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FORFATTER(E)

VEILEDER:

Kandidatnummer:

217681

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.....

Navn:

Rasmus Haneferd

.....

.....

Kenneth Wathne

# Preface

I would like to thank Kenneth Wathne, UiS for his support during this master thesis. Further to this I would like to thank Evelyn Edland, Head of Tendering, Subsea 7 Norway AS for her support with giving access to archive records and help with data collection.

# Summary

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The Norwegian sector has from the 70's been dominated by the major international oil companies. Statoil was modelled after these international giants with both upstream and downstream capability. The sector has matured and the age of elephant discoveries have come to an end. The major oil companies are exiting while new operators are establishing following the 2005 "exploration refund model" instituted by the Norwegian government.

These new operators typically are modelled around oil and gas exploration and when time came to develop the fields they sought new strategies for performing the field developments they carved out a new path with alliances and design competitions between the SURF and the SPS contractors.

This thesis seeks out to review the current field developments by the new oil companies and how their strategy for development is changing the marketplace. It is doing the research by means of a case study of Subsea 7 and its marked interaction with the new oil companies.

The case study shows that the market is splitting into Statoil and non-Statoil projects where the developments follow distinctly different strategies. The strategy from Statoil is to maximize competition, split developments into smaller packages and have a hard hand on the schedule to make all the contracts fit while the non-Statoil operators goes for fewer contracts with more collaborative approach into the development of the field development solutions.

The study further shows how the SURF and SPS contractors are collaborating on the field developments with the new oil companies in a way that is not representing their international alliances. The new oil companies drives cooperation's that are not reflecting the international alliances, however reflecting the local Norwegian market.

The cooperative approaches are analysed with interfirm governance theory, while early engagement is reviewed with regards to contractor's value model (shop vs chain) and a brief look at potential for actor-oriented organisational models for the alliances and the limitations with hierarchical organisation forms.

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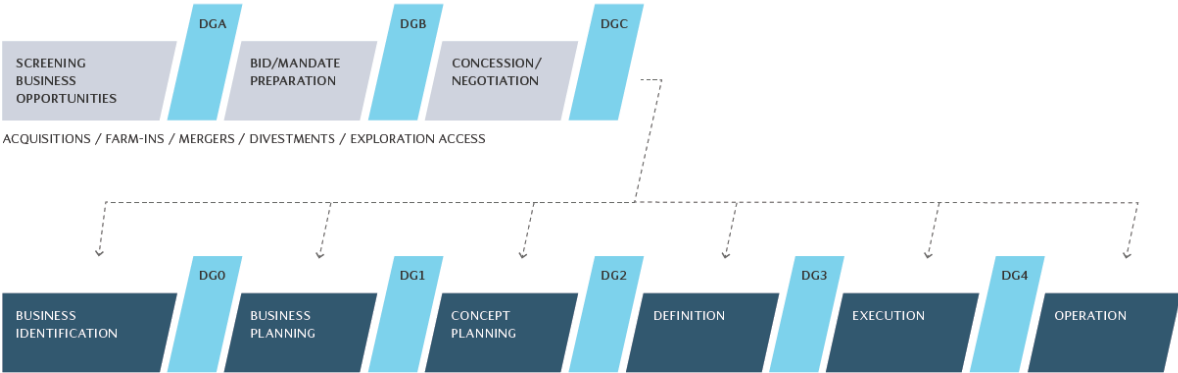
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# 1 General

The oil and gas upstream development industry is divided into several segments. Onshore conventional wells, tar sand and shale gas, offshore dry trees (bottom founded platforms) and wet trees (subsea fields). The lead time from discovery differs between the segments.

Offshore development can have a time frame of about 10 years from discovery till production (pending existing infrastructure), thus the financing of such long term investments require certain stability in oil and gas prices. From discovery till investment decision the field development solution is made. The duration from the actual investment decision (Execution in Figure 1) to first oil will typically range from 2 to 4 years.



*The Capital Value Process*  
*The Capital Value Process is a structured approach to developing a project.*

**Figure 1 : Statoil Capital Value Process (Statoil, 2017)**

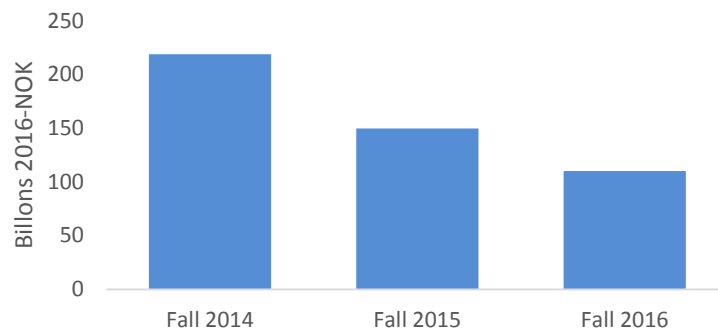
For operators on the Norwegian Continental Shelf (NCS) the oil price has dropped significantly since the top in 2014. This effectively put a halt to new projects coming to the market since the break-even price for the prospect development was higher than the price of oil.



**Figure 2: Crude oil prices 2007 - 2017**

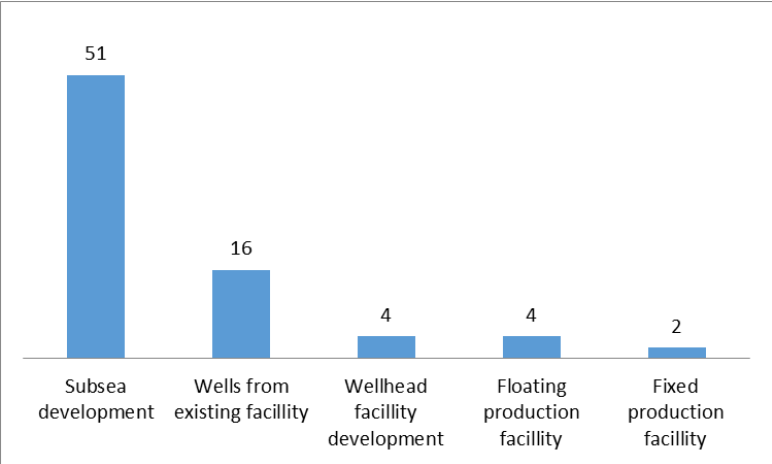
Given the rapid decline of the oil price a change in cost level was necessary to bring projects into execution stage on the Norwegian sector.

The Norwegian sector responded and developments were postponed until a lower break-even price could be achieved. Seven projects that are representative for the Norwegian development marked were measured in their drop in cost estimates for development that had yet to reach investment decision are shown in Figure 2. (*Projects pooled are: Johan Sverdrup phase II, Oda, Utgard, Trestakk, Snilehorn, Dvalin and Johan Castberg*)



**Figure 3 Investment estimate for seven developments 2014 – 2016 (Oljedirektoratet, 2017b)**

By the end of 2016 there were 77 discoveries on the Norwegian continental shelf that were under consideration for being developed (Oljedirektoratet, 2017b). Of these prospective developments the vast majority will be subsea developments where the production will be transported by pipelines back to existing or new infrastructure / platforms.



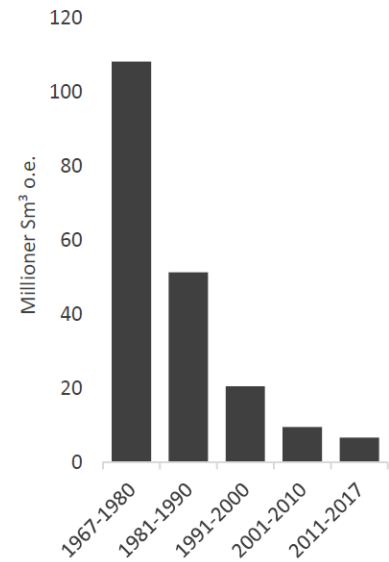
**Figure 4 : Likely development method for discoveries under consideration for development (Oljedirektoratet, 2017b)**

### 1.1.1 Government policies and the effect on the market

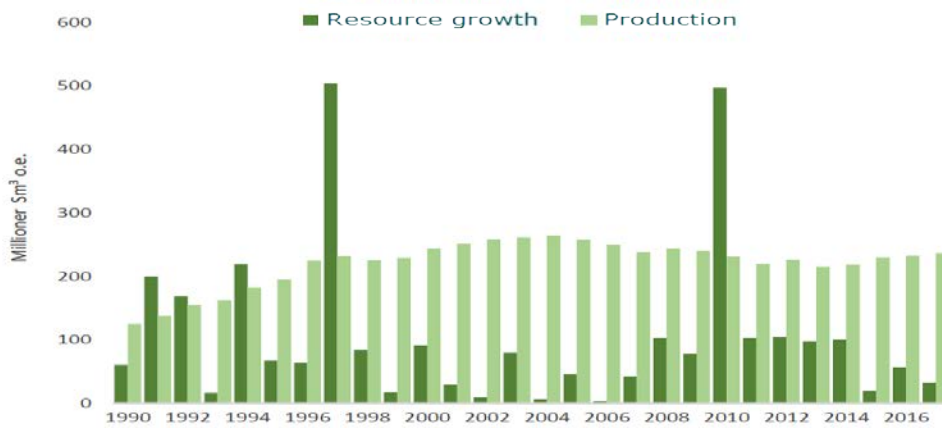
A trend in the Norwegian sector is that larger oil companies are exiting the sector (or not performing new investments) while smaller companies and foreign distribution companies have entered the sector. By the late 90s it was perceived that the oil elephants were discovered and major multinational oil companies in Norway were not showing enough interest in exploration to replenish the resources on the Norwegian continental shelf that would maintain production.



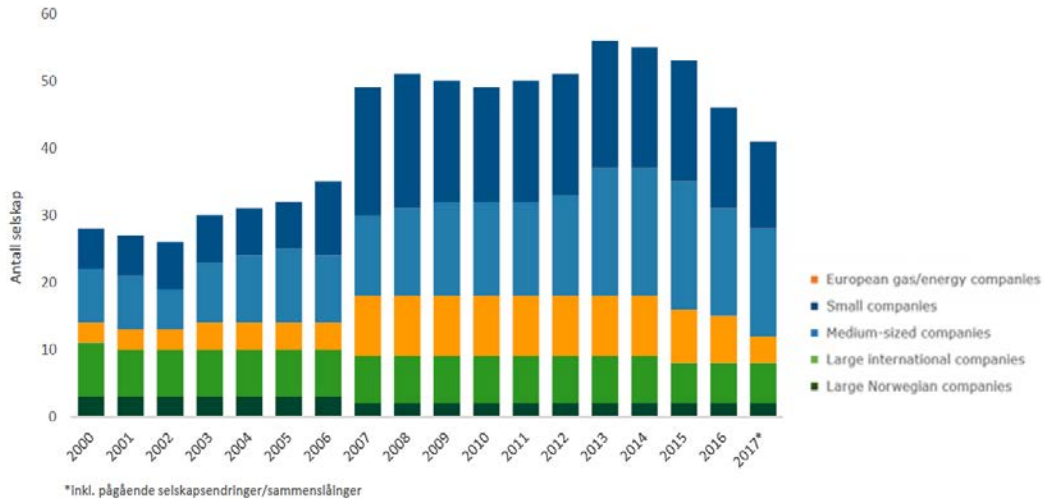
With this trend the Norwegian government responded by introducing the “exploration refund model” in 2005 (Oljedirektoratet, 2017a) that allowed oil companies which were not liable for taxation to be treated the same as oil companies which were in a tax position (were producing). This removed a significant barrier of entry into the Norwegian sector and as shown Figure 7 the sector has had an influx of multiple small and medium sized oil companies. The resources started to increase with the new regime as seen in Figure 5. The two large resource spike years includes the massive Ormen Lange and Sverdrup discoveries. As can also be seen in Figure 5 the resource growth more or less halted after the oil price crashed in 2014 as oil companies struggled to finance the search for new resources.



**Figure 5 : Average size of discoveries on NCS (Nyland, 2018)**

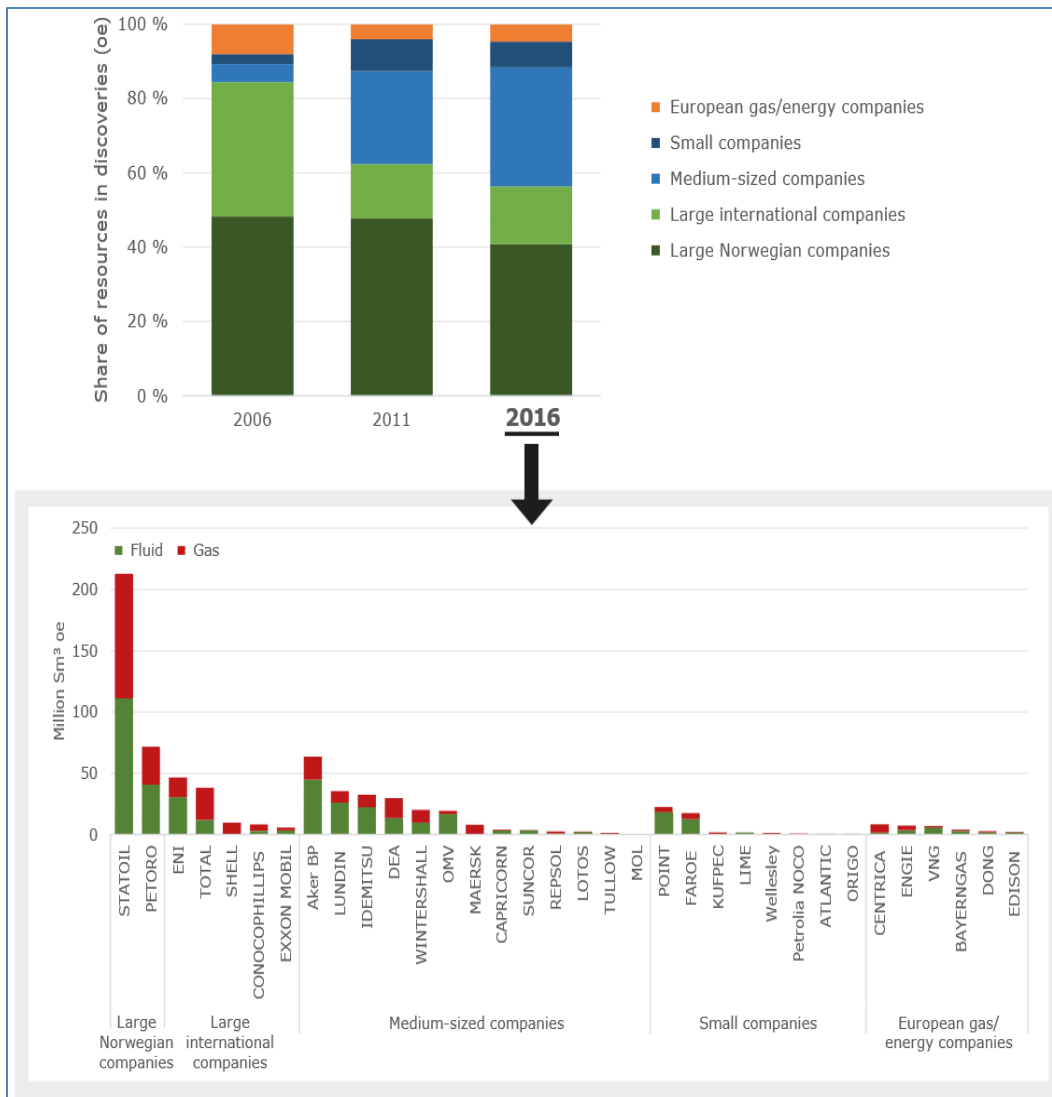


**Figure 6 : Total production and resource growth on NCS (Nyland, 2018)**



**Figure 7 : Number and size of oil companies in Norway by year (Nyland, 2018)**

As can be seen in Figure 7 Statoil (and Petoro) possess about 40% of the remaining undeveloped (and discovered) oil and gas reserves while the smaller and medium sized companies are in possession of a similar volume combined.



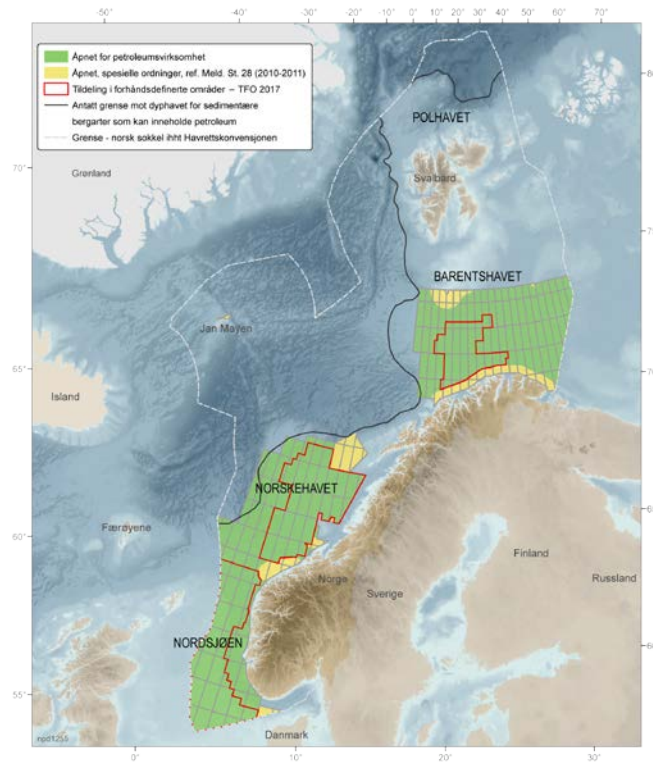
**Figure 8: NCS undeveloped resources by oil company size (Oljedirektoratet, 2017b)**

### 1.1.2 Path to field development

Oil companies that are pre-qualified can every year apply for search licenses within the mature areas (marked in with red border in Figure 8). These areas have well known geological data, infrastructure and will have the possibility of linking up discoveries to existing facilities.

The applications received by the Directorate of Petroleum will contain a plan for how the applicant is planning to proceed with exploring the license. The Directorate of Petroleum will

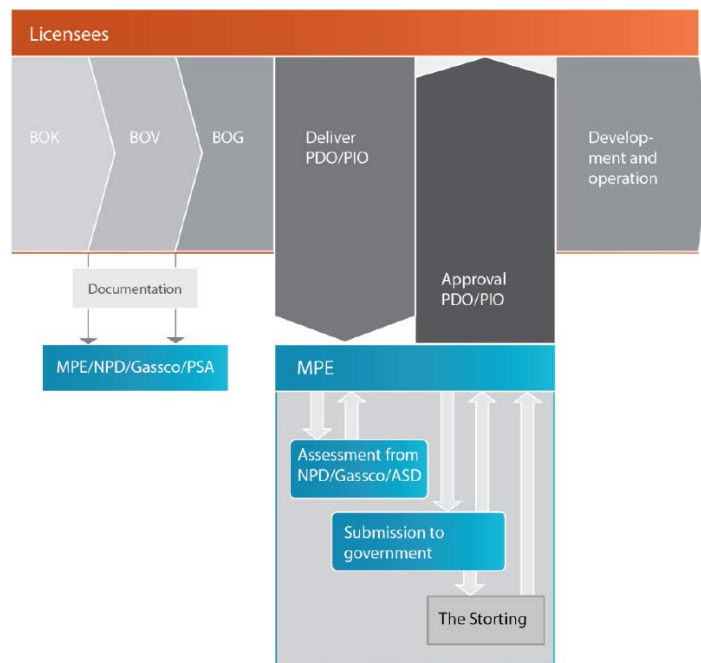
evaluate the location of the application and check corresponding applicants for the same license. A process of normalization between the exploration plans between the applicants will happen prior to the government announcing the distribution and operatorship for the exploration licenses sanctioned. Sanctioning licenses within the mature areas has a yearly occurrence. (Norwegian Petroleum, 2018a)



**Figure 9 : Norwegian continental shelf (NCS) (Norwegian Petroleum, 2018a)**

Within the immature areas defined as green outside the bordered red zone in Figure 9. A bi-yearly sanctioning is done based on applications from the oil companies on numbered search blocks. The Directorate of Petroleum will ensure that the awards of licenses for the immature areas are given in such a way that it minimizes the required amount of exploration wells to better understand the geology of the area. This also to limit the government cost as oil companies deduct exploration costs from taxes. (Norwegian Petroleum, 2018a)

Once a discovery is made the maturing of the discovery will start. Maturing prospects from discovery to making the decision to invest in field development follow a regulated plan with decision gates. Licence partners and authorities are involved to ensure return on investment and also to contribute when necessary. Fellow licensees also have a formal responsibility to ensure the quality of the development by the operator. To progress to the next stage it is imperative that the gate is passed. The Norwegian government has formalized this process and it is illustrated in Figure 9.



