Collaboration and competition:

How contract policies is shaping technology in offshore markets

Helge Ryggvik Rio de Janeiro November 2019

Innovation in the offshore petroleum sector takes place in a complex interplay between oil companies, an increasingly more integrated group of global dominant top suppliers, and a large, both local and international group of smaller sub-suppliers.

In the GLOBOIL-project **we study how Norwegian upstream oil and gas (OG) suppliers are adapting their production strategy, supply chain architecture and innovative capabilities to the demands of recent developments in global manufacturing**.

Understanding the dynamics and logics of the oil industry's global supply chain is critical in an oil producing nations abilities to facilitate the optimal utilisation of the country's own petroleum resources, as well as maintain its position as a large exporter of offshore-related technology.

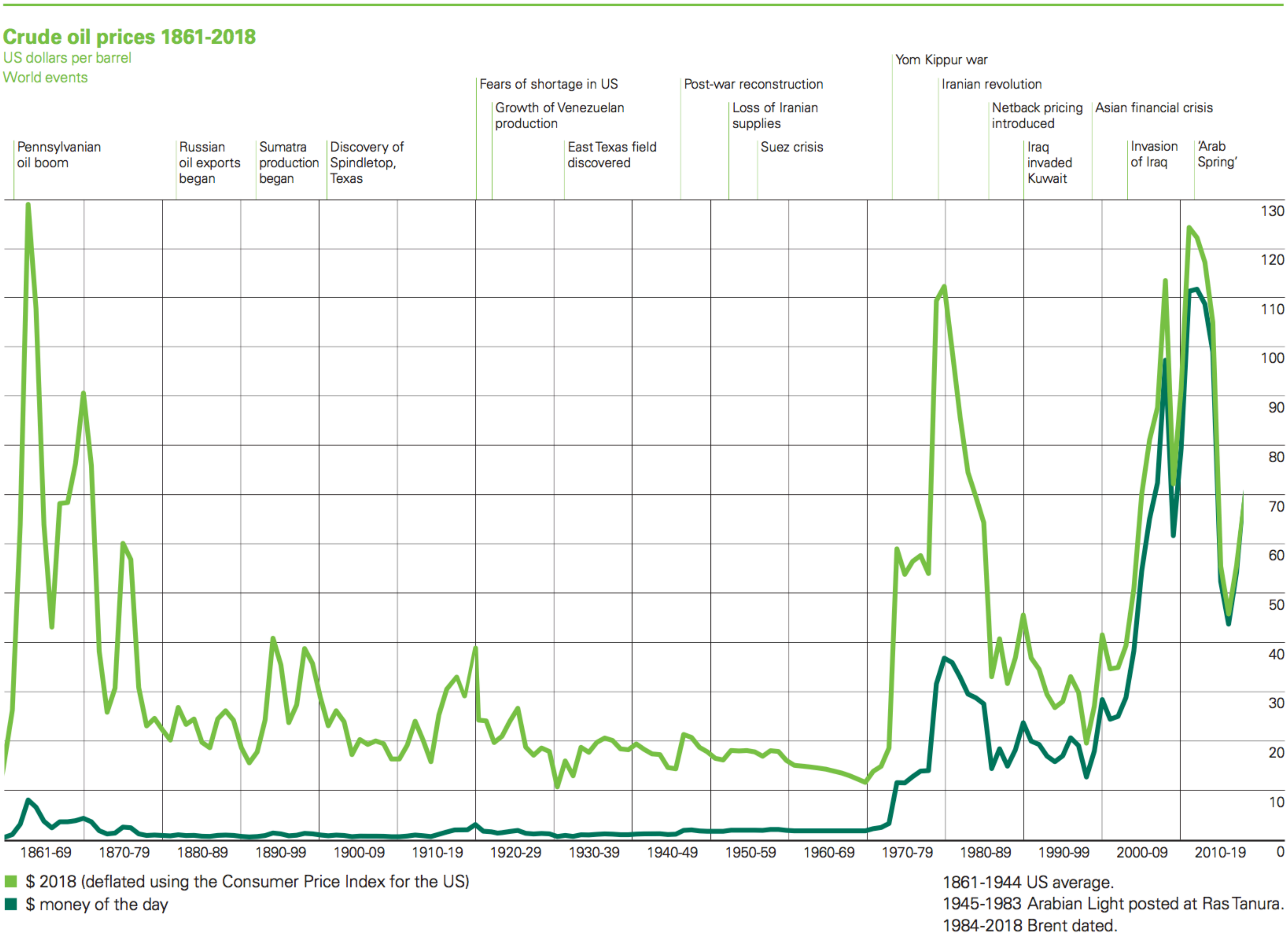
We will seek to answer key questions by combining:

1) case studies of selected key supply firms operating from Norway on the Global oil scene.

2) case studies of recent field development projects in Norway, Brazil and U.S. GoM.;

3) a comparison of key policies on how to promote the OG industry in the three countries.

