic:

The oil and gas industry is a significant contributor to the Country's economy, with the following domains:

Employment: Consider the example of the UK O&G sector, which directly employs over 30,000 individuals while indirectly involving an additional 120,000 jobs in supportive industries, making the multiplication coefficient equal to 4.

Tax revenue: The O&G industry remains a significant source of tax revenue for the government. For instance, in the UK, for the year 2022, with an average oil production rate of 809 thousand barrels per day and a total of 38 BCM of Gas, it contributed over £14 billion in taxes.

Balance of Payments: Domestic oil and gas production positively affects the balance of payments by reducing imports. This helps maintain a favorable trade and investment balance with the rest of the world.

Social: the reintegration of Crimean society will be a cornerstone of Ukrainian policymakers. Introducing a strong economic incentive with a clear path to prosperity and creating highly paid jobs will soothe social tensions.

As described in the above domain, considering the multiplication factor of 4, 2000 jobs created directly in the O&G sector will be repaid with an additional 8,000 jobs in supportive sectors, driving both local and central country economies when Major multinationals start establishing their operations, even on a limited scale at the initial stage.

Technological: technology continues to play a vital role in the O&G industry, improving safety, productivity, and efficiency.

Robotics and Automation systems have revolutionized the oil and gas sector. They perform a myriad of tasks and services, especially while engaged in hazardous or repetitive activities.

Artificial Intelligence became a cornerstone for industry decision-making, helping to analyze data from seismic surveys to propose exploration and production targets. AI-run predictive and planned maintenance significantly reduces unplanned downtime.

Digital Twins simulate physical assets, allowing for scenario testing and system optimization before physical project implementation, managing risks, and increasing performance.

Unfortunately, open-source data does not provide any insight into whether Ukrainian companies have developed the abovementioned technologies to the point where they can be utilized in offshore hydrocarbon E&P.

SWOT Analysis

Table 1 – Swot Analysis

Strength	- huge discovered reserves that can be augmented with new surveys; - availability of port infrastructure; - available human capital; - available and not saturated local market; strategic importance for the state
Weaknesses	- high capital and operation costs; - technical and operational challenges; - weather factor increases operational downtime; - long return on investment; - regulatory and environmental challenges; - absence or undeveloped oil processing infrastructure; - absence of gas and oil separation plants.
Opportunities	- positive change in a regional security paradigm;

	- huge need for investments in the postwar economy; - all extracted hydrocarbons will be consumed locally, preventing the currency from fleeing abroad; - surge for R&D processes with local scientific society; political will and need in the economic reintegration of Crimea.
Threats	- political and security instability; - oil and gas price market volatility; - breakthrough and innovative green technologies; - environmental and social pressure.

References

1. Zhixin, W. E. N., Jianjun, W. A. N. G., Zhaoming, W. A. N. G., Zhengjun, H. E., Chengpeng, S. O. N. G., Xiaobing, L. I. U., ... & Tianyu, J. I. (2023). Analysis of the world deepwater oil and gas exploration situation. *Petroleum Exploration and Development*, *50*(5), 1060-1076.
2. The Jamestown Foundation. (2014). *The cost to Ukraine of Crimea's annexation*. Retrieved from https://jamestown.org/program/the-cost-to-ukraine-of-crimeas-annexation/
3. *Turkish Petroleum mulls partnerships for multi-billion Black Sea gas project*. (n.d.). https://www.worldoil.com/news/2021/2/8/turkish-petroleum-mulls-partnerships-for-multi-billion-black-sea-gas-project
4. *South Akcakoca Sub-Basin Gas Field, Black Sea, Turkey*. (2020, July 23). Offshore Technology. https://www.offshore-technology.com/projects/south-akcakoca-sub-basin-gas-field-black-sea/?cf-view&cf-closed
5. Porter, M.E. (1985) Competitive Advantage. Creating and Sustaining Superior Performance. Free Press, New York, 557 p.
6. Day, George S. and Robin Wensley. 1988. "Assessing Advantage: A Framework for Diagnosing Competitive Superiority." Journal of Marketing 52 (April): 1-20
7. Barney, Jay. 1991. "Firm Resources and Sustained Competitive Advantage." Journal of Management 17 (1): 99-120.
8. Prahalad, C.K. and Gary Hamel. 1990. "The Core Competence of the Corporation." Harvard Business Review 68 (May-June): 79-91.
9. Roslyng Olesen, T. (2015). Offshore Supply Industry Dynamics: The Main Drivers in the Energy Sector and the Value Chain Characteristics for Offshore Oil and Gas and Offshore Wind l. CBS Maritime.