**Figure 10 : PSA guideline chart for project development (Norway, 2017)**

The milestones defined in Figure 9 are as follows:

- **Concretisation Decision - BOK:** Milestone where licensees have identified at least one technical and financially feasible concept that provides a basis for initiating studies that lead to concept selection.
- **Decision to Continue - BOV:** Milestone where the licensees decide to continue studies for one concept that leads to a Decision to Implement.

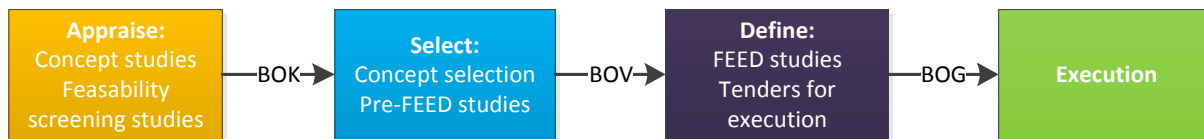
- **Decision to Implement** - BOG: Milestone where the licensees make an investment decision that results in submission of a PDO or PIO.

Plan for Development and Operation (PDO) will be approved by Stortinget prior to the development of the field. The operator of the licence can award contracts to subcontractors but is limited in allowed financial exposure prior to approved PDO. PIO stands for Plan for Installation and Operation and is mainly related to pure infrastructure not directly related to a discovery (such as a refinery or pipeline to Europe etc.).

Oil companies have adopted a similar internal decision gate strategy to match the authorities, but some with more gates for internal approval.

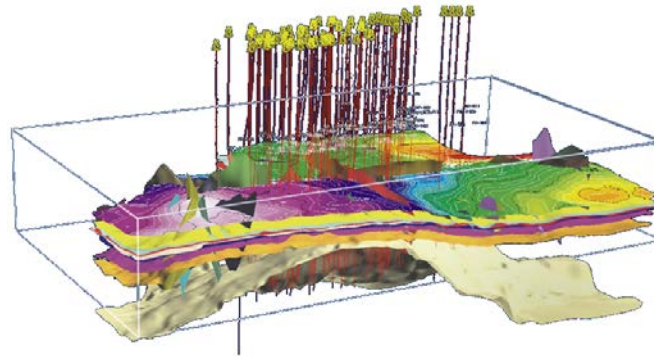
### 1.1.2.1 Stages in the development

The projects will go through 4 main stages interrupted by the three milestone decision points after discovery. The naming of the different phases differs between the oil companies.



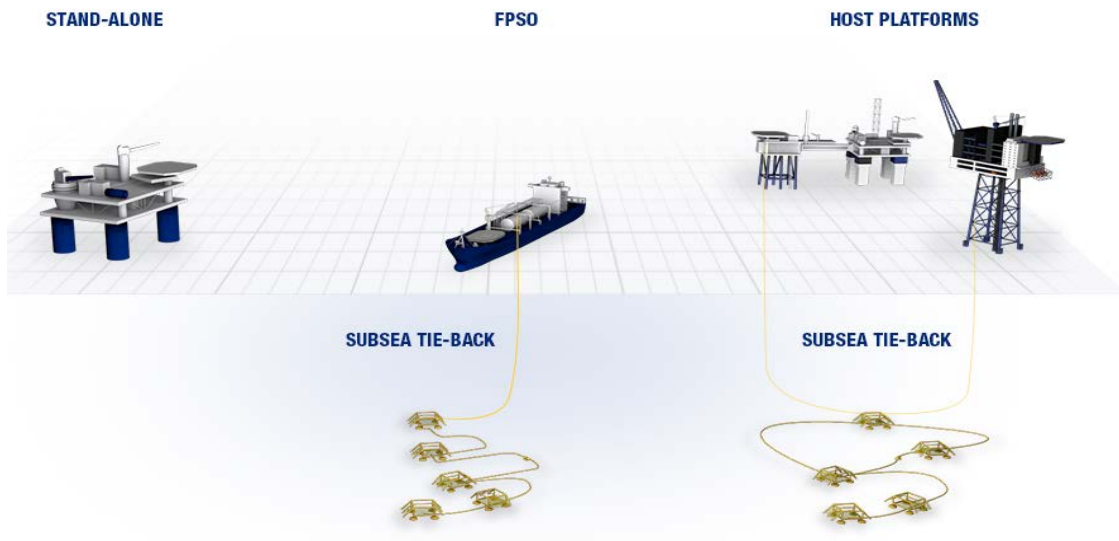
**Figure 11 : Stages of field development**

### 1.1.2.1.1 Appraise stage



**Figure 12 : Reservoir modelling with well locations  
(Wintershall, 2018)**

In the Appraise phase a number of development concepts may be identified. The reservoir and depletion strategy is explored and additional wells (appraisal wells) can be drilled in addition to advanced 3D modelling of the reservoir to better the understanding of the field. The potential concepts for the development may range from tie-backs to existing infrastructure to stand alone developments will be explored. These concepts will show that there is an economic high level model that can be further progressed to the Select Phase.



**Figure 13: Typical offshore development concepts (Wintershall, 2018)**

#### **1.1.2.1.2 Select stage**

In the select phase the different concepts are further matured and compared. In this phase preferably a single concept is identified for further development (recommended for the License holders) based on a number of constraints and criteria's set such as Health Safety and Quality (HSEQ) standards, Operational expenditures (OPEX) and Capital Expenditures (CAPEX).

Pre-FEED studies might also be performed in this phase to further prepare for the define phase. This can be done on several of the concepts to further mature the concepts prior to committing to a single development scenario.

#### **1.1.2.1.3 Define stage**

In the define phase the Front End Engineering Design (FEED) the field development is performed on the selected concept. The engineering is done to document the solution is in accordance with the health and safety legislation by the government (Directorate, 2018). Further to this it will identify all the materials required and schedule of execution. Specifications that will be used for supply chain packages are developed and critical testing and technology qualifications / gaps are identified and potentially performed. Following the completion of the FEED, pending on the development strategy the FEED documentation will form the basis of the execution contracts. These can be competitively tendered in this phase post the FEED to form a total development CAPEX estimate for the execution phase.

#### **1.1.2.1.4 Execution stage**

In the execution phase all the plans from the FEED is set out in real life and completes with handing over the field to the operator to start production.



### 1.1.3 The subsea tie-back industry

As the developments on the Norwegian Continental Shelf are developed with either bottom founded platforms (Dry trees) or tie-back / floating platforms (Wet trees). This thesis focuses on the field development for wet trees, i.e. the subsea tie-back industry.

The subsea tie-back sector can be divided into four main parts that are typically set as separate main contractor segments:

- Facility for processing and export
- Subsea Production System (SPS)
- Subsea Umbilical, Risers and Flowline system (SURF)
- Reservoir (Drilling)

The facility is an existing platform (bottom founded or floating), a new platform or an onshore facility which is directly connected to the field. Modifications are typically needed on existing facilities to receive fluids from the new field.

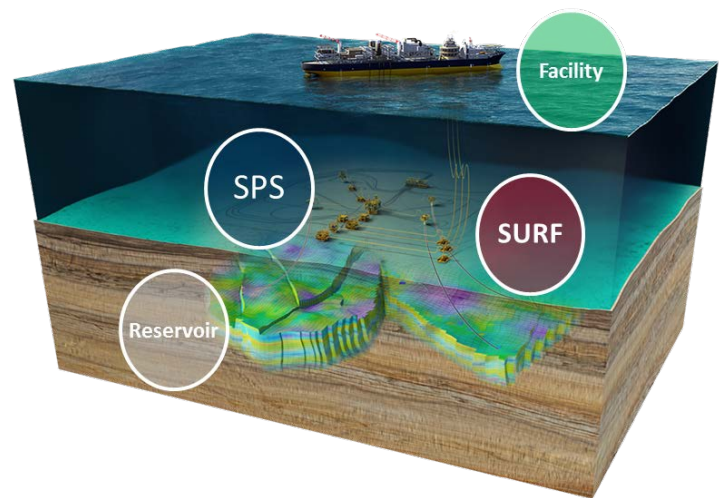


Figure 14 : Segments of Subsea Tie-back industry

The Subsea Production system (SPS) is the hardware such as wellheads, X-mas trees, manifolds, tooling, tie-in systems, control system and other components directly controlling the production. In addition to this, tooling for operating the field through its life cycle is provided from the SPS Contractor.

Subsea Umbilical Risers and Flowline (SURF) segment includes all pipelines, risers, control umbilicals. Installation of the SPS components except the wellhead equipment which is installed from drill rigs is also included in the SURF contract. Often the umbilical forms part of the SPS contract due to the control functionality. In essence the SURF contract will connect up the SPS equipment and install all the required lines and pipelines between the field and the Facility.

The reservoir is normally controlled by the oil company which has its core competence in reservoir engineering. Thus the drilling contracts are usually built up differently from the other project development contracts. Contractors operating on the drill rig are often directly contracted to the oil company and the drill rig is basically a bare boat charter to the oil company.

#### ***1.1.3.1 A shifting competitor landscape***

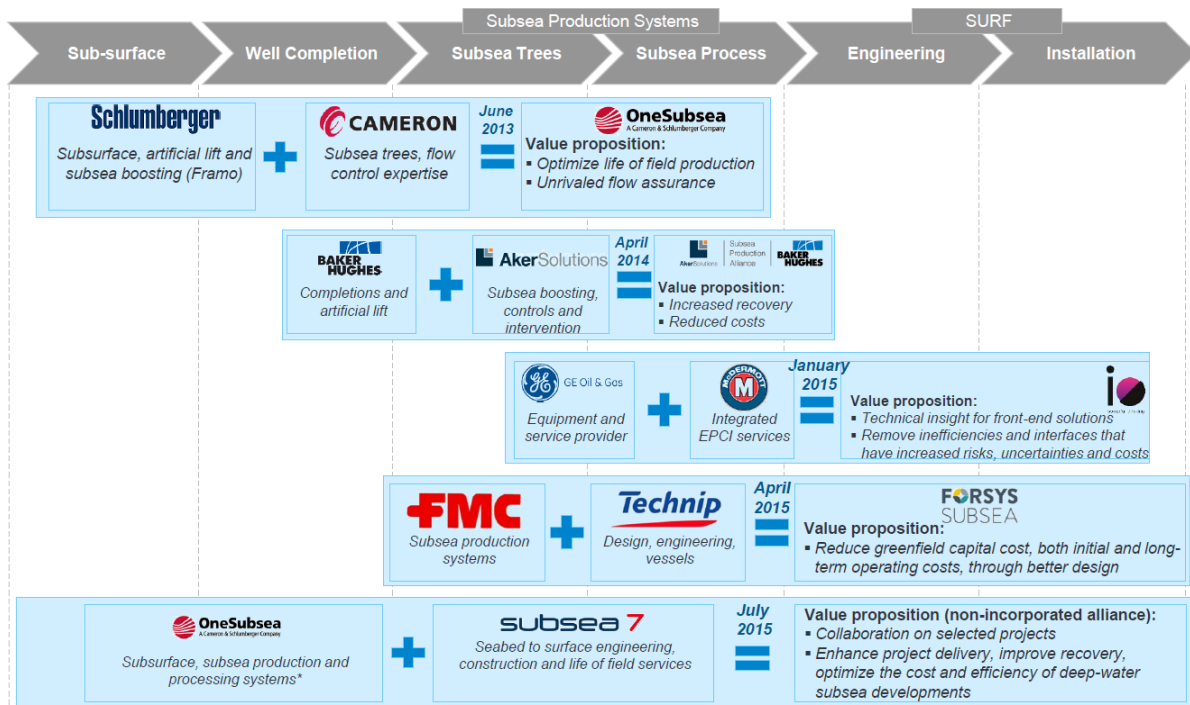
The large international oil and gas companies managed the process of field development through the various decision gates with the use of internal and external engineering houses that specialized in field development. Some of the reason this was happening was that the offshore execution companies business model were centred around utilisation and technology of vessels and assets for installation, but not in the design and development of the entire field architecture. Furthermore it was not common that a contractor possessed all the “tools in the basket” to develop the field and the oil companies had to contract several contractors in order to build the field offshore.

By means of mergers, organic growth and strategic moves four main international SURF Contractors emerged that are capable of full field development; Subsea 7, Technip, McDermott and Saipem. Saipem and McDermott have a limited footprint in Norway, so in reality the field development projects have been divided by Subsea 7 and Technip where the entire SURF scope is in a single contract (EPCI or Alliance contract).

Technip and FMC created a joint venture company in 2015 called Forsys which was to engineer and deliver full field developments (Kimball, 2015). The main purpose was to take out the inherent additional cost that were incurred by the battery limits of the two contract model and combine technologies to further reduce cost and differentiate. In 2017 the two mother companies of Forsys merged to form Technip-FMC.

In response to the Forsys JV and subsequent merger of Technip-FMC (Pilenko, 2016) the competitors responded with creating alliances between SPS and SURF. The following global alliances were created:

- Aker Solutions + Saipem (Milanese, 2015)
- One Subsea + Subsea7 (Curling, 2015)
- Baker Hughes GE + McDermott (Oldham, 2015)



\* OneSubsea has also initiated a JV with Chevron in order to develop subsea systems for HPHT fields.  
Source: Rystad Energy research and analysis

**Figure 15 : Rystad Energy analysis of the combined SPS / SURF Contractor constellations (missing the Aker-Saipem alliance) in 2015**

In Norway the marked leader in SPS had been Aker and FMC with Baker Hughes GE on a third place while the leading SURF Contractors were Subsea 7 and Technip. The global alliances did not fully reflect the marked that was on the Norwegian sector meaning that Saipem and One Subsea with the very small footprint in Norway was struggling to gain market access even though they were allied with AkerSolutions and Subsea 7.

Given this back-drop when Technip-FMC started to provide fully integrated SURF/SPS value propositions, oil companies in Norway wished to maintain competition proposed different partnering SPS Contractor alternatives to Subsea 7 than their Global alliance partner. In reality

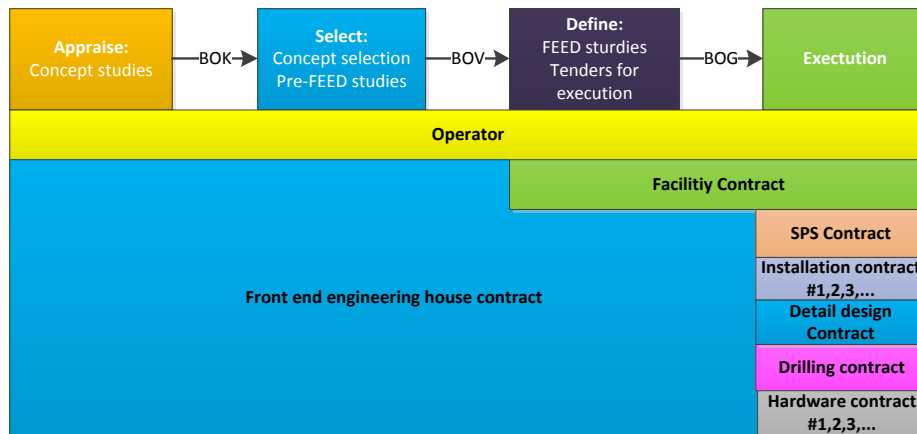
this has meant that Subsea 7 and AkerSolutions have been asked to cooperate in the delivery of the design competitions and projects (Petrie, 2016),(Lorentzen, 2016a). Even though Technip-FMC can offer a single contract solution, it also comes with a drawback to the oil companies might want to control the development through the interface between the SPS and SURF contractor.

#### **1.1.4 Changing contracting strategies with new oil companies**

The traditional strategy still applied by Statoil and other international large oil companies is to involve pure design houses such as IKM Ocean Design, Reinertsen, WoodGroup, Genesis, Xodus etc. for providing their required Front End Engineering Design (FEED) service to progress the field development solution to a execution stage. A FEED for the Facilities might be awarded to the topside contractor with mechanisms to handle the decision to execute. This is pending whether the tie-back is to an existing platform that already has an onsite topside contractor in place. The SPS and SURF contracts will be based on the specifications and interfaces between SPS, SURF and Facilities developed through the front end engineering of the FEED Company.

##### ***1.1.4.1 Transport and installation contract strategy (T&I)***

The advantage of running the model described in Figure 16 for the large operators is that they can split the SURF contract into many smaller contracts and utilize buying power to maximize the competition on each specialized package. They can also do a phased contract strategy securing long lead items early and maximizing its own project float. For oil companies such as Statoil with the large technical administration and the amount of projects running at all times in parallel, economics of scale can be achieved. The contracts issued for tenders to the SURF contractor are often referred to as Transport and Installation (T&I) contracts. This is due to that the oil companies will buy permanent hardware directly and free issue them to the SURF contractor. They often split the SURF scope into several contracts such as pipelines; structures etc. to maximize competition as there are more contractors that can undertake parts of the developments.



**Figure 16: (Simplified) T&I strategy**

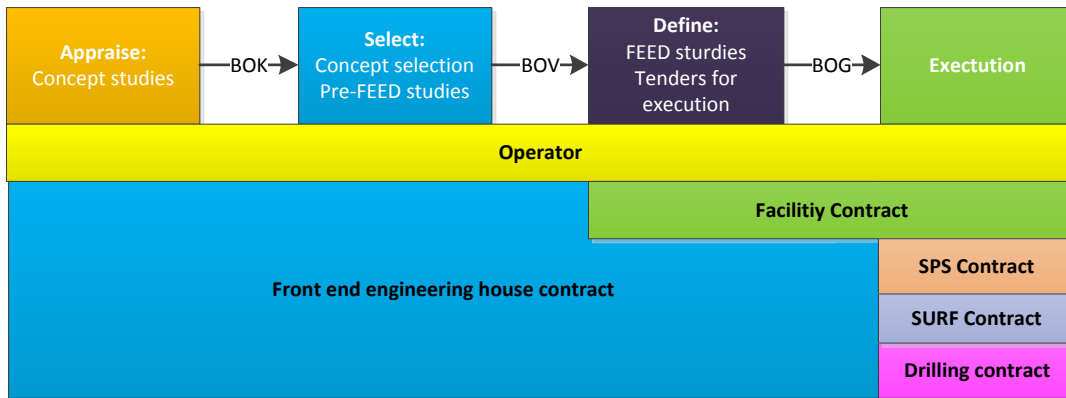
The oil companies will take on the risk of errors and omission in the contract basis performed by the engineering house as well as the potential mismatch between the contracts running in parallel which can inflict additional costs and consequences. The engineering house will follow the project and perform the detailed engineering based on their FEED. The potential for knock-on effects between the contracts are also significant. It takes a very competent buying organization with competency in every field of expertise to manage this strategy.