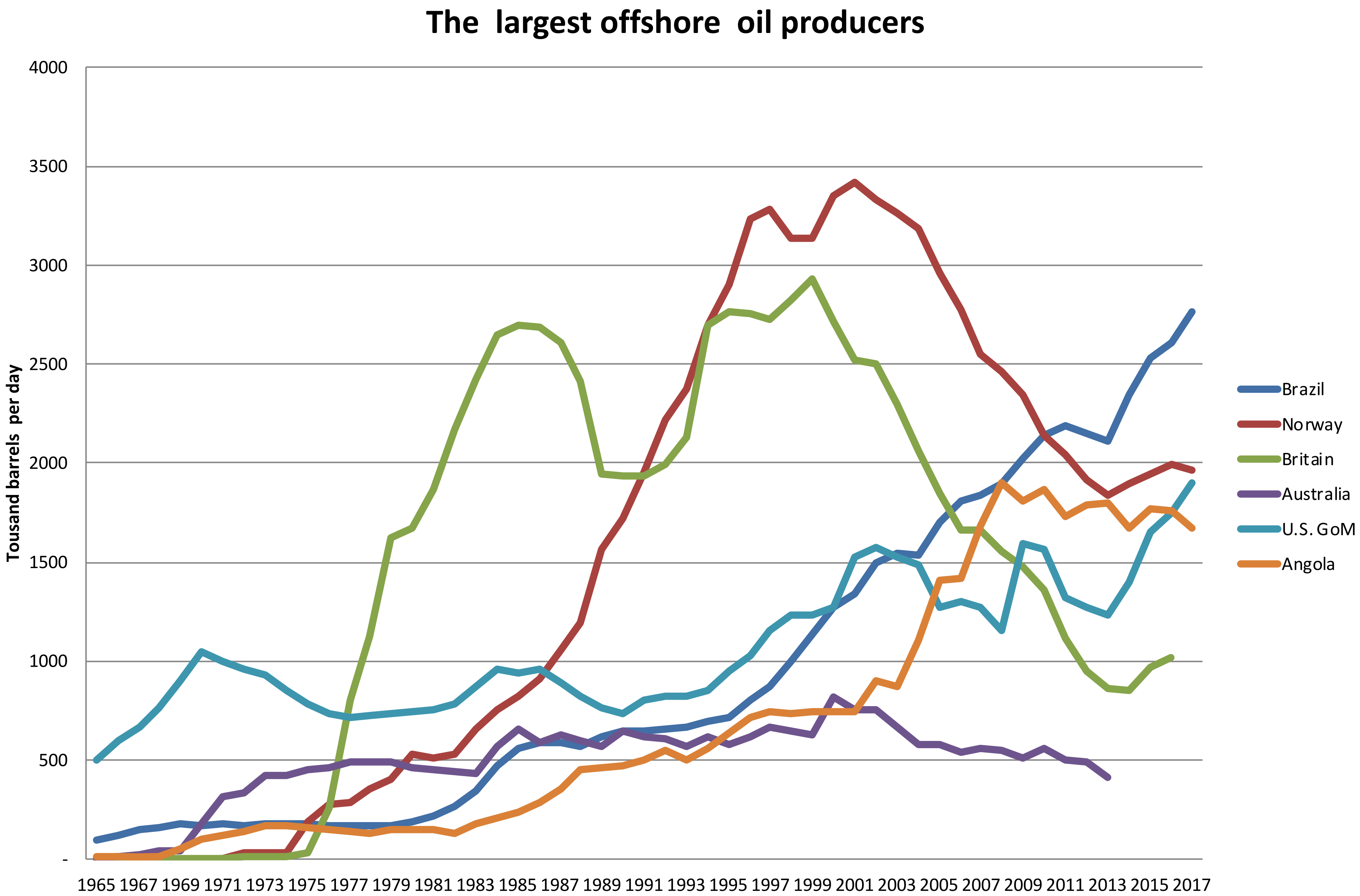
4) a survey on how Norwegian firms operate in foreign markets, with a special focus on Brazil and U.S. Gulf of Mexico (GoM);



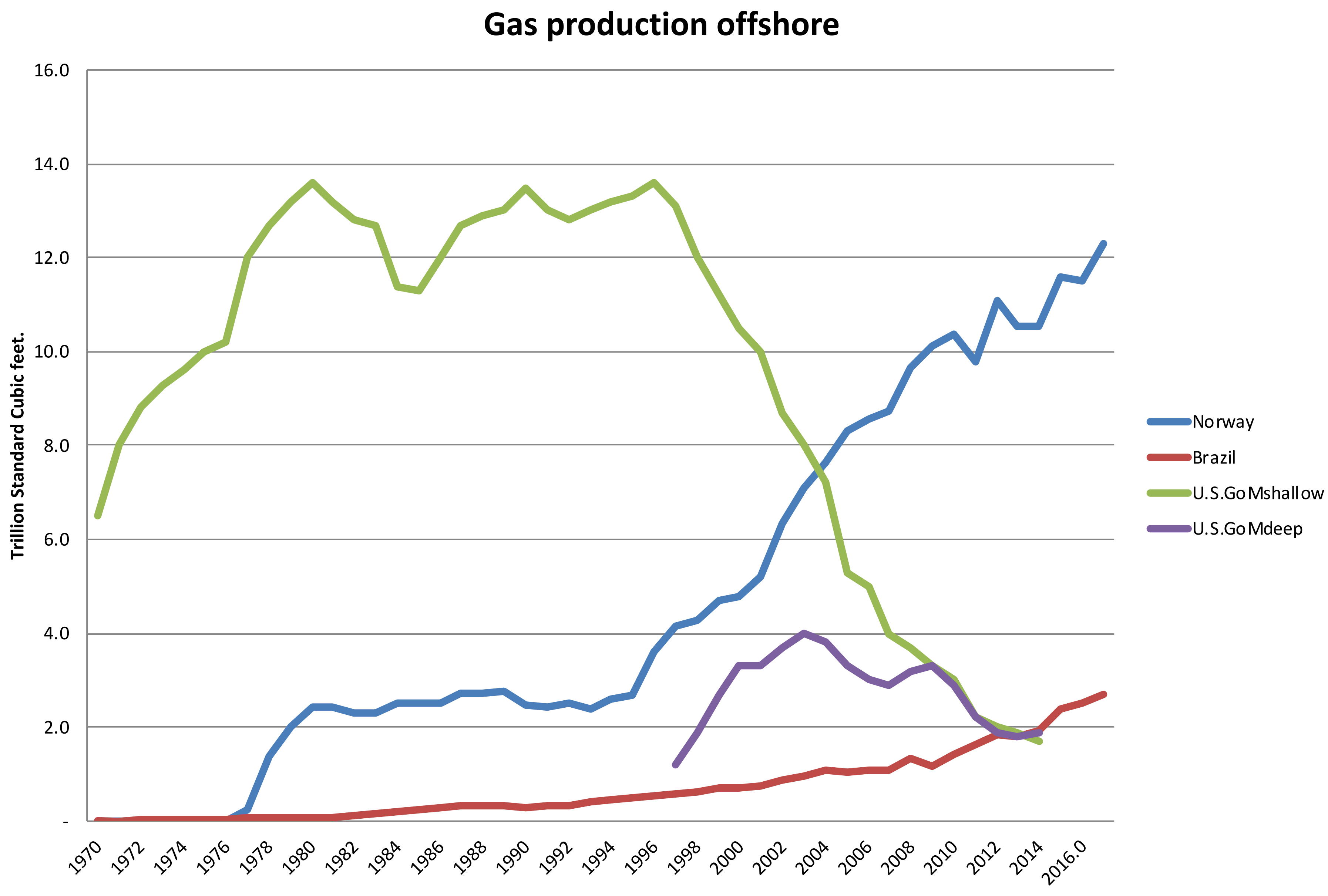
Crude oil prices 1861-2018
US dollars per barrel
World events
Pennsylvanian oil boom
Russian oil exports began
Sumatra production began
Discovery of Spindletop, Texas
Fears of shortage in US
Growth of Venezuelan production
East Texas field discovered
Post-war reconstruction
Loss of Iranian supplies
Suez crisis
Yom Kippur war
Iranian revolution
Netback pricing introduced
Iraq invaded Kuwait
Asian financial crisis
Invasion of Iraq
'Arab Spring'
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1861-69
1870-79
1880-89
1890-99
1900-09
1910-19
1920-29
1930-39
1940-49
1950-59
1960-69
1970-79
1980-89
1990-99
2000-09
2010-19
$ 2018 (deflated using the Consumer Price Index for the US)
$ money of the day
1861-1944 US average.
1945-1983 Arabian Light posted at Ras Tanura.
1984-2018 Brent dated.