10. Kaiser, Mark. (2015). Offshore Service Industry and Logistics Modeling in the Gulf of Mexico.
11. Horbova, Kh. V. (2012). Perspektyvy vydobutku nafty i hazu na ukrayinskomu shelfi Chornoho ta Azovskoho moriv. *Naukovyi visnyk NLTU Ukrayiny*, 22(7), 102-107.
12. Zhukov, I. M. (2015). Napriamy udoskonalennya zakonodavstva z vydobutku vuhlevodniv na kontynentalnomu shelfi. *Naukovyi visnyk Mizhnarodnoho humanitarnoho universytetu. Seriya: Yurysprudentsiya*, (18 (2)), 26-30.
13. Kryzhanivskyi, Ye. I., Dzyoba, O. H., Dzhus, A. P., & Mironov, Yu. V. (2013). Tekhniko-ekonomichni aspekty transportuvannya pryrodnoho hazu iz morskykh rodovyshch. *Naukovyi visnyk Ivano-Frankivskoho natsionalnoho tekhnichnoho universytetu nafty i hazu*, (2), 7.
14. Stetskiv, I. V., & Serhiienko, M. I. (2013). Efektyvnist zastosuvannya plavayuchykh burovykh ustanovok dlya vydobutku nafty ta hazu na Ukrayini
15. Akimova, O. V., & Kravchenko, O. A. (2017). Rozrobka metodolohiyi vyboru marshrutu roboty suden postachannya vydobuvnykh platform v shelfax moriv
16. Aneichyk, T. (2009). *Simulation model for strategical fleet sizing and operational planning in offshore supply vessels operations* (Master's thesis, Høgskolen i Molde).
17. Onea, F., & Rusu, L. (2019). Long-term analysis of the black sea weather windows. *Journal of Marine Science and Engineering*, *7*(9), 303.
18. Rusu, L., Raileanu, A. B., & Onea, F. (2018). A comparative analysis of the wind and wave climate in the Black Sea along the shipping routes. *Water*, *10*(7), 924.
19. Crossan, M. M. (2009). *Strategic analysis and action*. Pearson Prentice Hall.
20. OG21, External Factors Analysis report, revision 2, (2020, July 3) https://www.og21.no/contentassets/f826df43db324d79b148a14cfcf912c4/omgivelsesanalyse-2020_endelig-02-07-2020.pdf

21. Kaiser, M. J. (2022). Offshore oil and gas records circa 2020. *Ships and Offshore Structures*, *17*(1), 205-241.

22. Byzantrans. (n.d.). *Port information*. Retrieved September 25, 2008, from https://web.archive.org/web/20080925131109/http://www.byzantrans.com/port.html

23. SMP. (n.d.). *Power capabilities*. Retrieved June 19, 2014, from https://web.archive.org/web/20140619134454/http://smp.com.ua/power.html

24. Mil.in.ua. (n.d.). *Rosiia vtratyla dva korablya v Sevastopoli* [Russia lost two ships in Sevastopol]. Retrieved from https://mil.in.ua/uk/news/rosiya-vtratyla-dva-korablya-v-sevastopoli/

25. Zaliv Shipyard. (n.d.). *Graving dock and building berths*. Retrieved June 17, 2024, from http://www.zaliv.com/en/graving-dock-and-building-berths

26. Drilling Manual. (n.d.). *Oil drilling rig personnel crew organization*. Retrieved from https://www.drillingmanual.com/oil-drilling-rig-personnel-crew-organization/