The Oil Company will maintain the learning from each development in-house and can use this knowledge to perform better on concurring and future projects. The standardization of packages means that the contracts are refined during multiple projects can be seen as a cost reduction as the contractors will have a good understanding of the expected deliverables. Thus the transaction cost between the company and contractor is reduced over time.

#### ***1.1.4.2 Engineering Procurement Construction and Installation (EPCI) contract strategy***

In this strategy the front end engineering design (FEED) is performed by design houses. However the work scope in execution, both with regards to design, fabrication and installation, goes to the SPS and SURF contractor. The contracts for SURF are often split in an EPCI part and a T&I part where the EPCI part is tailored around the permanent items supplied by the SURF contractors such as pipelines, risers and structures while the SPS equipment will be a pure

transport and installation (T&I) part of the SURF contract. This strategy has been applied by both Statoil and new oil companies on some projects. The FEED documentation will then be regarded as a basis of the contracts; however the contractors will have to perform the engineering to prove the solutions provided still are complying with the requirements in the contract.



**Figure 17: (Simplified) EPCI strategy separating pre-execution and execution contracts**

If the FEED contains errors or omissions this will be discovered in the detailed phase and may be subject to adjustments of the contract price and/or schedule. Critical interfaces between the parties may still cause high coordination efforts from the oil company, but the number of contracts is reduced compared to a T&I strategy and therefore the cost of coordination will go down.

For the development contracts in the Norwegian sector a standard set of contract terms and conditions were developed by Subsea 7, Technip and Statoil that were to be used as a basis for the T&I and EPCI field developments (Gass, 2010). These terms of agreement are adjusted to suit the development, and are also used by several of the new oil companies for their developments.

#### **1.1.4.3 Design competition strategy**

There is a history within the Subsea 7 for performing competitions on large field developments in Africa and Brazil. This is both due to the complexity of the scopes and that the development

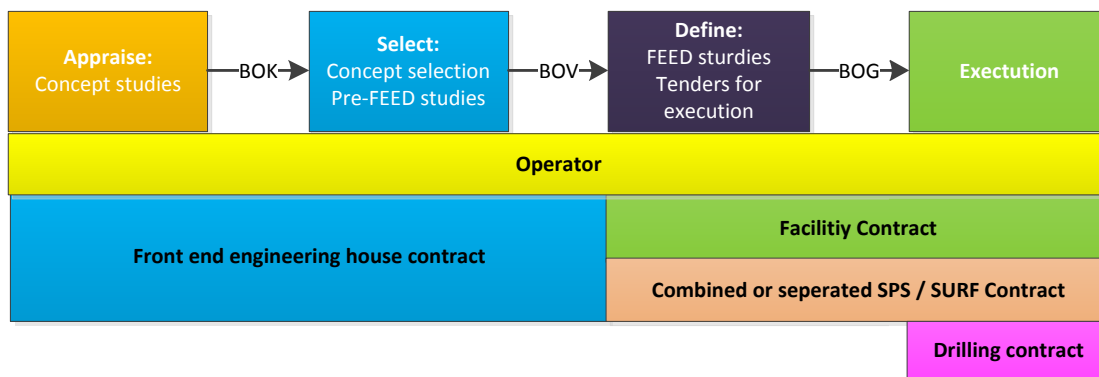
solutions are significantly varying between the industry suppliers, thus it has been a way of defining the scope of work for execution.

The strategy is seen as an evolution the traditional EPCI strategy with a FEED from a design house. The contractors are invited to perform the FEED where they develop the field solution based on their most suited technology and cost base. This FEED work can be paid studies on an equal lump sum basis to all competitors, but could also be sponsored by the contractors.

This means that the oil company will receive multiple FEEDs on the same field. Ideally the SPS, SURF and Facilities contractor will perform the FEED in parallel. In this period the contractors will interface to remove any uncertainty from the field execution solution and end up with a firm offer for the entire development. The development contract will be an EPCI contract.

Some of the advantages with the design competitions are that the contractors get to apply their own technology which can be unique from the onset of the design work meaning that the cost to convert the proposed FEED solution from the design house is removed. In typical EPCI strategy the design house will choose solutions that maximize alternative competitors but might be more costly. The contractors will give binding offers at the end of the FEED which is based on own solutions. This should reduce the risk of variations throughout the execution phase significantly. Furthermore the model allows for a lump sum contract model and limits the coordination effort required by the oil company as all the main delivery of hardware will be subcontracts to the Facilities, SPS and SURF contractors.

The oil company and contractors have the opportunity to build a relationship through the FEED phase which is not possible in a bid situation for only execution. The promise of continuity of personnel also means that the history and reasoning behind choices in design and method are known to all participants in the project. This gives an important increase in the quality of the project compared to a pure execution contract where the project organization might be unknown to the oil company prior to award.



**Figure 18: Design competition strategy**

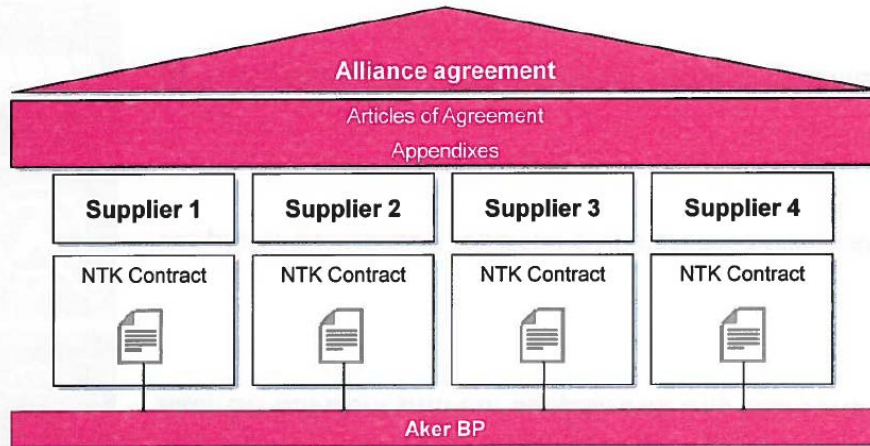
The strategy allows for an inexperienced oil company to demonstrate to the license holders that they are maintaining competitive bidding amongst the contractors prior to execution while limiting the risk due to limited experience in field development.

The learning of the field development is captured within the contractor's organizations while the oil company can use 3<sup>rd</sup> parties such as DnV to verify the work done by the contractors. By using 3<sup>rd</sup> party verification the oil company can show that they are in compliance with the Petroleum Act section 10-6 which regulates the responsibility of the operator to ensure compliance by all parties working on behalf of the operator to the Petroleum Act. (Directorate, 2018)

#### **1.1.4.4 Alliance strategy**

One step further from the design competition strategy is forming alliances with the SPS and SURF contractors. In this agreement the parties will work together and develop the portfolio of projects that the oil company is operator for. This means that the SPS and SURF contractors will be able to participate in the field developments from the appraise stage until execution.



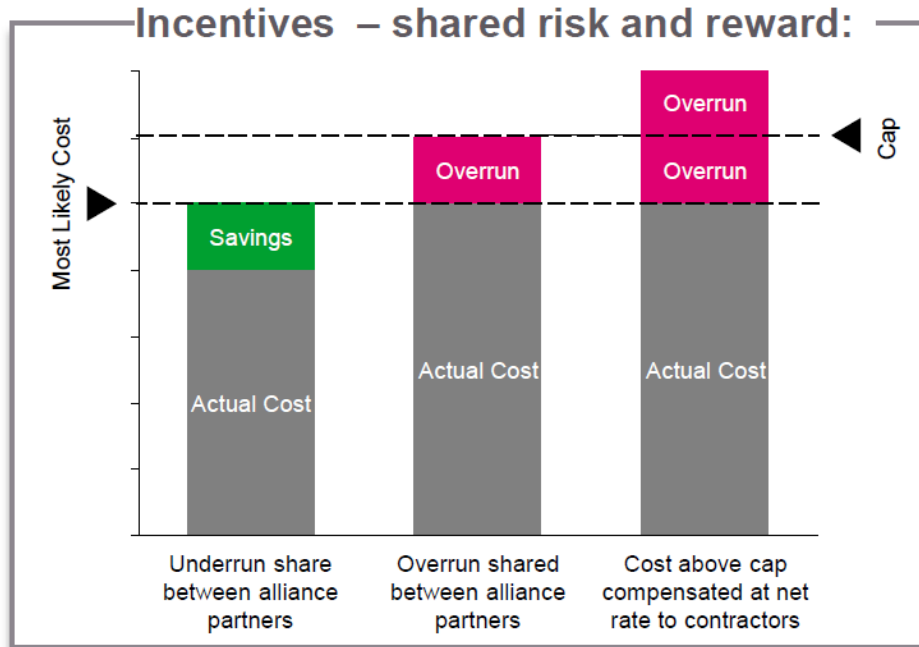


**Figure 19: Aker BP Alliance contractual arrangement (Hatteland, 2018)**

Advantages include a quicker development time from discovery till production by removing the tendering period between the stages of field development. This means that return on invested oil exploration and development cost are earlier and the present day value of the field can increase (lower break-even price). Some alliances include integrated project teams between the parties to reduce the overall manning of the project.

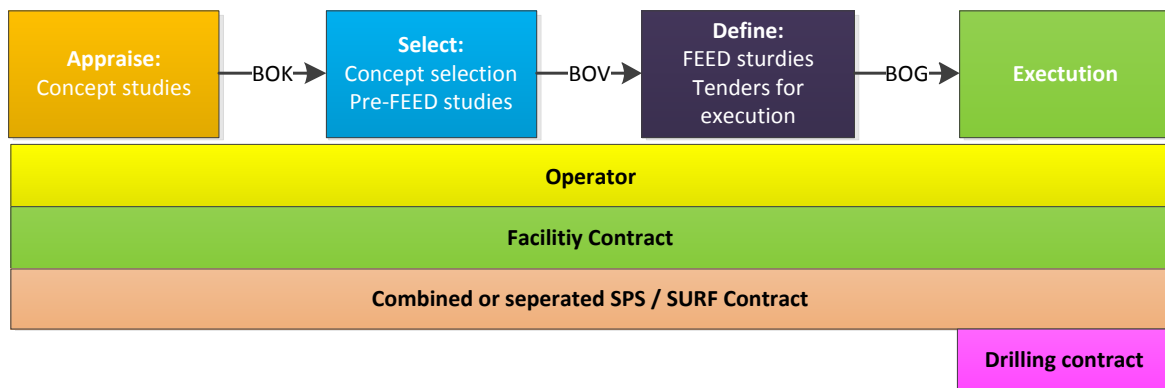
The field developments are normally regulated by a target sum. If the development exceeds the target sum including contingencies, a mechanism of penalty between the parties are enforced. Normally this is capped on cost and after reaching said cap contractors are remunerated at cost for the remainder of the development. If on the other hand the parties are able to perform better than planned a mechanism of profit share is included in the contract. This is illustrated in

Figure 19 for the AkerBP alliance model.



**Figure 20: Compensation model AkerBP Alliance (Hatteland, 2018)**

Other license holders might be sceptical to the operators approach on their development as it is not competitively bid in the marketplace. Furthermore the individual licensee might be sceptical due to the fact that the alliance due to capacity might prioritize other developments within the alliance that the particular license holder is not part of.



**Figure 21: Alliance contracting strategy**

In Figure 21 and Figure 22 the strategic partnership model of Spirit energy is described. There they have combined a topside facility contractor, Aibel, into the partnership. It follows however a similar compensation model as AkerBP where target sum is agreed prior to execution.

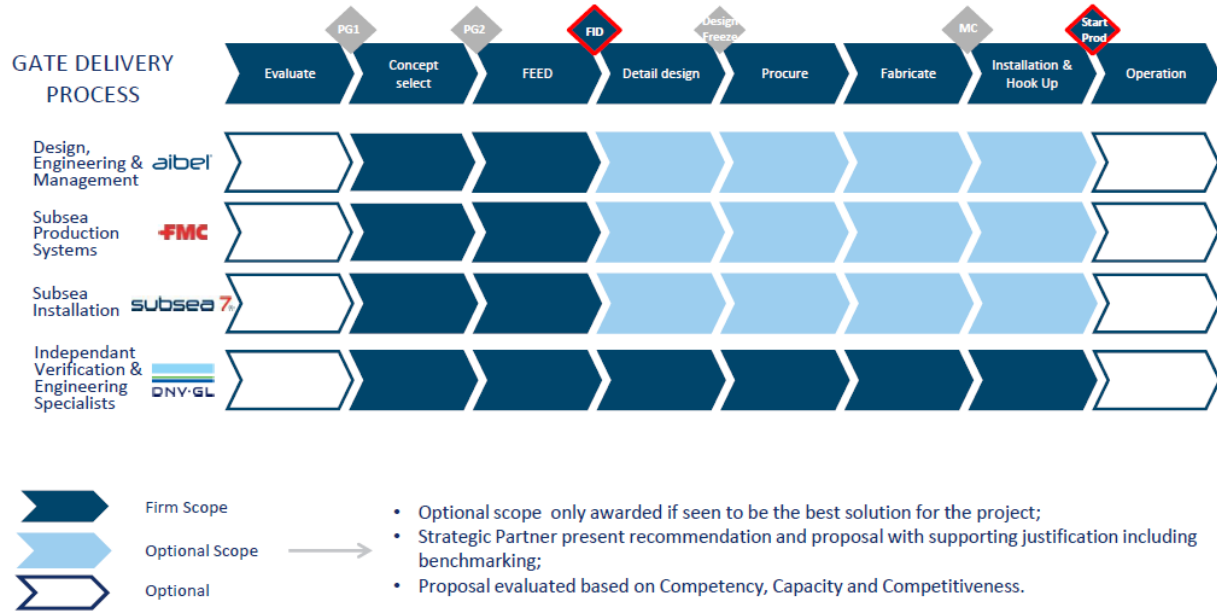


Figure 22 : Spirit Energy with Strategic Partnership Agreement (SPA) (Petrie, 2016)

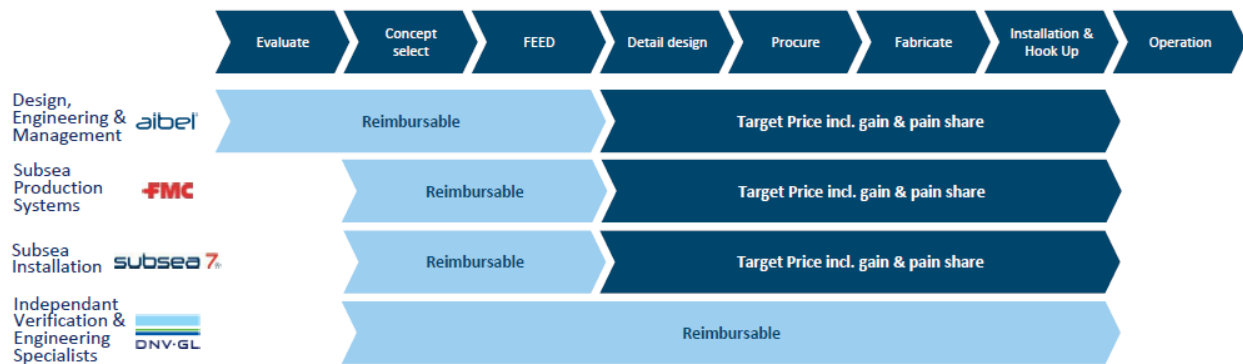


Figure 23 : Compensation model SPA (Petrie, 2016)

## **1.2 Thesis build**

The thesis seeks to research how the new oil companies develop the subsea fields on the Norwegian section. To research this detailed survey of the developments initiated the last 5 years are to be researched through the lens of the case “Subsea 7 Norway”.

The data collection has been from public sources where possible, internal information from live contracts and the Norwegian Petroleum Directorate.

- The research design is presented in section 3.1
- The research case is presented in section 3.2
- The data collection strategy is presented in section 0
- The results from the data collection is presented in chapter 4
- The findings are discussed with theoretical perspectives in chapter 0
- Finally a conclusion related to the research question and proposal for further work is presented in chapter 6.

## **1.3 The reason for the study**

The purpose of this study is to review the evolution in the subsea field development segment on the Norwegian continental shelf with the introduction of the new oil and gas operators. It can also act as an introduction into how the market has evolved to its current state.

This segment of the industry plays a significant part of the Norwegian oil and gas business and increasing the understanding of how it operates from a theoretical point of view hopefully inspires others to perform further research. The novel contracting models and innovative constellations in play makes the market complex and to add clarity to the current status, it is important to anchor the development with some theoretical perspectives.

## **1.4 Research questions**

To study the influx of the new companies in the perspective of the Norwegian market it is important to ask some research questions first (Yin, 2016). The research questions play a key

role in focusing the data collection and strategy for the study. The following main question is asked:

- How has the influx of new oil companies affected the subsea field development marked on the Norwegian Continental Shelf the last years?
  - o What strategy has been chosen for the field developments?
  - o Is the marked splitting into two segments, (Statoil / Non-Statoil)?
  - o How has the field development marked affected how the different SPS and SURF contractors collaboration?
  - o How are the global SPS / SURF alliances replicated on the Norwegian sector?

## 2 Theory

### 2.1.1 Value chains and shops (Stabell & Fjeldstad, 1998)

Porter sets out to describe the value creation within a firm with the value chain theory (Porter, 1985, 1990) where value creation can be described through a set of input parameters, operations and output parameters. Stabell and Fjeldstad (Stabell & Fjeldstad, 1998) analysed more than a dozen different companies and found that the value chain did not sufficiently describe the value creation logic for all companies. They found that value chain analysis was representative for traditional manufacturing industry while other industries and companies were better is described as value shops or value networks.

**Table 1 : Overview of alternative value configurations (Stabell & Fjeldstad, 1998)**

	<b>Chain</b>	<b>Shop</b>	<b>Network</b>
<b>Value Creation Logic</b>	Transformation of inputs into products	(Re)solving customer problems	Linking customers
<b>Primary Technology</b>	Long-linked	Intensive	Mediating
<b>Primary activity categories</b>	<ul style="list-style-type: none"> <li>• Inbound logistics</li> <li>• Operations</li> <li>• Outbound Logistics</li> <li>• Marketing</li> <li>• Service</li> </ul>	<ul style="list-style-type: none"> <li>• Problem-finding and acquisition</li> <li>• Problem-solving</li> <li>• Choice</li> <li>• Execution</li> <li>• Control/evaluation</li> </ul>	<ul style="list-style-type: none"> <li>• Network promotion and contract management</li> <li>• Service provisioning</li> <li>• Infrastructure operation</li> </ul>
<b>Main interactivity relationship logic</b>	Sequential	Cyclical, spiralling	Simultaneous, parallel
<b>Primary activity interdependence</b>	<ul style="list-style-type: none"> <li>• Pooled</li> <li>• Sequential</li> </ul>	<ul style="list-style-type: none"> <li>• Pooled</li> <li>• Sequential</li> <li>• Reciprocal</li> </ul>	<ul style="list-style-type: none"> <li>• Pooled</li> <li>• Reciprocal</li> </ul>
<b>Key cost drivers</b>	<ul style="list-style-type: none"> <li>• Scale</li> <li>• Capacity utilization</li> </ul>		<ul style="list-style-type: none"> <li>• Scale</li> <li>• Capacity utilization</li> </ul>
<b>Key value drives</b>		<ul style="list-style-type: none"> <li>• Reputation</li> </ul>	<ul style="list-style-type: none"> <li>• Scale</li> <li>• Capacity utilization</li> </ul>
<b>Business value system structure</b>	<ul style="list-style-type: none"> <li>• Interlinked chains</li> </ul>	<ul style="list-style-type: none"> <li>• Referred shops</li> </ul>	<ul style="list-style-type: none"> <li>• Layered and interconnected networks</li> </ul>

## 2.1.2 Governance in interfirm interactions (Heide, 1994)

Jan B. Heide developed a typology of three different forms of Governance based on existing research models (Resource Dependency Theory, Transaction Cost Theory and Relational Contracting Theory). This is a generalized governance model for three types of interfirm transaction with a special attention towards non-marked governance. Marked Governance is governance of pure product transactions which are pre-defined. Unilateral governance is that a supplier is incorporated into the hierarchy of the buyer while bilateral governance is how interaction between two companies is governed in order to jointly create value.