Oil price:

Between 2011 and summer 2014: +/-	110 dollars
January 2015:	50 dollars
January 2016:	29 dollars
From 2018: ,	60 dollars +



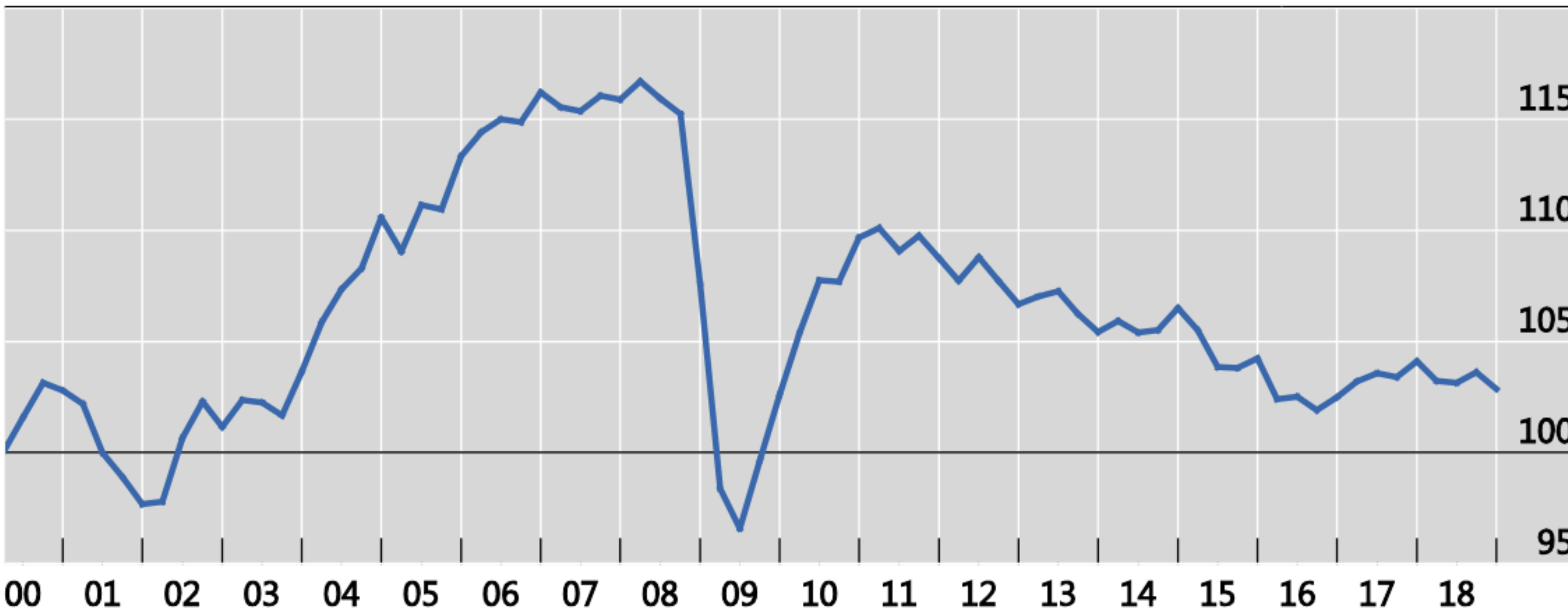
The largest offshore oil producers
4000
3500
3000
2500
2000
1500
1000
500
-
Tousand barrels per day
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Brazil
Norway
Britain
Australia
U.S. GoM
Angola



Gas production offshore
Trillion Standard Cubic feet.
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
-
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016.0
Norway
Brazil
U.S.GoMshallow
U.S.GoMdeep

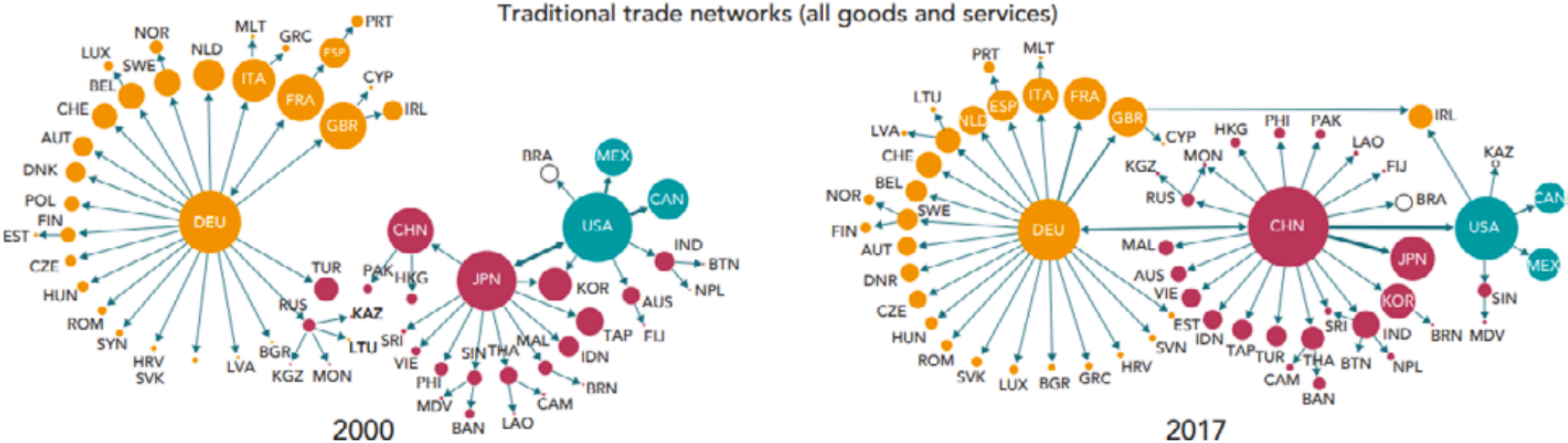
Ratio of world goods exports to world GDP