27. Ivano-Frankivsk National Technical University of Oil and Gas. (n.d.). *Trenazherniy buroviy centr akreditaciya centru*. Retrieved from https://nung.edu.ua/department/trenazherniy-buroviy-centr/akreditaciya-centru

28. Kyiv Maritime Safety Training Centre. (n.d.). Retrieved from https://kmstc.org/

29. Lerus Training Centre. (n.d.). *OPITO courses in Ukraine*. Retrieved from https://www.lerus.com/courses/ukraine/opito-courses-ukraine.html

30. Nefterynok. (n.d.). *Kilkist zadyanikh burovykh verstativ v Ukraïni zbil'shylasya na 24*. Retrieved June 15, 2024, from https://www.nefterynok.info/novosti/klkst-zadyanih-burovih-verstatv-v-ukran-zblshilasya-na-24

31. Interpipe. (2024, May 2). *[PDF document]*. Retrieved from https://eu.interpipe.biz/upload/photo/20240502182818a450040261930097ae624add6adab103.pdf

32. State Service of Geology and Subsoil of Ukraine. (n.d.). *Analiz rozvytku haluzey krytychnykh korysnykh kopalyn* [PDF document]. Retrieved from https://www.geo.gov.ua/wp-content/uploads/presentations/ukr/analiz-rozvytku-haluzey-krytychnykh-korysnykh-kopalyn.pdf
33. State Service of Geology and Subsoil of Ukraine. (n.d.). *Oil and gas investment guide* [PDF document]. Retrieved from https://www.geo.gov.ua/wp-content/uploads/presentations/en/oilgas-investment-guide.pdf
34. MarineTraffic. (n.d.). *MarineTraffic: Global ship tracking intelligence*. Retrieved from https://www.marinetraffic.com/
35. VesselFinder. (n.d.). *VesselFinder: Real-time vessel tracking and maritime information*. Retrieved from https://www.vesselfinder.com/
36. Equasis. (n.d.). *Equasis: The maritime database*. Retrieved from https://www.equasis.org/
37. Upstream Online. (2023). *Global demand surges for semisubs and drillships with dayrates at highest in 10 years*. Retrieved from https://www.upstreamonline.com/rigs-and-vessels/global-demand-surges-for-semisubs-and-drillships-with-dayrates-at-highest-in-10-years/2-1-1601990?zephr_sso_ott=f5FN6a
38. S&P Global. (n.d.). *No newbuild cycle? No problem*. Retrieved from https://www.spglobal.com/commodity-insights/en/research-analytics/no-newbuild-cycle-no-problem
39. Riviera Maritime Media. (n.d.). *Drillship bonanza: Utilisation to hit 97% in 2025*. Retrieved from https://www.rivieramm.com/news-content-hub/news-content-hub/drillship-bonanza-utilisation-to-hit-97-in-2025-81978

40. Nedcon Maritime. (n.d.). *Crew structure on board merchant vessels: Deck department*. Retrieved from https://nedcon.ro/crew-structure-on-board-merchant-vessels-deck-department/
41. Ukrport. (2012). *Sevastopol port* [Archived version]. Retrieved from https://web.archive.org/web/20120320221327/http://www.ukrport.org.ua/p-sevastopol.htm
42. OG21. (2020). *Omgivelsesanalyse 2020* [PDF document]. Retrieved from https://www.og21.no/contentassets/f826df43db324d79b148a14cfcf912c4/omgivelsesanalyse-2020_endelig-02-07-2020.pdf
43. Dyckerhoff. (n.d.). *Використання тампонажних цементів від Dyckerhoff*. Retrieved from https://www.dyckerhoff.com.ua/media/news/vikoristanna-tamponaznih-cementiv-vid-dikergoff
44. PESTLE Analysis. (n.d.). *PESTLE analysis of oil and gas industry in the UK*. Retrieved from https://pestelanalysis.education/pestle-analysis-of-oil-and-gas-industry-in-uk/
45. Statista. (n.d.). *Oil production in the United Kingdom (UK)*. Retrieved from https://www.statista.com/statistics/332009/oil-production-in-the-united-kingdom-uk