**Table 2 Dimension and Forms of Interfirm Governance (Heide, 1994)**

Dimension		Marked Governance	Non-marked Governance	
			Unilateral/Hierarchical	Bilateral
<b>Relationship Initiation</b>		No particular initiation process	Selective entry; skill training	Selective entry; value training
<b>Relationship Maintenance</b>	2.1 Role Specification	Individual roles applied to individual transactions	Individual roles applied to entire relationship	Overlapping roles; joint activities and team responsibilities
	2.2 Nature of planning	Non-existent; or limited to individual transactions	Proactive/unilateral; binding contingency plans	Proactive/joint; plans subject to change
	2.3 Nature of Adjustments	Non-existent; or giving rise to exit or immediate compensation	Ex ante/explicit mechanism for change	Bilateral/predominantly negotiated changes through mutual adjustment
	2.4 Monitoring Procedures	External/reactive; measurement of output	External/reactive; measurement of output and behaviour	Internal/proactive; based on self-control
	2.5 Incentive System	Short-term; tied to output	Short- and long-term; tied to output and behaviour	Long-term; tied to display of system-relevant attitudes
	2.6 Means of Enforcement	External to the relationship; legal system/competition/offsetting investments	Internal to the relationship legitimate authority	Internal to the relationship; mutually of interest
<b>Relationship Termination</b>		Completion of discrete transaction	Fixed relationship length, or explicit mechanisms for termination	Open-ended relationship

### 2.1.3 Actor based collaboration theory (FJELDSTAD, SNOW, MILES, & LETTL, 2012)

Organization of projects in knowledge-intensive industries has had traditional approach of hierarchical organization.

**Table 3 : Organizational forms**

<b>Organizational form</b>	<b>Purpose</b>	<b>Control and coordination mechanism</b>
<b>Simple hierarchy</b> 1. <b>Simple structure</b> 2. <b>Machine bureaucracy</b> 3. <b>Professional bureaucracy</b>	Achieve economies of scale through specialization of functions and expertise	1. Higher-level units control and coordinate lower-level units 2. Planning 3. Standardization of skills and values
<b>Divisional</b>	Respond to differentiated customer demand and achieve economies of scope	Division level controls and coordinates functional units. Corporate level controls and coordinates cross-divisional activities and resources
<b>Matrix</b>	Combine responsiveness to differentiated customer demand with varied technological expertise	Multiple superiors (e.g., functional, product-group, and regional/country) Cross-functional teams
<b>Multi-firm network</b>	Use flexible assembly of firms with specialized capabilities to achieve economies of scale and experience	Hierarchical control and coordination by the lead firm over the total network Hierarchical control and coordination within network member firms

With the fast moving, technology intensive and shifting collaboration constructs a new organizational design is proposed which removes some of the inefficiencies of hierarchical control; Actor-oriented architectural scheme.



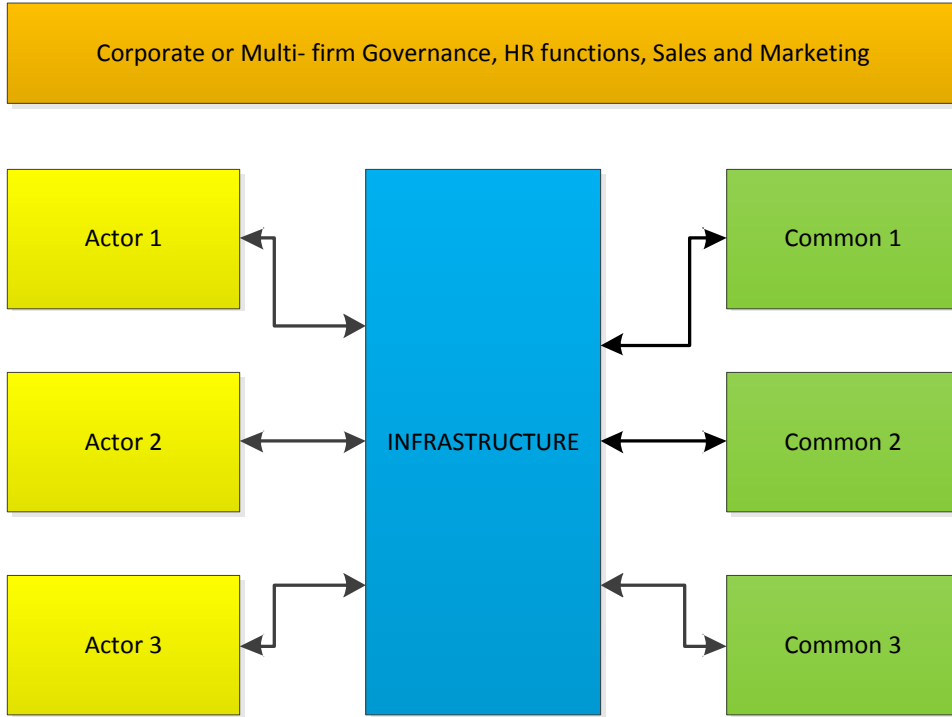


Figure 24 : Actor-oriented architectural scheme

Actors	Commons	Infrastructure
Units with common values that are able to self-organize	Assets that are accessible and shared by the units	Protocols, processes and infrastructure enabling multi-actor collaboration

## **3 METHOD**

### **3.1 Research design**

To investigate the research questions posed it is important to acknowledge that the information is not readily available in the public domain and that much of the information required is confidential and hidden inside the applicable organisations. However studying how they interact with their subcontractors will give a view of how they operate. It might not give the applicable organisations reasoning for choosing such strategies, but will give the information required to answer the research questions posed.

A case study is chosen because (Yin, 2018):

- It copes with the technical distinctive situation in which there will be many more variables of interest than data points, and as one result
- benefits from the prior development of theoretical propositions to guide design, data collection, and analysis and as another result
- relies on multiple sources of evidence, with data needing to converge in a triangulating fashion.

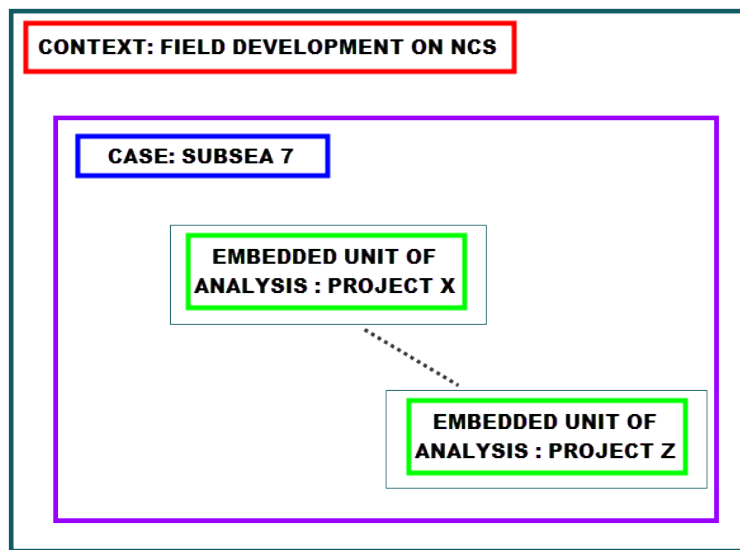
#### **3.1.1 Case Study**

A case study as defined by Yin (Yin, 2018) as an empirical method that investigates contemporary phenomenon's in depth and within its real world context. It copes with theoretically distinctive situations where there are many more variables than data points. It benefits from prior theoretical developed propositions to guide the design, data collection and analysis, and as a result relies on multiple sources of evidence.

To ensure quality in the case study four pillars of validity are proposed (Yin, 2018):

- Construct validity:
  - o Multiple sources of information
  - o Key informants review of study report
- Internal validity:

- Perform pattern matching
- Explanation building
- Address rival theories
- Use logical models
- External validity:
  - Use theory
- Reliability:
  - Use case study protocol
  - Develop case study database
  - Maintain chain of evidence



**Figure 25: Embedded Single case study design(Yin, 2018)**

The case research design chosen to explore the research questions is an embedded single case study as illustrated in Figure 24. The single case design can be justified as the case organisation will be used to illustrate the marked and is as such not the target of the study, more a means exploring the research questions. The reason for choosing an embedded design is that the field developments are the units of analysis, i.e. Subsea 7 is a vessel for examining the change in the

oil companies approach to field developments through the projects that are performed by Subsea 7.

### **3.1.2 Qualitative research**

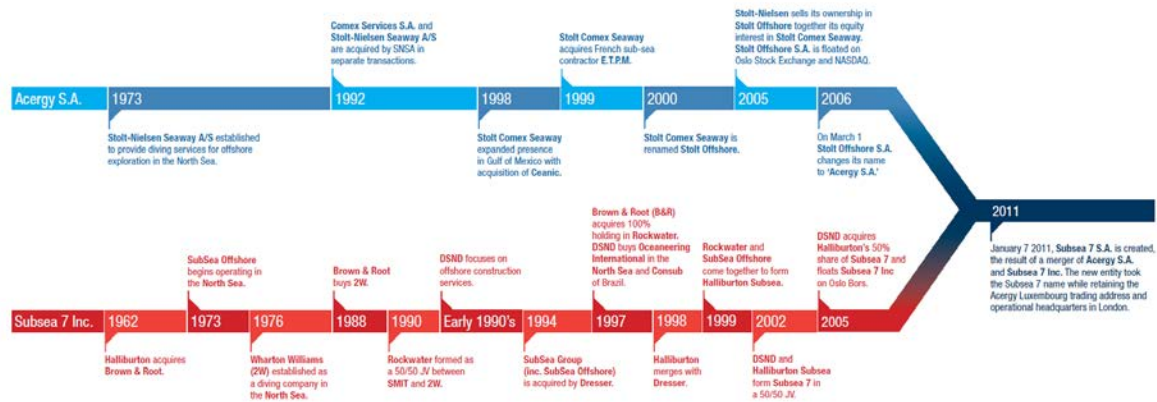
Qualitative research is defined by Yin (Yin, 2016) by distinguishing it from other social sciences by five attributes required in qualitative research;

1. Studying the meaning of people's lives (organisations) in real world roles
2. Representing the views and perspectives of people (participants) in the study
3. Explicitly attending to and accounting for real-world contextual conditions
4. Contributing insights from existing or new concepts that may help to explain social behaviour & thinking
5. Acknowledging the potential relevance of multiple sources of evidence rather than relying on a single source

To do qualitative research, three main pillars are required; Transparency, methodic-ness and adherence to evidence.(Yin, 2016).

## **3.2 The case: Subsea 7 Norway AS**

Subsea 7 S.A. operates in three main segments; SURF, Conventional and Renewables. Subsea 7 Norway AS is a subsidiary to Subsea 7 S.A. Its main marked purpose is to serve the Norwegian continental shelf (NCS) oil and gas companies with field development and project execution services in the SURF segment. It has a large marked share of the Norwegian sector and competes against its main rival Technip-FMC for the development projects. Subsea 7 Norway AS is a relatively new company that came into existence in 2011 after the merger of Acergy S.A. and Subsea 7 Inc. Subsea 7 Norway can however trace its history back to the start of the offshore oil industry on the Norwegian Sector with its history of mergers and acquisitions. After the merger it was finally capable of fully competing with Technip (prior to the merger with FMC) in its diverse offering to the oil companies.



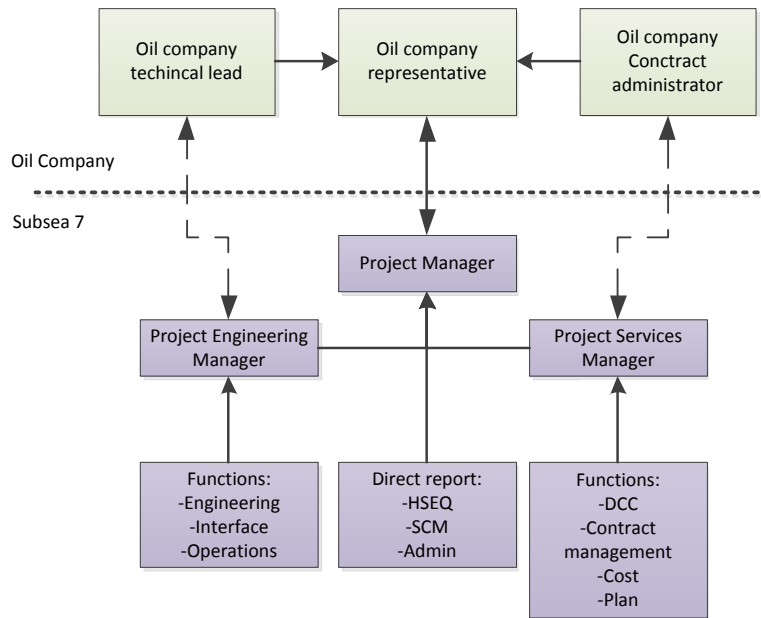
**Figure 26 : History of Subsea 7 S.A.(Subsea7, 2018)**

Subsea 7 Norway is organized around projects and main purpose of the organization is to win and performs projects. To do this the organization is supported by a number of internal service providers.

Subsea 7 has 5 stated values; Performance, innovation, **collaboration**, safety and integrity. It has a vision: “to be acknowledged by our clients, our people and our shareholders as the leading strategic partner in our market”(Subsea7, 2018).

### 3.2.1 Project organisations

Each project executed by Subsea 7 follows normally a set setup where the project management is consisting of three functions; a Project Manager with a Project Services Manager and a Project Engineering Manager reporting to him. The Project Manager is the oil company’s main point of contact. The Project Engineering Manager will manage the technical delivery of the project while the Project Services Manager will ensure that the business services are operating and will also administrate and manage the contract. The setup shown in Figure 26 has been the norm and would be the way the project are set up following the Subsea 7 Business Management System (BMS). However with the new constellation between SPS and SURF contractors and the alliances/partnerships with oil companies, a number of different constellations have seen the light of day. This report will not go further into the different models for project organization; however it could be a subject for a separate study.



**Figure 27: Typical Subsea 7 project organization setup**

### 3.2.2 i-Tech services

I-tech services are a separate entity owned by Subsea 7 S.A. and they are providing the survey and ROV services for the projects. They operate a vast fleet of ROV and associated tooling. In addition to the ROVs they also operate the smaller light construction and survey vessels that are supporting the field developments. I-tech is also providing Life-of-Field services to the oil companies, however this part is not included in the development projects.

### 3.2.3 Offshore resources (OR)

With exception of IT, all of Subsea 7's internal service providers are grouped into the Offshore Resources.

The Offshore Resources organisation comprises 4 operational elements: Fleet & Equipment, Crewing, New Builds and Pipeline Group, supported by common Finance, SCM, HR and Legal Teams. They also maintain the global vessel schedule and charter in vessels to meet project requirements.

## Operational



**New Builds & CAPEX**  
New Builds & CAPEX Page



**Pipeline Group**  
Pipeline Group Page



**Fleet & Equipment**  
Fleet & Equipment Page



**Crewing**  
Crewing Page



**Global Vessel Schedule**  
Click here to access the GVS Page

## Support



**Finance**  
Finance Page



**Fleet HSEQ**  
Fleet HSEQ Page



**SCM & Chartering**  
SCM Page



**Human Resources**  
Human Resources Page

**Figure 28 : Offshore Resources main functions from intranet page**

### **3.2.3.1 Pipeline group (PG)**

Further, the pipeline group is a service provider within Offshore Resources with the main purpose to deliver pipeline fabrication and installation services to the projects. This group runs the company's pipe lay vessels in addition to operate the fabrication sites for pipe stalk fabrication such as the Vigra stalk fabrication base outside Ålesund, Norway, ref: Figure 28 & Figure 29.



Figure 29 : Pipe lay vessel Seven Oceans



Figure 30: Vigra pipeline fabrication site



### 3.3 Data collection strategy

To construct validity within qualitative research it is important to have multiple sources of evidence. To gather the information required a procedure has been put in place. To look at the field development projects on the Norwegian sector a broad approach including all projects (PDO's) sent for approval to the Petroleum Directorate.

One very important assumption is that all the subsea field development projects have been issued to Subsea 7 for tendering purposes. In addition to the PDO applications, Alliances that had been formed with oil companies which have not yet resulted in field developments sent for PDO approvals are also to be reviewed.