In constant prices, Q1 2000 = 100 Graph 4



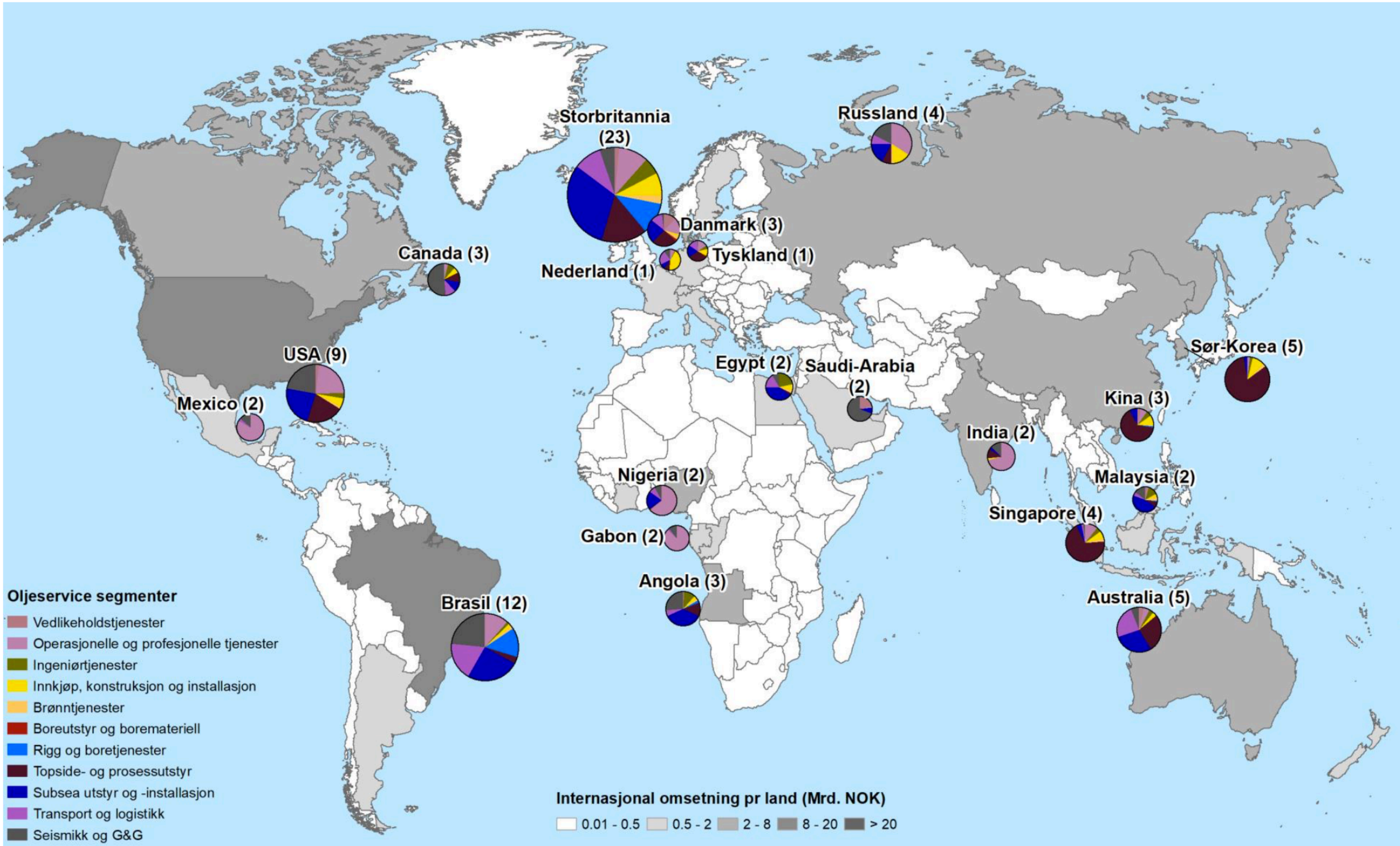
Sources: IMF, *World Economic Outlook*; World Trade Organization; Datastream; national data; BIS calculations.

Network structure of global value chains in 2000 and 2017 Graph 3



Source: X Li, B Meng and Z Wang, "Recent patterns of global production and GVC participation", in D Dollar (ed), *Global Value Chain Development Report 2019*, World Trade Organization et al (see footnote 3 for full reference).

Norske leverandører har betydelig aktivitet i alle viktige offshore-regioner



Kilde: Rystad Energy

Theory and background

Classics on theory of the firm: Coase 1937, Penrose 1962, Chandler 1962, 1977 and 1990, Williamson 1975. Horizontal/vertical integration, differentiation, transaction economics etc.

The firm and the globalization process: Porter 1985 and 1990. Reich 1990, Omahe 1990, Dunning 1993, J. Jones etc. Skills and competence, not ownership the central theme. Massive growth in FDI. The globalized product, the nationless firm, etc.

The counter tendencies from 2000: Keynesian criticism attacked the neoliberal framework of institutions promoting free trade and capital movements, such as the IMF and the Word Bank (Stigliz 2003, Skidelsky 2009 and many more).

From 2016, populist political right has garnered support by opposing globalization, with a particular focus on immigration.

Recent development

However, the kind of extreme globalization announced in the early 1990s did not materialize, despite trade and FDI being larger in a historical perspective.

Since 2010 most types of international trade have either been stagnant or falling (UNCTAD 2013 Evenet & Riz 2015 Taglioni & Winkler 2016. Livesey 2017). The same has been the case with FDI.

Measured in percentage of total global GDP, FDI is lower than in the late 1990s. Further, the share of export in in cross-border supply chains has been stagnant since the 2008 financial crisis.

Finally, in recent years, return on equity has been smaller for MNC than for domestic firms (Economist 2017).

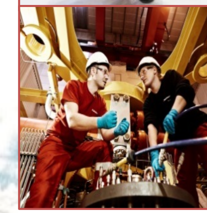
International law on borders (Genève convention etc.)
Jurisdiction (Country, region, landowner)
Balance State and Market
Political decisions on access.
Concessionary system
Tax laws, royalties and fees
Regulation of competition (local laws, international law, International trade regimes, EU regulations
Technical standards
Safety regulations
Labour regulations,
Environmental regulations
Regulation of marine life,
Corporate governance
Climate regulations?
Internal company regulations/auditing

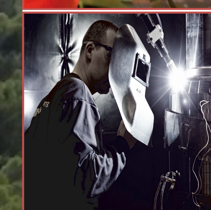

TRANS
3071-4747


2016
CALANDRAPAR


MONITORAMENTO
TRINITY
3045-7765
LOCAL PROTEGIDO

Aker Solutions | Tranby





December 19, 2019

The downturn
In the downturns in from 2015, as always following long periods of falling and relatively low oil prices, the Norwegian offshore oil industry had to struggle to reduce cost.