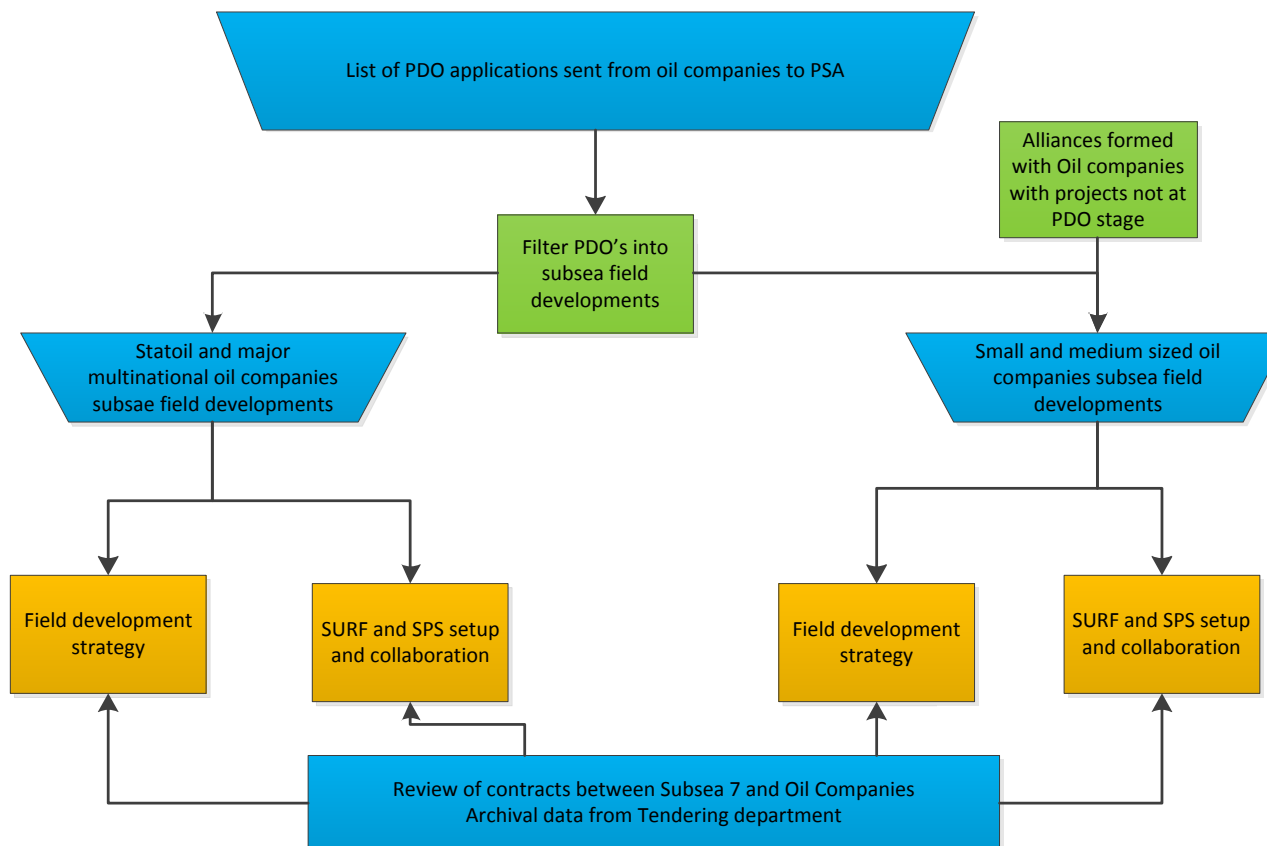


Figure 31: Data collection strategy

The data collection strategy is divided into the following method:

1. Contact the Norwegian ministry of oil to review the PDO applications submitted from 2013 till end of 2017.
2. Review the list and remove all PDO applications that does not contain a subsea field development
3. Review Subsea 7 tendering department library for information issued by operators to evaluate field development strategy, contract strategy and constellations for SPS and SURF
4. Review online resources for the field developments

### ***3.3.1.1 Period of examination***

Field developments applied for prior to 2013 were dominated by the international and Statoil. This said there were two field developments that were done by companies that could have fallen into the category of medium oil companies; Marathon Volund development and the Talisman Yme development.

Even though there are a number of interesting project and constellations with oil companies and SPS contractors ongoing at the moment and the reader might ask why they are not included. It is decided to avoid disclosing any marked sensitive information that could jeopardize this work and relations with other companies.

The period to be examined is from January 2013 till December 2017 for PDO applications.

## **3.4 Data analysis**

Screening whether the PDO application to the government is a subsea field development or not is to be done by screening tendering information within Subsea 7, and reading the information related to the licence on the NPD fact pages (<http://factpages.npd.no/factpages/>). The following PDO applications were disregarded as not being relevant:

- Wells drilled from existing subsea infrastructure into new reservoirs (no new infrastructure)

- Dry trees – Oil field development with bottom founded platforms (no subsea wells)
- Modifications (Yme) where the initial field development is not producing

Using the data collection strategy on each specific field development, metadata (or attributes) to each development is developed.

The following metadata is to be produced for the field development projects:

- Oil Company (From NPD)
- Development Name (From NPD)
- Year of PDO application (From NPD)
- Field development strategy (T&I/EPCI/Design Competition or Alliance) (From Subsea 7 Tender Archive)
- FEED performed by SURF contractor? (From Subsea 7 Tender Archive)
- SURF / SPS constellation if Alliance / Design competition (From Subsea 7 Tender Archive)
- Awarded contracts and final constellations for development projects (From Subsea 7 Archive)

On the projects awarded to Subsea 7 the following additional data is to be produced:

- Field developments in oil company alliance contracts on earlier stages than Execute (Correspondence with Alliance projects)

### **3.5 Reliability and validity**

When performing a case study its purpose is to do an in-depth study of contemporary phenomenon. By having multiple sources of evidence on each development project a convergence of the findings support the validity. (Yin, 2018)

To validate the information gathered within the case organisation it is necessary to support internal information with public sources available for verification as far as possible. For public verification, oil company press releases, web pages and government data published for the applicable development is to be used.

As the thesis relies on archival data, the main source of error would be omission of evidence or misrepresentation of the data. To avoid this, all developments in the period of examination will be subject to the thesis.

### **3.6 Ethics**

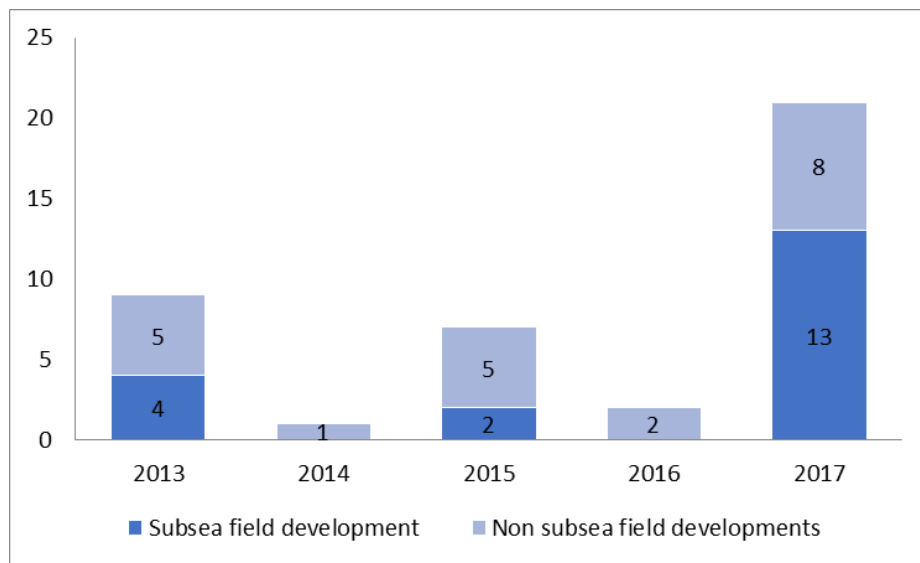
To perform the study in an ethically sound way is important as there are several pitfalls that may hinder this. First it is important to consider the influence of the researcher's lens. It can be argued that the researcher as a participant-observer has a bias towards pre-conceived conviction and can misrepresent the data or results to support own beliefs. One way of avoiding suspicion is to disclose the researcher's position to demonstrate research integrity.

The researcher has worked in Subsea 7 for 14 years and held the position as Project Engineering Manager the last 7 years executing projects for ConocoPhillips, Statoil and Wintershall. The researcher has worked with all (Baker Hughes GE, AkerSolutions, FMC and OneSubsea) SPS contractors on projects, studies and tenders. The researcher has worked on multiple tenders and studies and is currently working on tenders in the tendering department. The researcher has no motive to obscure the results and will strive to maintain truthfulness on statements and results. To avoid any "sensitive" material going out to competitors the report is confidential and withheld from public. Furthermore the report has been reviewed by the Subsea 7 head of tendering to ensure correctness.

## 4 Results

### 4.1 Classification of the PDO applications

A total of 40 PDO applications were sent to the Norwegian Petroleum Department in the period between January 2013 and December 2017. Following the procedure set in section 0 a total of 19 of the applications was considered as a subsea field development while 21 of the developments were considered not to be subsea field developments. The applications are displayed by year in Figure 31.



**Figure 32: Classification of PDO applications sent to NPD for approval**

In Table 4 the applications filtered out is shown. Some of the field developments have had involvement from SURF contractors; however this has been limited to pipelines between platforms or other secondary work scopes and thus has not fallen into the category of being a subsea field development as defined in section 1.1.3.

**Table 4: PDO applications filtered out as not being subsea field developments**

<b>Year</b>	<b>PDO application</b>	<b>Oil Company</b>	<b>Project</b>	<b>Reason for exclusion</b>
2013		Statoil	Gina Krog	Dry trees (New Platform)
2013		AkerBP	Ivar Aasen	Dry trees (New Platform)
2013		Mærsk	Gudrun	Dry trees (From existing Clyde Platform)
2013		AkerBP	Ula	Dry trees (From existing Ula Platform)
2013		Statoil	Visund	Wet tree from existing subsea infrastructure
2013		Statoil	Fram H-Nord	Wet tree from existing subsea infrastructure
2015		Statoil	Johan Sverdrup Phase 1	Dry trees (New Platforms)
2015		Statoil	Gullfaks	Dry trees (From existing Gullfaks Platform)
2015		Statoil	Gullfaks Sør	Dry trees (From existing Gullfaks Platform)
2015		Statoil	Snøhvit N	Wet tree from existing subsea infrastructure
2016		Statoil	Fram C - Øst	Wet tree from existing subsea infrastructure
2016		Statoil	Oseberg Vestflanken 2	Dry trees (New Platform)
2017		Statoil	Byrding	Wet tree from existing subsea infrastructure
2017		Statoil	Sindre	Dry trees (From existing Gullfaks C Platform)
2017		ENI	Goliat Snadd reservoir	Wet tree from existing subsea infrastructure
2017		Statoil	Njord Future	Njord Floating platform upgrade project
2017		Statoil	Troll Brent B	Wet tree from existing subsea infrastructure
2017		Total	Martin Linge Herja/Hervor	Dry trees (From future Martin Linge Platform)
2017		Statoil	Oseberg Shetland/chalk	Dry trees (From existing Platform)
2017		Repsol	YME	Repair / modification project. Subsea infrastructure in place.
2017		AkerBP	Valhall Flanke Vest	Wellhead platform tied-back to Valhall (*)

(\*) Significant parts of the Valhall Flanke west is performed by the AkerBP Subsea alliance, however the scope does not qualify as a subsea field development

The projects classified as subsea field developments in the period are shown in Table 5. As can be seen only two of the nineteen developments involves a new floating platform. The remaining seventeen are all connected to an existing platform or several platforms. Worth noting is that Spirit Energy, Wintershall, VNG and DEA are all developing tie-backs to Statoil operated platforms.

**Table 5: Subsea Field development PDO applications 2013-2017**

<b>Year</b>	<b>PDO application</b>	<b>Oil Company</b>	<b>Project</b>	<b>Subsea Field Development Scope</b>
2013		AkerBP	Hanz	Subsea tie-back to Ivar Aasen *
2013		Statoil	Aasta Hansteen	New floating platform, subsea tie-back
2013		Statoil	Oseberg Delta 2	Subsea tie-back to Oseberg platforms
2013		Statoil	Visund Nord	Subsea tie-back to Visund
2015		Statoil	Gullfaks Rimfaksdalen Rutil	Subsea tie-back to Gullfaks
2015		Wintershall	Maria	Subsea tie-back to Kristin / Aasgard / Heidrun
2016		Statoil	Utgard	Subsea tie-back to Sleipner
2016		DEA Norge	Dvalin	Subsea tie-back to Heidrun
2016		Statoil	Trestakk	Subsea tie-back to Aasgard
2016		Spirit Energy	Oda	Subsea tie-back to Ula platform
2017		Statoil	Bauge	Subsea tie-back to Njord
2017		ConocoPhillips	Ekofisk Sør	Subsea tie-back to Ekofisk
2017		Statoil	Snefrid Nord	Subsea tie-back to Aasta Hansteen
2017		Statoil	Johan Castberg	New floating platform, subsea tie-back
2017		AkerBP	Skogul	Subsea tie-back to Alvheim
2017		AkerBP	Ærfugl	Subsea tie-back to Skarv
2017		VNG	Fenja	Subsea tie-back to Njord
2017		Statoil	Snorre Expansion	Subsea tie-back to Snorre

## 4.2 Field developments by the new oil companies

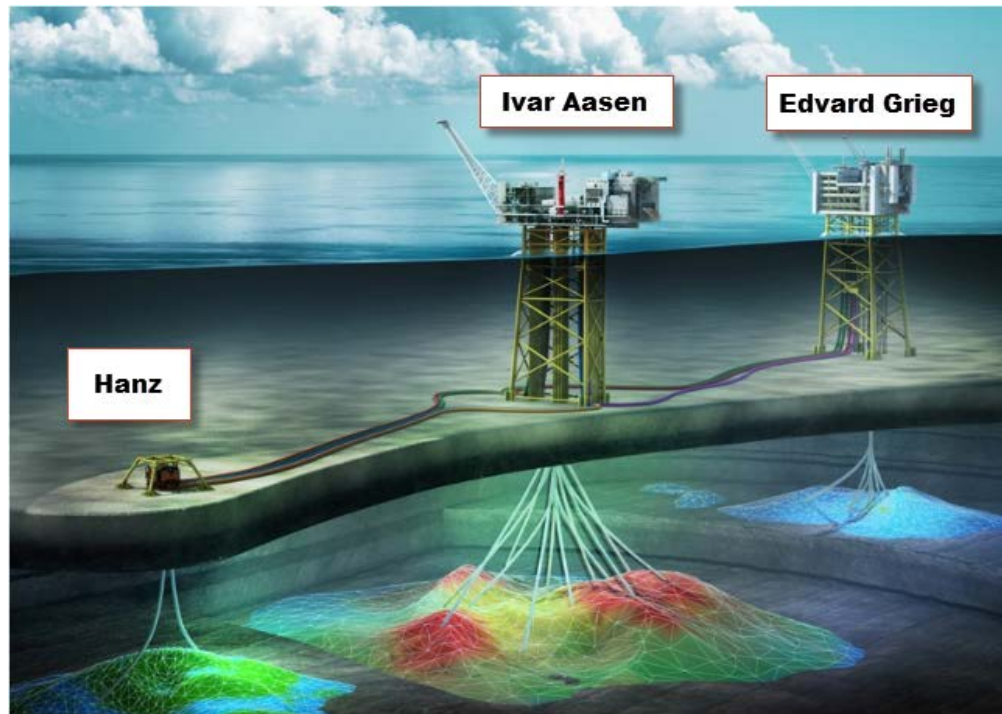
Narrowing down to the developments with the new operators the following sub-cases are defined in Table 6.

Table 6: Subsea Field development PDO applications 2013-2017 Small and medium sized oil companies

Year	PDO application	Oil Company	Project	Subsea Field Development Scope
2013		AkerBP	Hanz	Subsea tie-back to Ivar Aasen *
2015		Wintershall	Maria	Subsea tie-back to Kristin / Aasgard / Heidrun
2016		DEA Norge	Dvalin	Subsea tie-back to Heidrun
2016		Spirit Energy	Oda	Subsea tie-back to Ula platform
2017		AkerBP	Skogul	Subsea tie-back to Alvheim
2017		AkerBP	Ærfugl	Subsea tie-back to Skarv
2017		VNG	Fenja	Subsea tie-back to Njord



## 4.2.1 Aker BP Hanz



**Figure 33: Artistic view of the Hanz development (AkerBP, 2014)**

### Development solution (Norsk Petroleum, 2018b):

The field is situated 12 km north of Ivar Aasen platform in the North Sea. The water depth is 115 meter and will be developed as a subsea tie-back to Aker BP operated Ivar Aasen platform. The field will require water injection to maintain production pressure. The PDO application was submitted and approved in 2013 for this field. However it has not been executed and might be re-submitted after the FEED in the alliance. (Ref Table 8)

### Licence partners:

- Statoil 50%
- Aker BP ASA 35%
- Spirit Energy Norge AS 15%

## 4.2.2 Wintershall Maria

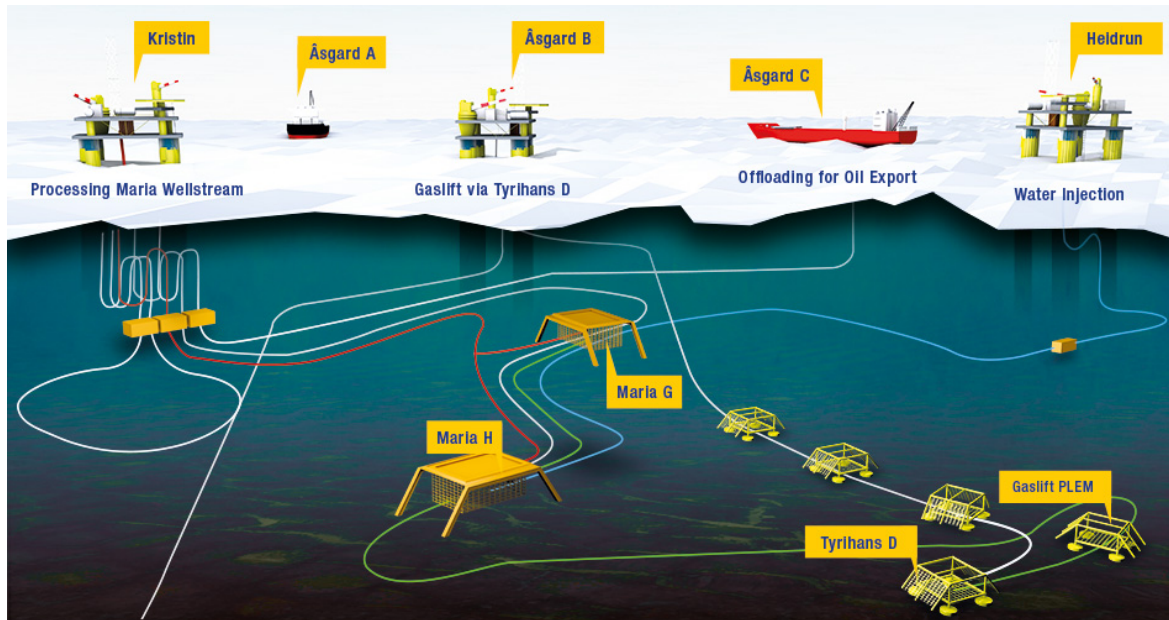


Figure 34 : Cartoon presentation of the Maria development (Wintershall, 2015)

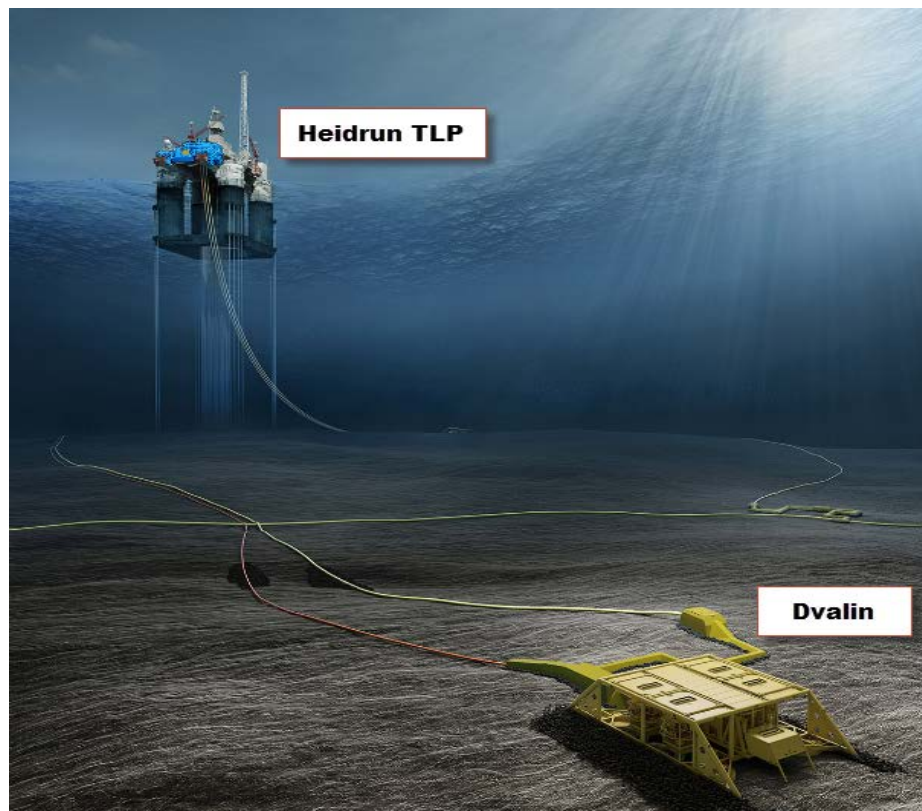
### Development solution (Norsk Petroleum, 2018a):

The field is situated on the Haltenbanken area in the Norwegian Sea which is a mature area with existing infrastructure. The water depth ranges from 300 to 340 meter. It was developed using two 4 slot templates with a 26km production pipeline subsea tie-back to Kristin FSU. Water injection for pressure boosting is supplied by a 46 km pipeline from Heidrun TLP while Aasgard B supplies lift gas through the Tyrhans field to a 23 km pipeline to Maria field. It is one of the more complex subsea tie-back developments since a number of hosts with multiple licence owners have been involved.