Apart from the large Johan Sverdrup find (1,9 billion barrels), several proven oil & gas fields were not profitable with the cost structure developed during the boom-years.

In the crises first phase, oil companies as operators could capitalize on the fact that all major offshore supply firms had spare capacity. Oil companies were in a good position to negotiate contract based on much lower cost.

The top tire suppliers in all segments (top side construction, drilling, subsea structures and services, well service, etc) could in a similar way load some of their cost reduction on to a large number of smaller sub-suppliers.

However, from the very start of the downturn, there was a general understanding that major structural changes in the industry were going on.

New trends

First, (with some notable exceptions) it seemed clear that period of easily accessible oil & gas was over.

Second, a large part of the increased supply that trigged the fall in price was related to the major growth in both shale oil and shale gas in onshore in U.S. Shale oil & gas were influenced by oil prices too, but proved to survive in a much lower price segment than were generally expected.

Moreover, with a much lower lead time from investment to production, shale oil & gas had a strong advantage compared to the offshore sector, where the time from an initial find till oil and gas came on stream, could be up till 10 years.

A strong indication of the new situation on the Norwegian continental shelf was the fact that almost all major oil companies withdrew from new concession rounds and sold off their existing asset in Norway.

Technology I

Of course, In Norway, as in other offshore oil plays, the crises created strong incentives for radical cost saving technologies.

With automated and remote controlled subsea-system, flexible risers, horizontal drilling, 3 d and 4 d seismic, two phase streamed pipes and several new form of floating production units, the industry had been through radical innovations in the 1990s and in to the 2000s.

The industry could now operate in extreme deep waters, a change that radically enlarged the industries scope (Deep-sea Campus, pre-salt Santos, deep-sea U.S and Mexican gulf of Mexico, Nigeria, Angola).

With “tie inn solutions” smaller fields far away could be connected to existing installations.

Technology II

This time around the industry struggled to make these system more effective, containing **less weight**, more **effective connections** etc.

As in other industries oil companies wanted to make effective use of new development **in IT-sector** like big data, digital twins etc.

Particular for Norway, and partly based on government incentives, there was on-going initiatives to **reduce CO2 emission** in the production phase by getting cleaner power sources and **electrifying** most part of machinery on installations.

However, the industry's **main effort to reduce cost were focused on contractual relations,** the way relations between operators and major EPC providers where organized. Based on several cost overruns in relation to large field development projects during the peak years, there was now a particular strong focus on getting it right in so-called Front-End Engineering Design (FEED) phase.

At the same time, and partly related the same focus on project management, several new oil companies established tight **collaborative alliances** with large EPC firms.

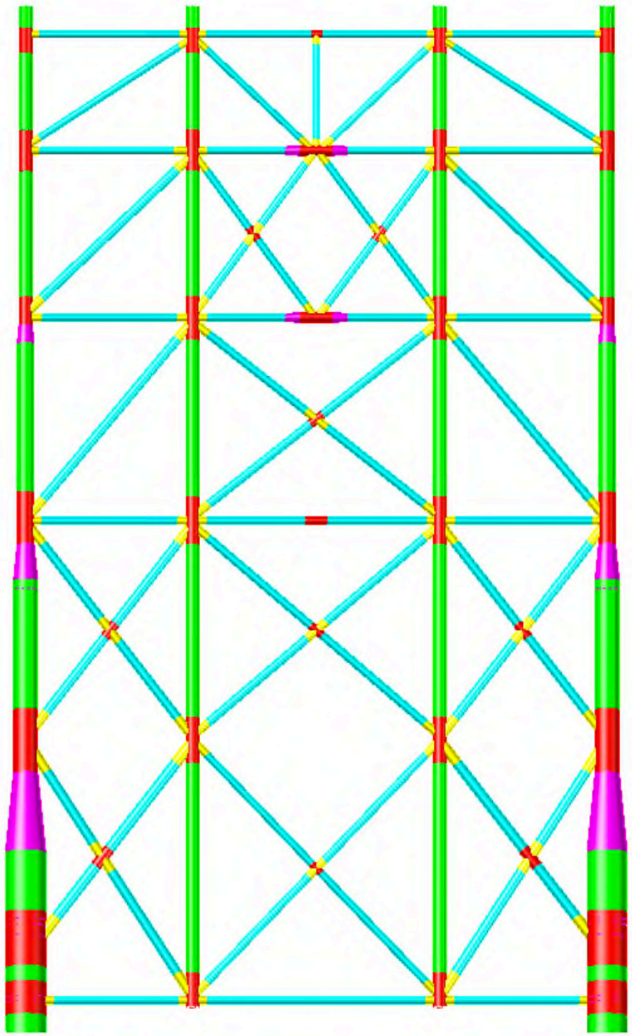

NOV
Seabox ™

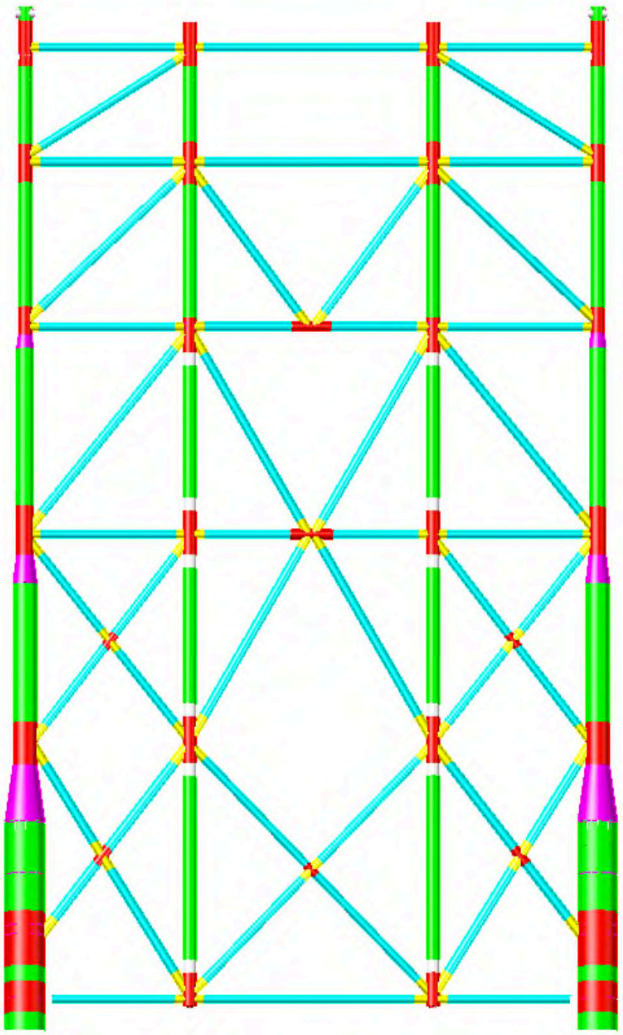
POST_FEED
On 05.06.2015

Fjerning av mer enn 50 bracer

Model from Current
EPC On 17.03.2017

Row A





KVÆRNER

Dokument 3-serien

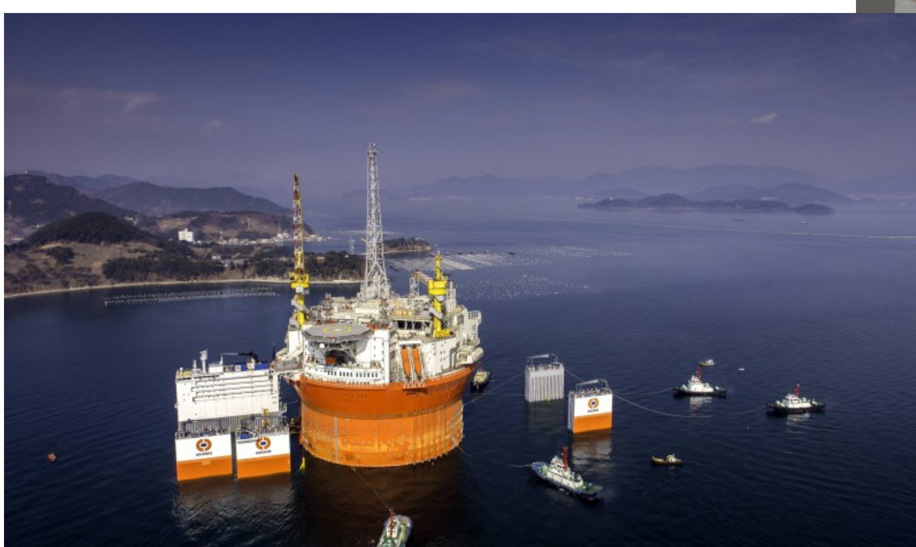
Riksrevisjonen

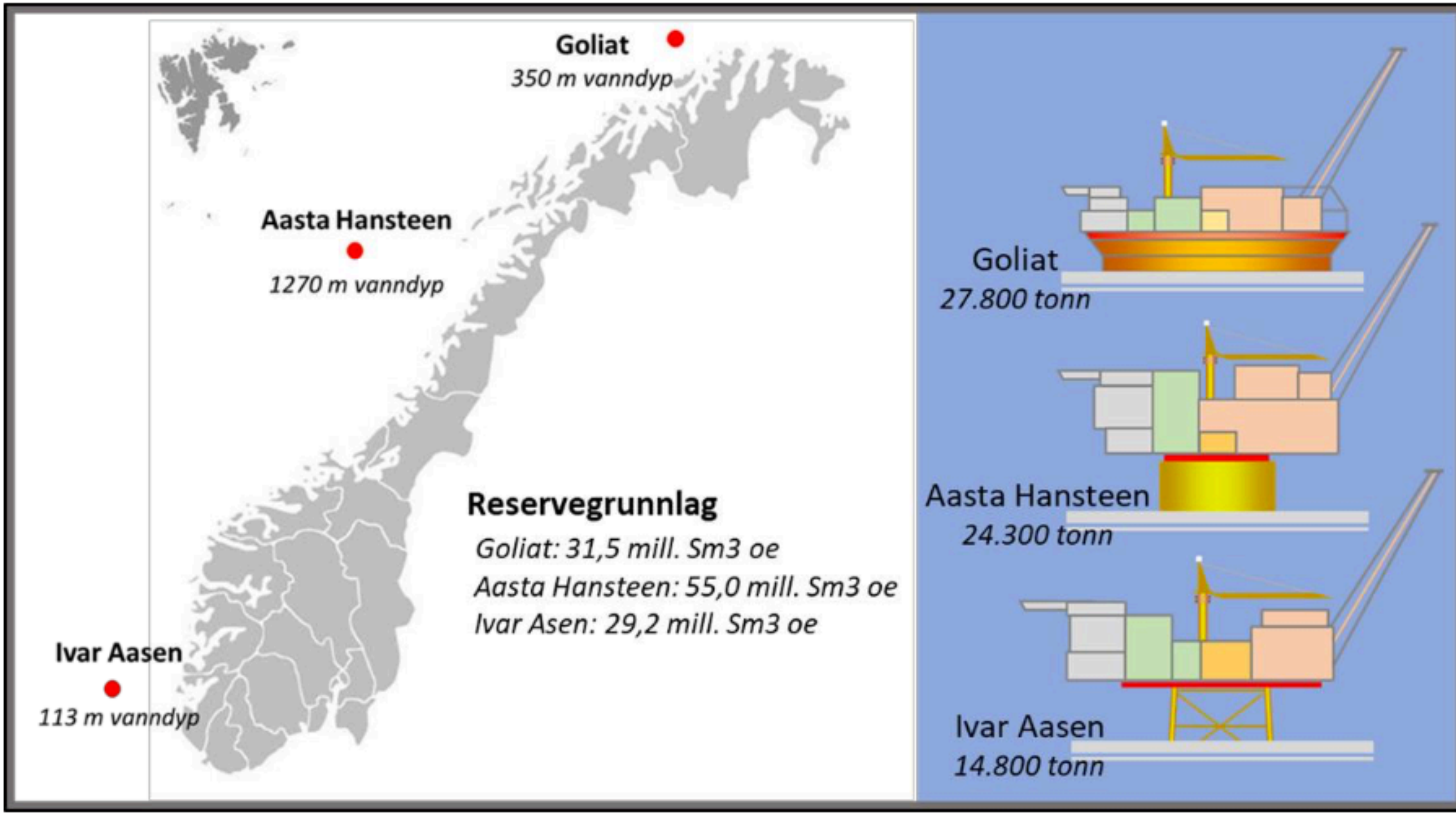
HOVEDRAPPORT

Utredning av feltutbyggings-prosjekter på norsk sokkel

Riksrevisjonens undersøkelse av Petroleumstilsynets oppfølging av helse, miljø og sikkerhet i petroleumsvirksomheten