### Licence partners:

- Wintershall 50%
- Petoro 30%
- Spirit Energy Norge AS 20%

### 4.2.3 DEA Norge Dvalin



**Figure 35 : Artistic view of Dvalin development (DEA\_Norge, 2018)**

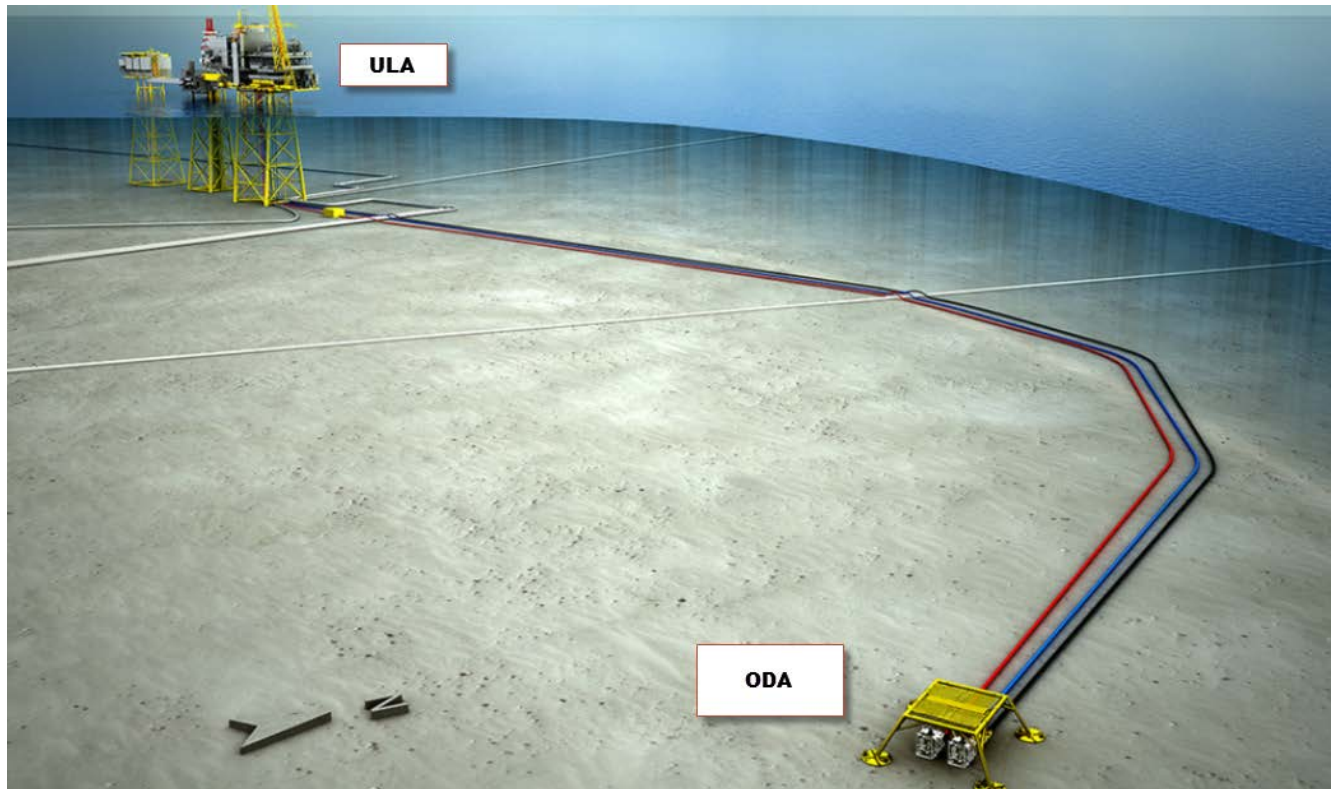
#### Development solution (Norsk Petroleum, 2018a):

The gas field is situated on the Haltenbanken area in the Norwegian Sea. It was developed with a 4 slot template to a 15 km pipeline tied back to Heidrun. From Heidrun the gas is exported through a 7.5 km pipeline connected to Polarled for further processing in Nyhavna gas terminal.

#### Licence partners:

- Dea Norge AS 55%
- Petoro 35%
- Edison 10%

## 4.2.4 Spirit Energy Oda



**Figure 36: Artistic view of the Spirit Energy Oda development (Lorentzen, 2016b)**

### Development solution (Norwegian Petroleum, 2018b):

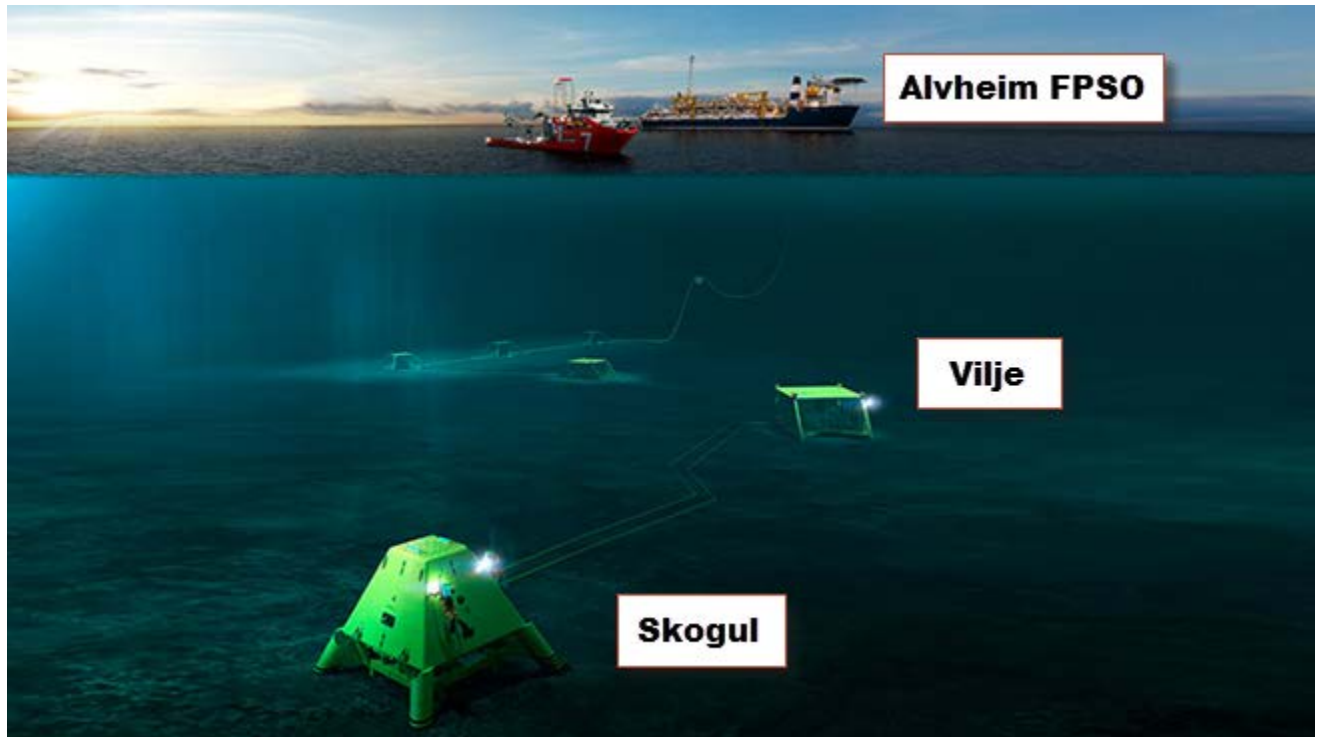
The field is located in the North Sea at 65m water depth 10 km east of the Ula field. It will be developed with a 4 slot template with a subsea tie-back to the Ula facility. Water will be supplied by Ula via a water injection pipeline for pressure support.

### Licence partners:

- Spirit Energy Norge AS 40%
- Suncor Energy Norge AS 30%
- Faroe Petroleum Norge AS 15%
- Aker BP ASA 15%



## 4.2.5 Aker BP Skogul



**Figure 37: Artistic view of the Aker BP Skogul development (Aker\_BP, 2017a)**

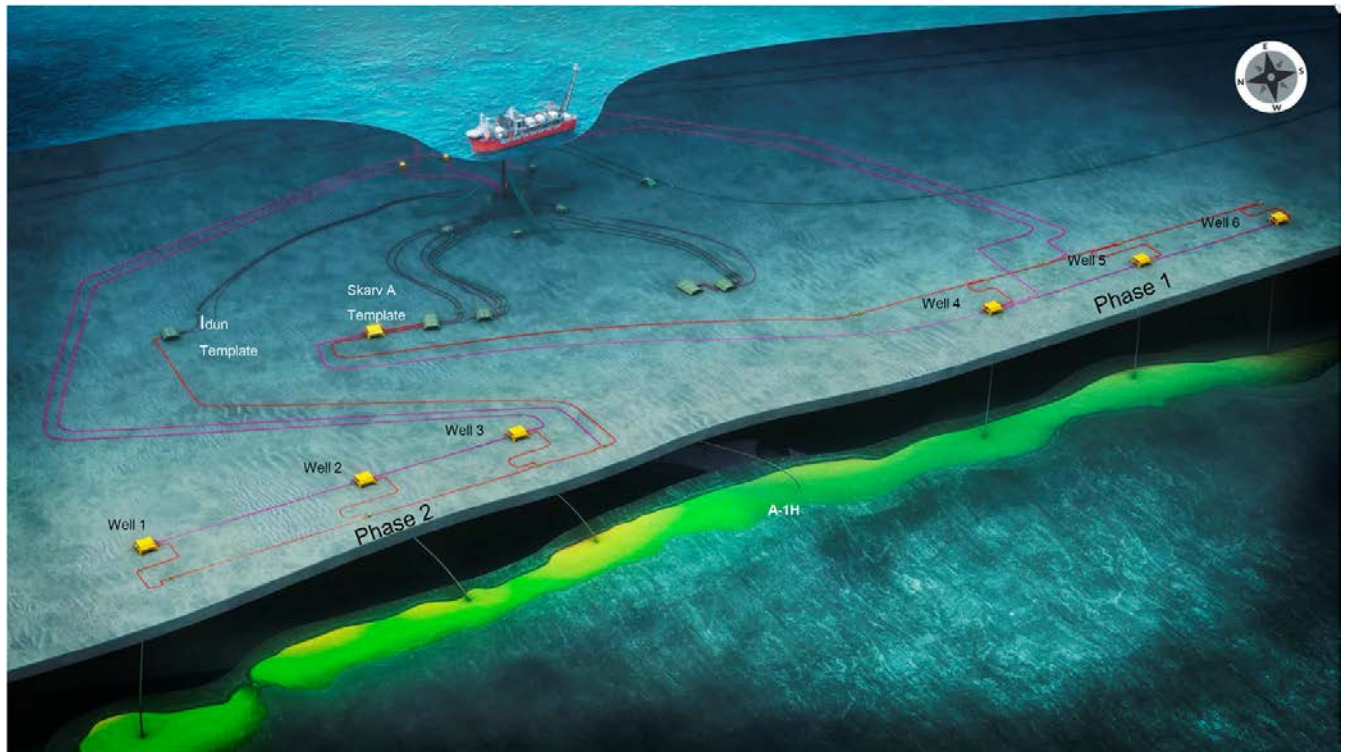
Development solution (Norwegian Petroleum, 2018c):

The field is located in the mid part of the North Sea at 110m water depth 30 km north of the Alvheim FPSO. It will be developed with a 2 slot template with a 16.5 km subsea tie-back to the Vilje subsea development that is connected to the Alvheim facility. Lift gas pipeline from Vilje to Skogul will also be installed.

Licence partners:

- Aker BP ASA 65%
- PGNiG Upstream Norway AS 35%

## 4.2.6 AkerBP Ærfugl



**Figure 38: Artistic view of the Aker BP Ærfugl development (Aker\_BP, 2017b)**

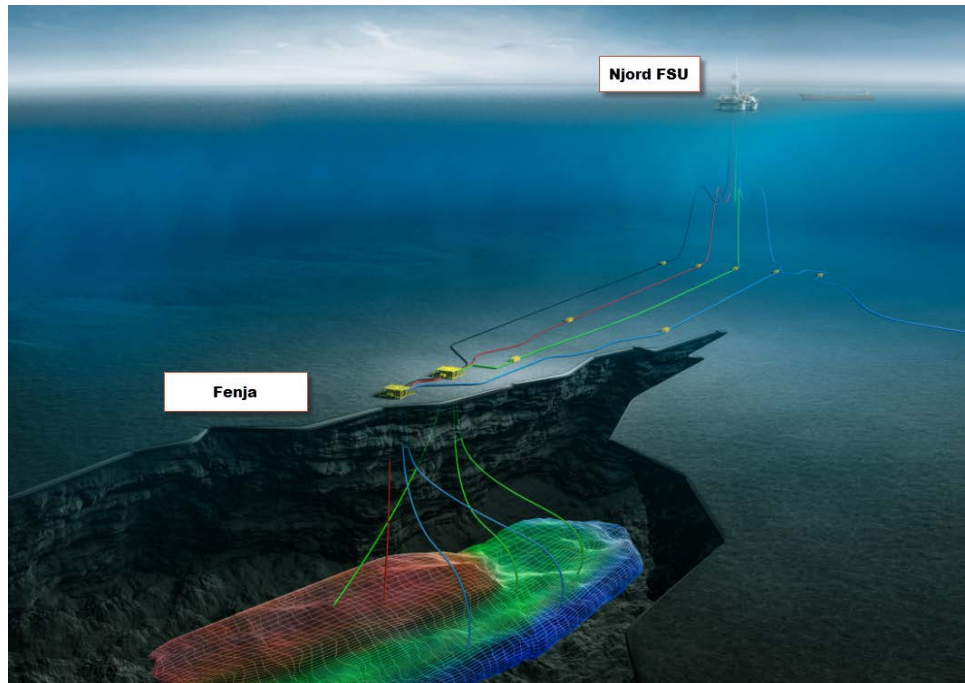
### Development solution (Aker BP, 2017b):

The field is located in the Norwegian Sea west of the Skarv development. The reservoir is a 60km long gas field that will be developed in two phases. The first phase is developed with three templates located on a string tied back to Skarv A Template with a trace heated 21 km pipe-in-pipe flowline.

### Licence partners:

- Aker BP ASA 23.8%
- Statoil 36.2%
- DEA Norge AS 28.1%
- PGNiG Upstream Norway AS 11.9%

## 4.2.7 VNG Fenja



**Figure 39: Artistic view of the VNG Fenja development (Stangeland, 2017)**

### Development solution (Nowegian Petroleum, 2018):

The field is located in the Norwegian Sea 35 km south west of the Njord field. The water depth at the field is 325 meter and it will be developed with two templates subsea tied back to Njord FSU with a trace heated pipe-in-pipe flowline. Water injection and gas lift is also provided in pipelines from the Njord FSU facility.

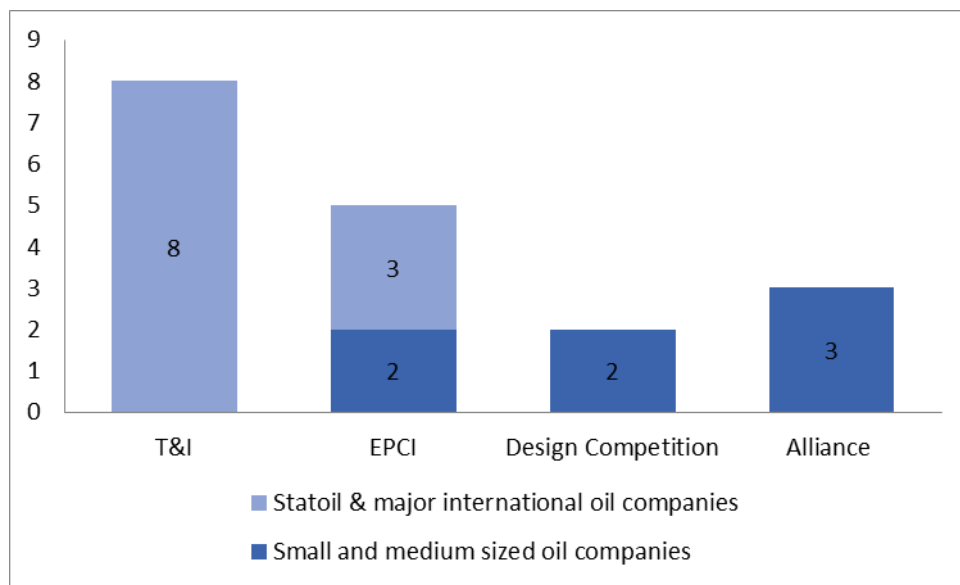
### Licence partners:

- VNG Norge 30%
- Faroe Petroleum 25%
- Point Resources 45%

### 4.3 Subsea field development strategy

In Figure 39 the development strategy is shown for the 19 developments. It shows how Statoil and the other major international oil companies' strategy remains firmly on T&I and EPCI while the new oil companies are utilizing EPCI, Design competition and Alliance approaches to their developments. It can be seen that the new oil companies choose a more collaborative approach.

One anomaly from this picture was that Statoils Trestakk development FEED (Halvorsen, 2016a) was awarded to Forsys and subsequently the EPCI contract was awarded to Technip and FMC (Halvorsen, 2016b) as a result of the FEED work.



**Figure 40: Field development strategy**

With exception of the Trestakk development, none of the Statoil or other major international oil companies had awarded a FEED contract or earlier stages studies to the SURF contractors. They often issued single studies to check out feasibility of proposals in their own master studies managed by them together with design houses. In Table 7 the projects sent for PDO approval being developed by the new oil companies is shown with stage of SURF involvement. Wintershall Maria and DEA Dvalin are the only developments where SURF did not perform the FEED study. They were also the first to be developed by the new oil companies. Following the Maria project Wintershall decided to go for the design competition strategy for the Nova



development which is a subsea tie-back to Gjøa. This development was sent for PDO approval in 2018 and is not part of the selected developments period. However it shows that Wintershall is also moving in the direction of earlier SURF involvement in the field developments.

The AkerBP alliance has had Subsea 7 involvement from the Select stage in Skogul while the remaining ongoing projects have had SURF performing FEED through design competitions. The reason Ærfugl was a design competition was partly due to this development being started when the field was owned by BP (prior to the merger with Det Norske) and that it included novel technology, Electrically Heat Traced Flowlines EHTF, which Technip-FMC and Subsea 7 are competing in developing. At the time of the design competition the price of the different solutions by Technip-FMC and Subsea 7 was unknown in the market. Subsea 7 won the EHTF project Ærfugl while Technip-FMC won a similar type of pipeline on VNG Fenja. Both these projects were seen as strategically important as they bring new enabling technology to the market.