Dokument 3:6 (2018–2019)

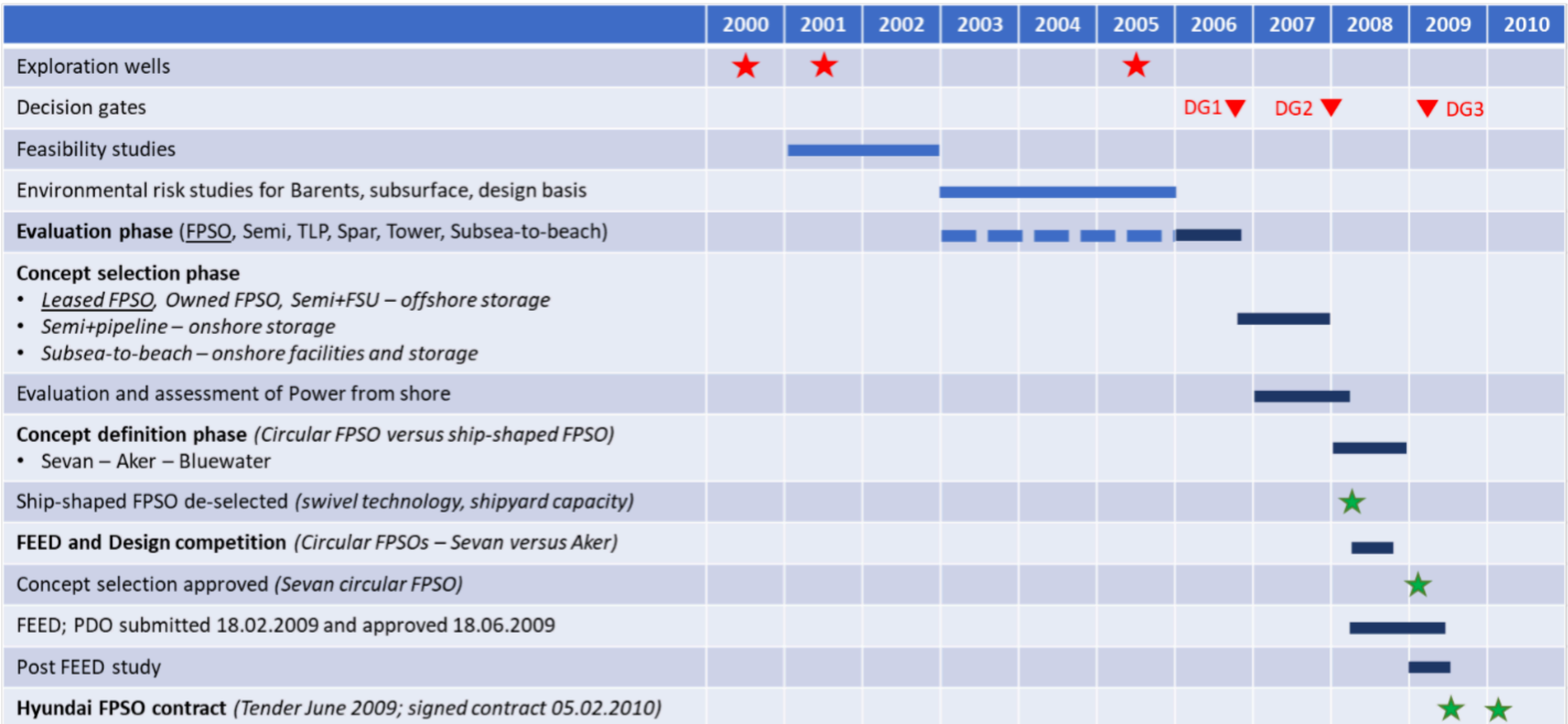




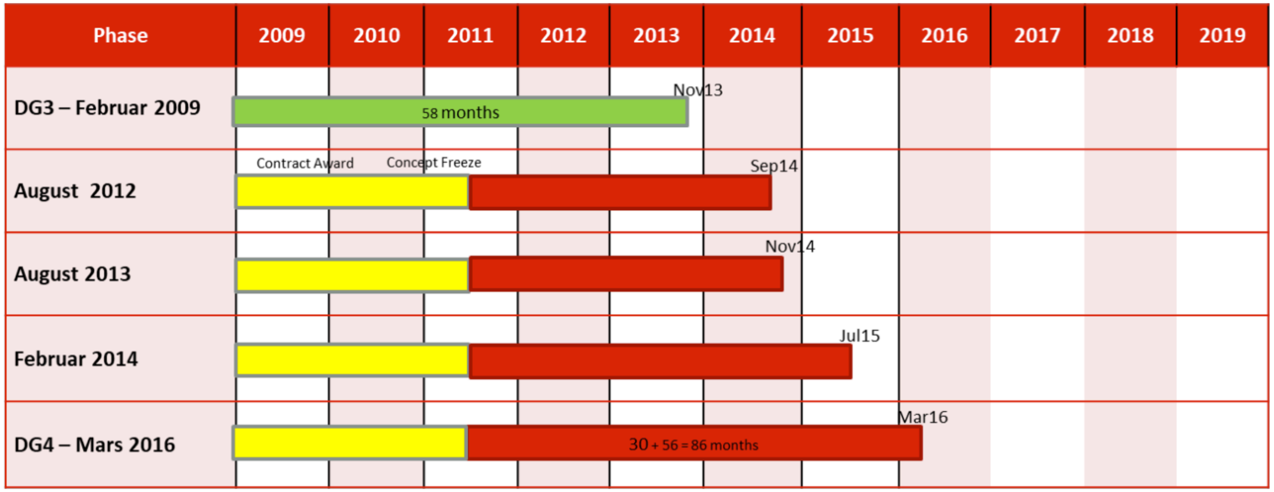
Figur 2-1. Beliggenhet av de tre utvalgte prosjektene (Kilde: Acona)

3.1.3 *Utvikling av planer og kostnader gjennom prosjektets levetid*

De viktigste milepelene for totalprosjektet er listet i Figur 3-7 og Figur 3-8.

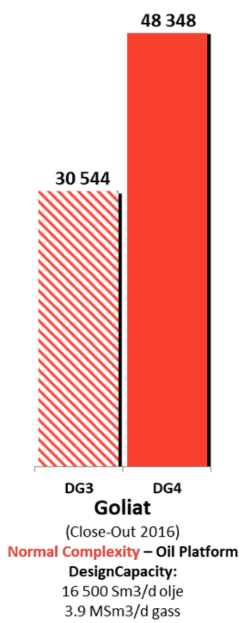


Figur 3-7. Tidsplan for tidligfasen (Kilde: Acona)



Figur 3-8. Gjennomføring – planutvikling (Kilde: Acona)

Figur 3-9 gir en oversikt over de viktigste kostnadselementene ved DG3 og DG4. Figur 3-10 viser en grafisk framstilling over endringene for hvert hovedelement i estimatet over tid.