**Table 7 : Stage of field development with Subsea 7 involvement for the new oil companies**

Field Development	Oil Company	Appraise	Select	Define	Execution
Hanz (*)	AkerBP		Q4 2018		
Skogul	AkerBP		Complete	Complete	Ongoing
Ærfugl	AkerBP			Complete	Ongoing
ODA	Spirit Energy			Complete	Ongoing
Fenja	VNG			Complete	Ongoing by Technip-FMC
Maria	Wintershall				Complete
Dvalin	DEA				Ongoing by Technip-FMC

(\*) Hanz project was originally applied for PUD in 2013 however not executed. A update on PUD could be expected based on AkerBP alliance define phase

Table 8 shows subsea field developments in the alliances that are currently in the earlier stages of development by Subsea 7 on the Norwegian sector. It tells a tail regarding the future that more

and more of the future field developments will have been built based on the front end engineering and concepts by Subsea 7 and the other SURF contractors.

Field developments by non-alliance smaller and medium sized oil companies are also ongoing at stages prior to define. These are typically following the design competition strategy and are not included as it is commercially sensitive information.

**Table 8: Subsea field developments (Pre PDO) in alliances where Subsea 7 perform field development**

<b>Field Development</b>	<b>Oil Company</b>	<b>Appraise</b>	<b>Select</b>	<b>Define</b>	<b>Execution</b>
Anonymized	Spirit Energy		Ongoing	Q3 2017	
Anonymized	Spirit Energy		TBC		
Anonymized	Spirit Energy		TBC		
Anonymized	AkerBP		Ongoing		
Anonymized	AkerBP		Q2 2018		
Anonymized	AkerBP	Q2 2018			
Anonymized	AkerBP	Q3 2018			

#### 4.4 SURF and SPS collaboration

When looking at the contracts and how they have been awarded the SPS and SURF contractors in Table 9 it shows that, with exception of VNG Fenja, none are following the international alliance partner setup between SPS and SURF for the developments by the new oil companies.

**Table 9 : SURF and SPS contractors awarded field developments for the new oil companies**

		<b>Contractors</b>	
<b>Field Development</b>	<b>Oil Company</b>	<b>SURF</b>	<b>SPS</b>
Hanz	AkerBP	Subsea 7	AkerSolutions
Skogul	AkerBP	Subsea 7	AkerSolutions
Ærfugl	AkerBP	Subsea 7	AkerSolutions
ODA	Spirit Energy	Subsea 7	Technip-FMC
Fenja	VNG	Technip-FMC	
Maria	Wintershall	Subsea 7	Technip-FMC
Dvalin	DEA Norge	Technip-FMC	AkerSolutions

Further to this Table 10 shows the established frame agreements and alliances between the oil companies and SPS and SURF contractors. Again there are only the OKEA and Lundin alliances following the international SURF / SPS alliances.

**Table 10: Subsea partnerships/alliances formed on Norwegian Continental Shelf**

<b>Oil Company</b>	<b>Contractors</b>	
	<b>SURF</b>	<b>SPS</b>
Spirit Energy Strategic Partner Alliance	Subsea 7	Technip-FMC
AkerBP Subsea Alliance	Subsea 7	AkerSolutions
OKEA Alliance	Subsea integration Alliance: Subsea 7+OneSubsea	
Premier Oil Partnership frame agreement (*)	Subsea 7	
Lundin Alliance	Technip-FMC	

(\*) Premier Oil sold its Norwegian business to AkerBP and is not currently active on NCS

## 5 Discussion

### 5.1 Value Shop vs Value Chain

As can be seen in the choices of field development contract strategies from the new oil companies in the Figure 39 & Table 7 the SURF contractors have performed FEED on 4 of the developments that are in the execution phase.

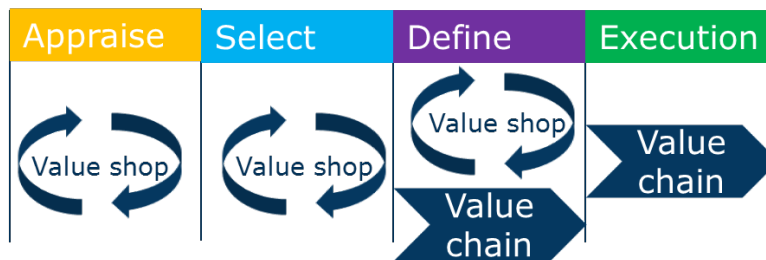
From the alliances it shows that on subsea field development prospects that are currently being studied, Subsea 7 is involved all the way from the appraisal stage, ref Table 8. At the end of each stage a decision gate is reached and based on the study done by Subsea 7 the gate is passed or re-work needs to be performed.

When looking at the classification of value chain and value shop defined in section 2.1.1 (Stabell & Fjeldstad, 1998) a more detailed review of the value creation in each stage of the field development is necessary.

In the appraise stage uncertain input based on a discovery is the input. The contractors will propose different concepts applicable to the field and do an early assessment. The requirement is to find some possible field solutions that can make the discovery commercially viable, i.e solving the customer's problems. Following the appraise stage the select stage starts off with the concepts identified in the appraise stage. Typically more information regarding the drainage strategy of the reservoir is then known based on potential appraisal wells and reservoir modelling. Again the concepts are narrowed down into preferably one with more certainty. Preparations for the define stage is also done (Pre-FEED) on the selected concept. Both these stages have a clear Value Shop creation logic.

In the define stage the selected concept is engineered to a detailed enough level to ensure that the risk of proceeding into the execution stage is minimal. A range of standard deliverables from engineering is performed in the define stage. Further to this, all defined materials are either estimated based on accurate marked intelligence or for the long lead high risk items sourced with back to back agreements with major international suppliers. The engineering, procurement, fabrication and offshore installation plans are detailed out. Finally a price for the development is

included in the delivery of the define stage. One can look at the entire define stage yet another revolving cycle for the field development, however it does preferable follow a predefined path so I would classify this stage as having both a value chain and a value shop value creation logic. The Execute stage clearly follows a Value Chain value creation logic as this stage sets into life the plan developed in the define stage. Focus in this stage is turning the input into products. Thus as a contractor there is not a pure value shop or value chain logic, however at the different stages of the development the value creation logic changes from value shop till value chain.



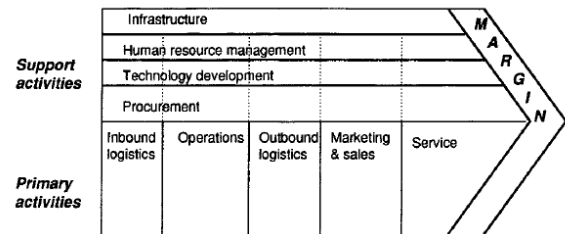
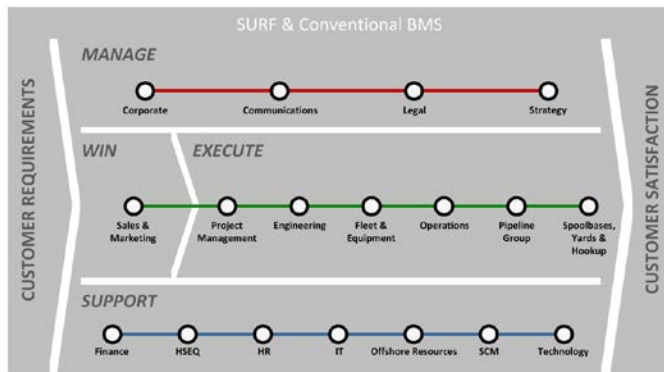
**Figure 41 : Value shop & Value chain in different field development stages**

A strong incentive for the new oil companies to approach Subsea 7 and the other traditional SURF contractors for participation in the earlier stages of the developments is that there is a clear information asymmetry (Stabell & Fjeldstad, 1998). They have not built up an in-house detailed knowledge like the international major oil companies when it comes to field developments. Further to this they will gain access to the learning done by Subsea 7 on a number of similar field developments. This is a key feature of the value shop model. Further to this, by being invited in the earlier stages of the development, the threat from new players in the offshore installation market is reduced. I.e. the barrier for market access is increased significantly from being a pure execution operator.

Following the strategic positioning options in (Stabell & Fjeldstad, 1998) Subsea 7 have integrated several key technology companies and by having a strategic alliance with One Subsea able to offer the customers a broad coverage of specializations. The organization also trains and promotes generalists that can refer to the different specialization. This is in line with a value shop business model.

Subsea 7 takes on more design risk by applying itself in the field architecture design, however it can with the correct technology differentiate itself better towards generic field solutions where the competition will be larger. The Oil companies in turn lowers their technical and financial risk for the development by transferring the design responsibility to Subsea 7, however this comes at a price of being more dependent on Subsea 7 for future work on the field.

Subsea 7's business management system (BMS) is clearly set up around the value chain when looking at Figure 41 and comparing it to the value chain diagram in (Porter, 1985). All the pre-execution activates in the BMS, i.e. the value shop resides in the "WIN" while the remainder is related to the Execute stage of the field development.



**Figure 42: Subsea 7 Business Management System**      **Figure 43 Value chain diagram(Porter, 1985)**  
**Overview**

In response of the new opportunities in getting involved in the earlier stages of the field development, Subsea 7 created a field development group within the engineering discipline. This engineering organization is to follow the oil companies through the earlier stages of the field development and coordinate the specialist technologies involved.

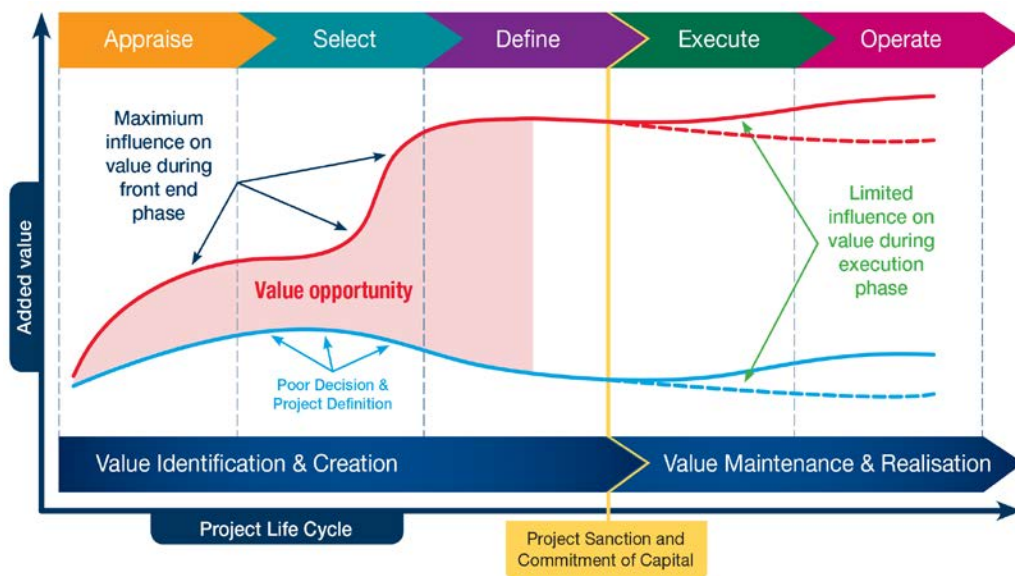
The Subsea 7 field development groups stated main mission (Matthews, 2017):

- *Influence Client's field development strategies*
- *Maximize value of our Alliances*
- *Understand Client forward thinking processes*

- *Demonstrate innovation and creativity*
- *Establish and build Subsea 7's technical credibility*
- *Promote in-house design capabilities*
- *Showcase and introduce our technologies*
- *Develop strong client relationships*
- *Build the foundations for Subsea 7 to win and successfully execute projects*

It could be argued that this list of goals is seen value-chain point of view where it is more a marketing function to help bring in the client requirements into the value chain. However as a true value shop function the goal could be stated more clearly as:

- *To provide problem solving expertise and specialist capability at pre-execute stages to maximize the value of subsea field developments.*



- **Figure 44 : Value creation through the field development (Matthews, 2017)**

The cost of performing the development stages up until the Execute stage is minimal compared to the execution stage. A development contract can range from typically 50 to 200 MUSD while a FEED in a design competition can be compensated by typically 1-2 MUSD. Design houses that only are selling engineering services will not be able to “sponsor” the study stages and will



normally be compensated on rates. As such with the promise of future execution work, the SURF contractors are willing to work for less compensation. Seen from the oil company side since they are getting several FEEDs in a design competition the budget is more or less unaltered compared to getting one FEED from a design house with no commitment on price.

## 5.2 Interfirm governance

The terms for the contracts ranging from pure T&I to EPCI contracts were standardized in 2005 by Statoil, Stolt Offshore (Now Subsea 7), Subsea 7 and Technip. The terms were called NSC05 (Gass, 2010).

Looking at the alliances formed with the new companies' vs the Design competition and EPCI contracts both contracting models elude to non-marked interfirm governance.

For all the development contracts there is a selection process on who is qualified to participate in the tendering process. For project specific governance the most important is being able to meet the specific requirements of the field development while for alliance agreements interfirm relations and unit rates play a more significant role. The alliances cross the new oil companies do not have a standard set-up and are custom to each oil company (Landa, 2017). The standard frame agreement with the oil company may be based on NCS05 and then an Alliance agreement on top that regulates the alliance, ref Aker BP alliance model in Figure 44.

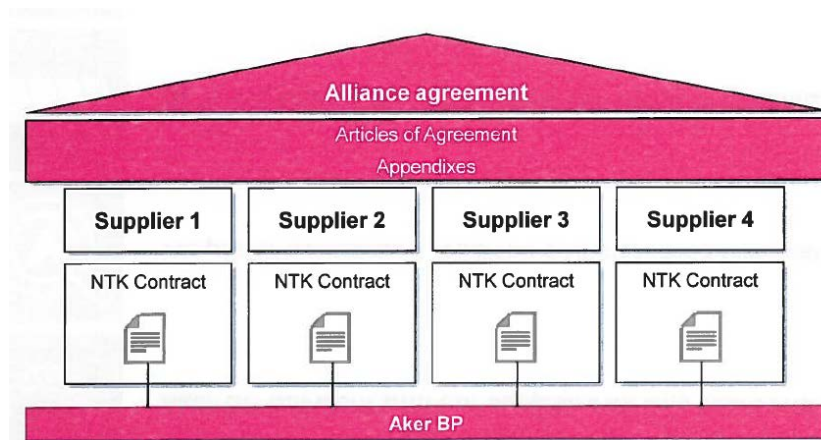


Figure 45: Aker BP Alliance contractual arrangement (Hatteland, 2018)

Comparing the standard NSC05 contracts to alliance agreement by Aker BP (S. Aker\_BP, AkerSolutions, 2017) which has gone to the most extreme by the different alliance partners in integrating the alliance into the teams one can find the following dimensions for inter-firm governance(Heide, 1994):

### **Relationship initiation:**

- EPCI:
  - Invited to participate in tender process for both FEED and Execution
  - Demonstrate through FEED that compliance is met towards standards of the oil company
- Alliances:
  - Invitation to participate in a tender for a frame agreement.
  - Projects initiated under the frame agreement are based on contractors maintaining their commitment to the partners and maintaining relations

All initiations of relationships are unilateral as the oil company asks the contractor to tender. A true bilateral relationship initiation would be between two parties that together seek out opportunities on equal footing. Not as a customer / supplier.

### **Role Specification:**

- EPCI:
  - Each company has their own organization with clear battery limits. Communication between the parties follows strict procedures (interface systems) which are managed by the oil company.
- Alliances:
  - Here it differs between the different oil company alliances, however for the Aker BP alliance they follow a “best man for the job” principle and create project

organizations with personnel filling the different roles in an integrated project team from all the participating companies.

Here we can see a difference where the Alliance model is following a bilateral path while the others are unilateral with strict communication protocols between each organization.

#### **Nature of planning:**

- EPCI:
  - For the design competitions the plans are potentially agreed though the Define phase or tender for execution. However they are binding and normally controlled by penalty structure for critical milestones.
- Alliances:
  - The planning inside the alliances through the various steps of the field development is developed in partnership to create a robust schedule. As the parties are together on the cost and development of the project the plans are adjusted during the stages and execution to optimize the resources and juggle restrictions between parties and suppliers to the alliance partners.

The Alliance model is again following a bilateral approach while the others are unilateral.

#### **Nature of adjustments:**

- EPCI:
  - Adjustments can arise from change in schedule from other parties / client or change in design basis.
  - The oil company has a right to adjust the work scope while the contractor can only propose an adjustment to the work.
- Alliances:
  - The adjustments to the scope are mainly an adjustment of the target sum through negotiated as a mutual agreement between the partners in the alliance.

- The adjustments will be based on the competitively bid unit rates in the frame agreements as far as possible

The Alliance model is again following a bilateral approach while the others are unilateral after the execution stage has started.

### **Monitoring Procedures:**

- EPCI:
  - In the execution phase monthly schedule updates are provided normally to the oil company. The schedule progress may be linked to payment.
  - Not meeting planned milestones may result in penalties
- Alliances:
  - In the alliances there is not a parent project organization monitoring the progress of the works with control functions. Monitoring of progress is based on the individual partners self-policing and reporting progress.
  - Dependencies between parties are monitored closely to ensure critical path management

For all the different constellations the ultimate customer is the license holders that are paying for the works. The reporting can be similar in all the contract models; however it differs in the sense that the alliance partners are trusted to self-monitor.

### **Incentive System:**

- EPCI:
  - The incentives are tied to the achievement of the milestones in the specific contract.
  - Repeat business with the oil company is also a strong incentive to adhere and honour the deliverables in the contract.
- Alliances:

- As the set-up is that the target sum has a profit sharing mechanism there is an incentive to save money between the partners to increase profit. This can be making smart mutually beneficial simplifications to processes, minimize non-value activities and standardize work methods across the alliance projects.
- Another joint strong incentive to reduce cost in the development stages of the development is the risk of it not being sanctioned due to the budgeted cost.

The EPCI incentives are tied towards the deliverables while the alliance incentives have a holistic approach towards the total alliance deliverable. As such the alliances are bilateral while the EPCI has a unilateral incentive system.

**Means of enforcement:**

- Design competitions and EPCI:
  - Disputes related to adjustments of the work will if not agreed between the parties elevated to external pre-appointed independent experts. If the decision of the experts is not accepted the last means of settlement is in the court system.
- Alliances:
  - Disputes in relation to adjustments to the target sum that cannot be agreed within the alliance will be raised to a steering committee between the partners. If the steering committee cannot reach a agreement the dispute will be processed by a external expert committee. Ultimately disputes will be settled by court system.

For the enforcement the Alliances have more layers where agreement is to be made but ultimately both models use external experts and ultimately the court system. Both are unilateral, however the alliances have a steering committee that will in practice be a bilateral enforcement panel towards the individual alliance project.

**Relationship termination:**

- EPCI:
  - The contract terminates with the delivery of the project.

- Alliances:
  - The alliances are built on frame agreements that have a fixed duration with options for extension.

Both contracts are finite and as such have a unilateral approach, however as long as the alliances are beneficial to all parties the alliance contracts can be extended.

Four out to the seven field developments by the small and medium sized oil companies currently sent for PDO approval is being performed under alliance agreements. This shows that some the alliance model is gaining ground with the new oil companies.

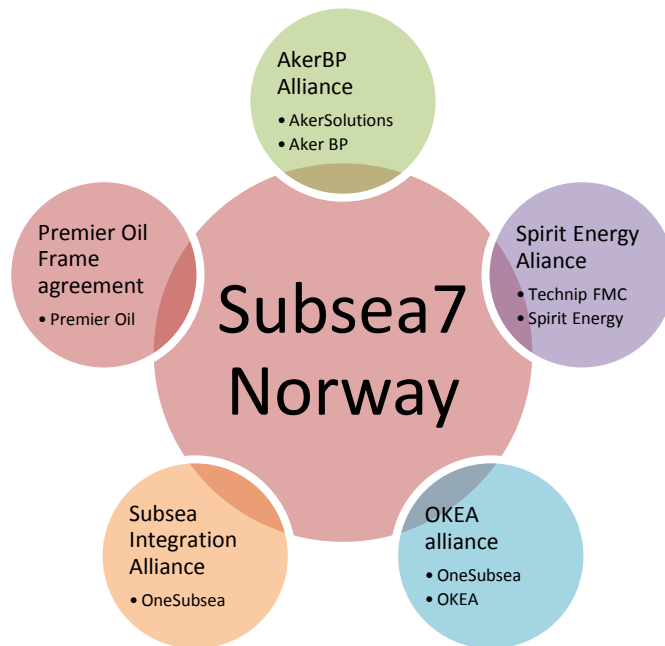
Looking at the potential motivation of their strategic move to collaborate closer with the contractor it can be seen from a resource dependency perspective where the strategy is seen as a response to conditions of uncertainty and dependence (Pfeffer and Salancik 1978). The new oil companies were developing their projects at a time where the oil price was low and there was an expectation of recovery in the market. By entering into alliances with the main contractors they were able to lock in unit rates at a time when the market activity was low for their developments being executed in a potentially higher cost market. They also secured access to resources at an early project development stage compared to field developments only coming to market at execution stage. This means that the alliances have gained access to the potentially scarce resources of the contractor in a booming market. From a transaction cost perspective (Williamson 1975) Statoil and the other major oil companies has the internal capacity and knowledge to develop projects into execute stage and manage multiple contracts for the developments while the new oil companies might lack organisational knowledge thus making it very challenging in a uncertain environment to describe the scope in a contract with required safe guards and contingency scenarios (Rubin 1990).

For the contractors the alliances have created a more visual future with regards to “secure” work which creates stability. The challenge might come during market recovery when alliance unit rates are not seen as attractive as capitalising on lump sum projects with high rewards when there are more developments going into execute than the contractor market is able to handle. Re-

negotiations of unit rates on benchmarked market rates might be required to maintain the alliances.

### 5.3 Collaboration

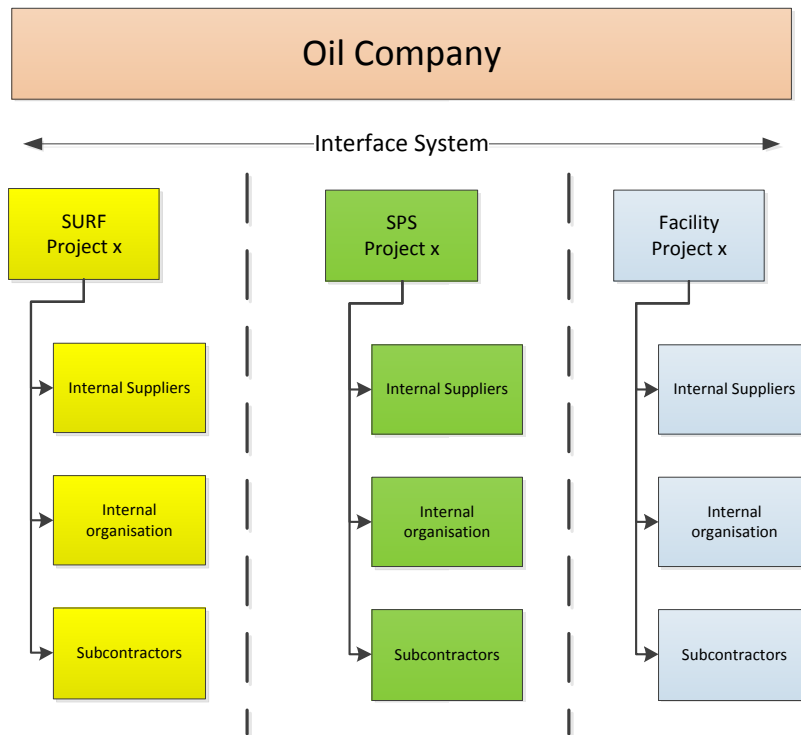
As can be seen from Table 9 and Table 10 Subsea 7 have to collaborate with both SPS and Oil companies in a more integrated way with the alliances. In addition to the oil companies Subsea 7 have the Subsea Integration Alliance with One subsea. Both Subsea 7 and Technip-FMC have ongoing development projects with Aker Solutions as SPS provider while Technip-FMC and Subsea 7 is locked into the Spirit Alliance. The contractors are collaborating while at the same time being fierce competitors.



**Figure 46 : Subsea 7 Norway collaboration partners**

The traditional setup between the projects for EPCI projects have been “SILO” organization between the different contractors working for the oil company illustrated in Figure 46.

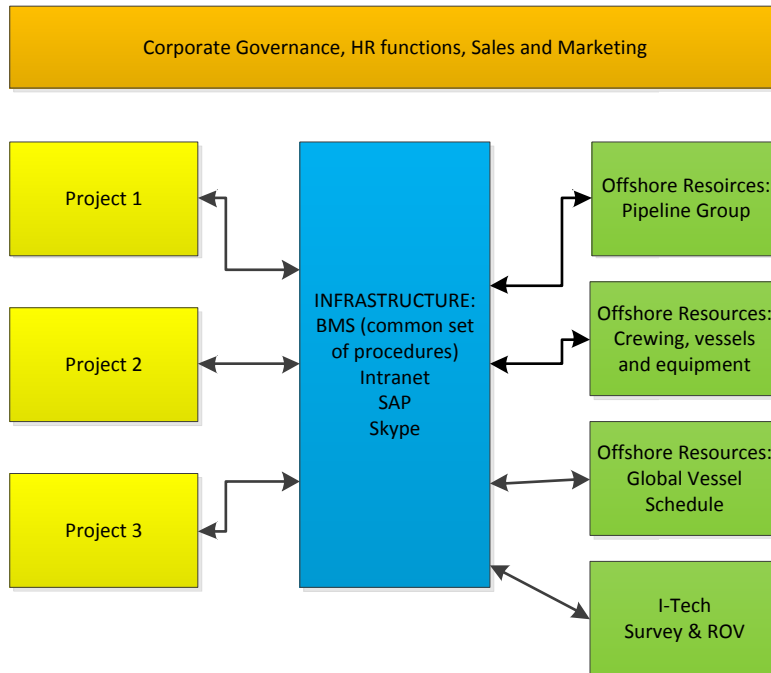
Communication through company provided interface systems has been the main information exchange between the parties to coordinate the development.



**Figure 47 : Separate contract EPCI Collaboration model**

One could argue that the major SURF and SPS contractors are consisting of a number of self-organizing business units (BU's) that are more or less operating autonomously. They deliver services to the projects and are specialized on the deliverable. Utilizing the novel actor-oriented model proposed for organization one could describe the projects as actors, the infrastructure as the intranet, common IT platforms and BMS while the commons are the various specialized business units such as i-Tech and offshore resources that are self-organizing (FJELDSTAD et al., 2012):



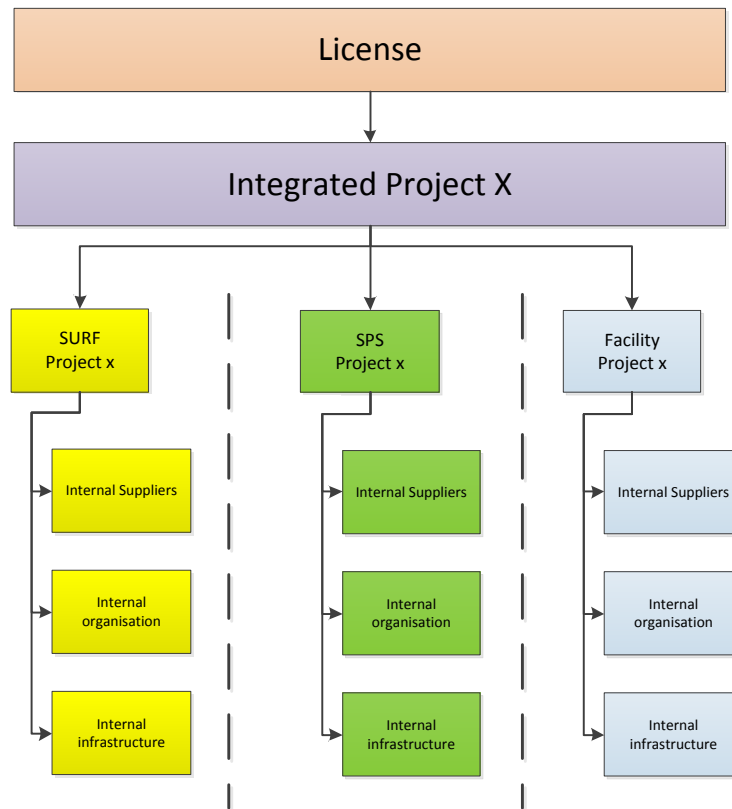


**Figure 48: Subsea 7 described through actor-oriented design**

Utilizing this actor model one could look at the alliance projects where Subsea 7 is involved where integrated projects are the actors.

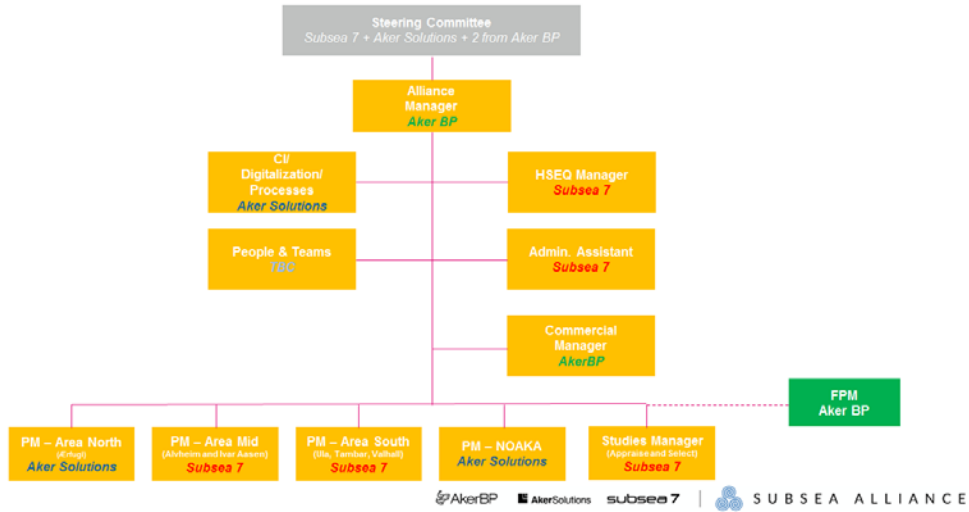
The added cost of running the alliances can increase due to the fact that there is no common infrastructure and that the individual contractors have their own set of infrastructure that is required to be able to operate.

What could happen is that the 3<sup>rd</sup> party interface system is replaced by an integrated project team. The project is run similar to the stand alone projects and the integrated team has replaced some of the oil company's governance project team as illustrated in Figure 48. This is how some of the alliances are organized where each organization has all the functions of the project team. This is a result of the organisations not being able to efficiently cooperate due to each contractor is set up with their own set of common operating procedures, planning tools, cost control tools, resource tools, intranet communication tools.



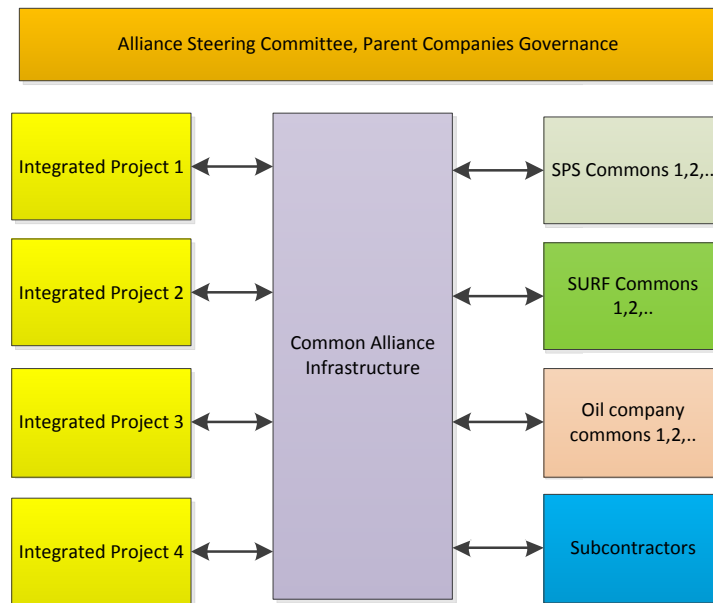
**Figure 49 : Hierarchical integrated projects**

For the AkerBP Subsea alliance an integrated organization has been created where each project has a mixture of personnel from the different organizations following the “best man for the job” principle. This is illustrated in the overall organization chart of the subsea alliance in Figure 49.



**Figure 50 : AkerBP Subsea alliance organization (Alliance, 2018)**

For the Subsea Alliance to operated efficiently with the least amount of double bureaucracy one could envisage an actor-oriented common alliance infrastructure where all the different commons from the contractors were able to coordinate with the integrated project teams. In addition to this the subcontractors to the various integrated project teams would use the infrastructure.



**Figure 51: Actor-oriented organization for alliance projects**

This implies that the common tools of communication will need to be standardized across companies going forward. Programs such as Office 365 and cloud tools will become the standard way of collaborating. Company specific software that is not transferrable to cloud stands the chance of being replaced with software that is available on cloud platforms. However as the scheme allows the commons being self-organizing it is the protocols of information exchange that needs to be standardized. I.e. a software tool such as planning in Subsea 7 will be able to speak with a planning tool in the integrated project.

Moving ahead the number of constellations will potentially bring a future where the contractors become more and more similar in the way they collaborate as lessons learned are applied across the projects and more collaborative software tools are available with cloud functions. The additional cost of setting up these teams due to organisational friction within each organisation needs to be reduced if these constellations are to be competitive vs standalone companies like FMC-Technip which has merged both SPS and SURF under one organisation.

## **6 Conclusion and proposal for future work**

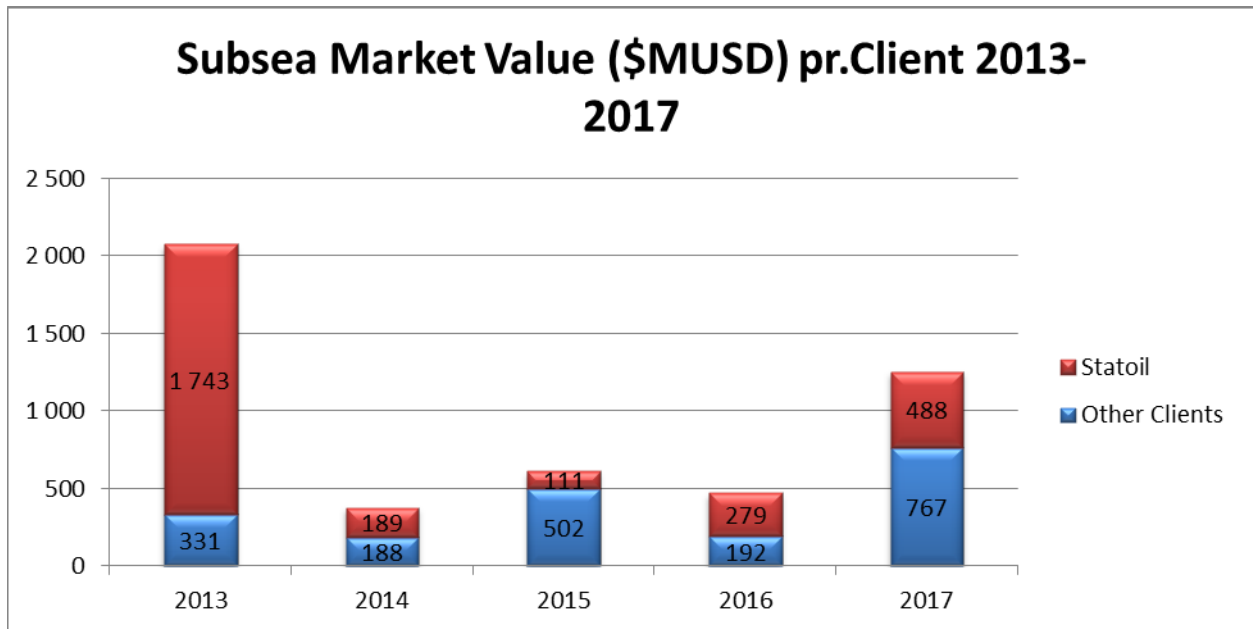
From the onset of the study there were some research questions asked related to the influx of the new oil companies. These have been answered to as far as practically possible by the results of the study.

There is no doubt that the new oil companies have changed the market bringing the SPS and SURF contractors into the development solution at a much earlier stage than what has been the historical model on the Norwegian Continental Shelf. One could call it a paradigm shift on the Norwegian Sector. The sector is starting to resemble the UK sector where an array of smaller operators is developing subsea fields. The alliance model was a well-established model on the UK sector prior to making its entrance on the Norwegian sector.

The oil companies have also moved into a much more collaborative style of running their field developments with design competitions and alliance models. Statoil on the other hand have so many projects that they are staying on the path of managing the field developments with multiple contracts and splitting out work to maximize their buying power. As such the subsea field

development marked has split in two segments; the Statoil and non-Statoil segment. Looking at Figure 51: Estimated revenue in the Subsea Market by Subsea 7 tendering department one can see that the revenue from the Non-Statoil operators surpassed Statoil in 2017. In 2015 the graph lies since the main contributor to the non-Statoil revenue was the Martin Linge field developed by Total which is a major international oil company. The revenue from the developments initiated in 2017 will mostly come in 2018-2020.

Both AkerSolutions and Subsea 7 have failed in bringing in their international alliance partner on the Norwegian Continental Shelf for the developments that have been reviewed. The constellations are driven by the oil companies and are more reflecting the facts of the local Norwegian market and not the international market.



**Figure 52: Estimated revenue in the Subsea Market by Subsea 7 tendering department**

Proposal for future work:

- Study the way the different oil companies and contractors collaborate using cloud software and research the potential savings of simplifying the internal contractor

processes into collaborative cloud processes. Is there a saving in moving into an actor-oriented project organisation model?

- Study Subsea 7s transformation into a value shop over the next years to see whether it is sustainable and gains acknowledgement for its problem solving field development solutions.
- Further review the changing market and alliances. How are international mergers and acquisitions influencing the cooperation on the Norwegian Continental Shelf?
- Is Statoil able to maintain its strategy of splitting contracts into pieces while the major suppliers are merging to provide full field solutions?
- A comparative case study between alliance and design competition strategy projects that have completed based on a selected array of key performance indicators. Is there any opportunistic behaviour or are the alliances even more efficient than the market driven design competitions?

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