GOLIAT

MNOK

MNOK	DG3	DG4	DIFF
Management	3 945	6 694	
FPSO	12 118	-	
Topside	-	14 523	
Living Quarter	-	-	
Completion	-	2 566	
Substructure	-	902	
Mooring,Offloading & Inst.	-	1 342	
Risers & Flowlines	2 406	2 987	
Heavy Lift and Transport.	-	-	
Extend./Remaining Scope	-	868	
Contingency	-	-	
Facilities – Platform	**18 469**	**29 882**	**+ 61%**
Facilities – Subsea & Pip.	2 818	2 996	
Drilling & Well	**8 186**	**10 479**	
Power Supply incl. Infra.	897	1 278	
Host	-		
PMT/Petek	-		
Preparation for Operation	174	207	
Insurance	-	553	
Adjust. (Currency impact)	-	2 953	
Phase 1	30 544	48 348	
Phase 2			
Total (Project Close-Out)	**30 544**	**48 348**	**Close-Out16**
Total – RNB 2019	32 600	50 800	MNOK'16

DG3 - Total Topside Dry weight 18 202 tonnes

DG4 - Total Topside Dry weight 27 752 tonnes

Figur 3-9. CAPEX – kostnadsutvikling (Kilde: Acona)

The alliance turn

April 2019: Neptune Energy-TechnipFMC alliance:

“The agreement covers the full project lifecycle from early concept work, through engineering, procurement, delivery of subsea production systems and installation of subsea equipment and infrastructure, and continues into life of field support. (iEPCI)”

Lundin: TecnipFMC

Aker BP: Subsea: Aker Solutions and Subsea 7. Topside: Kværner, Aker Solution, Simens, ABB, Herema

Spirit: Subsea 7, FMC, DnV, Aibel.

“The industry has standardized, simplified and reduced the size of equipment in recent years, but a further step-change is needed to drive a sustainable future for the subsea industry and the world it serves.”

The integration of FEED

Typical for all these firm a strong has been a strong focus on developing capacity to take part in the collaborative arena in the very first phase of new project, from so-called feasibility studies, concept studies to front end engineering (FEED).

The term FEED is often used as a general term for all these phases.

By taking on work that before either have been done in-house, inside oil companies or by specialized, “independent” engineering houses (Wood Mustang, Doris, Reinertsen etc.), the EPC contractors argue, that they partly can reduce by transaction cost and even more important can radical reduce lead time.

“With Aker Solutions’ intelligent subsea approach, the time it takes to generate optimal subsea field layouts can be cut by 75 per cent and the cost of field development capex can be halved. Accelerated field development is achieved by combining Aker Solutions’ modular, optimized and configurable subsea equipment with automated design which can reduce engineering hours by up to 70 per cent.”


SEA TROLL
CLYDE

SEMI FPSs / FPUs

DESIGNERS

- **Aker Solutions** Norway
- **Bennett Offshore** (9) Houston & New Orleans
- **Doris Engineering** Paris & Houston
- **Exmar Offshore** Houston, Texas
- **Friede & Goldman, Ltd.** Houston, Texas
- **FloaTEC** Houston, Texas
- **GustoMSC** Schiedam, The Netherlands
- **GVA** Goteborg, Sweden
- **Kvaerner** Oslo, Norway
- **MODEC** Houston, Texas
- **SBM Offshore** Houston, Texas
- **Technip** Houston, Texas
- **WorleyParsons** Houston, Texas

TOPSIDES ENGINEERING

- **Aker Solutions** Norway
- **Audubon Engineering Solutions** Houston, Texas
- **Doris Engineering** Paris & Houston
- **KBR** Houston, Texas
- **Kvaerner** Oslo, Norway
- **Technip** Houston, Texas
- **Wood Group Mustang** Houston, Texas
- **WorleyParsons** Houston, Texas

FABRICATORS Hull

- **BraFELS** (5) Brazil
- **COSCO Shipyard Group** Dalian Shipyard, Qidong Shipyard
- **Daewoo Shipbuilding & Marine Engineering (DSME)** Geoje Island, South Korea
- **Hyundai Heavy Industries (HHI)** Ulsan, South Korea
- **Kvaerner Stord AS** Stord, Norway
- **Samsung Heavy Industries (SHI)** Geoje Shipyard, South Korea
- **Sembcorp** Singapore

FABRICATORS Topsides

- **BraFELS** (5) Brazil
- **DYNA-MAC** Singapore
- **Daewoo Shipbuilding & Marine Engineering (DSME)** Geoje Island, South Korea
- **Gulf Island Fabricators** Houma, LA
- **Gulf Marine Fabricators** Ingleside, Texas
- **Hyundai Heavy Industries (HHI)** Ulsan, South Korea
- **Kiewit** Ingelside, Texas
- **Kvaerner Stord AS** Stord, Norway; **Kvaerner Verdal AS** Verdal, Norway
- **McDermott** Morgan City, LA; Tampico; Batam, Indonesia; Jebel Ali, UAE
- **Samsung Heavy Industries (SHI)** Geoje Shipyard, South Korea

FPSOs

PROJECT MGMT & ENGINEERING

- **Aker Solutions** – Norway
- **Bluewater Offshore** – Hoofddorp, Netherlands
- **BW Offshore** – Oslo & Arendal, Norway
- **Doris Engineering** – Paris & Houston
- **Deltamarin, Ltd** – Turku, Finland
- **Friede & Goldman, Ltd.** – Houston, Texas
- **KBR** – Houston, Texas
- **MODEC** – Houston, Texas
- **SBM Offshore** – Houston, Texas
- **SEVAN MARINE ASA** – Arendal, Norway
- **Sembmarine SSP Inc. (6)** – Houston, Texas
- **Technip** – Houston, Texas
- **TeeKay** – Oslo, Norway
- **Wood Group Mustang** – Houston, Texas
- **WorleyParsons** – Houston, Texas

CONVERSION SHIPYARDS

- **BraFELS (5)** – Brazil
- **Chengxi Shipard (Xinrong) Co., Ltd** – Jingjiang City, China
- **COSCO Shipyard Group** – Dalian Shipyard, Qidong Shipyard
- **Drydocks World** – Dubai, UAE
- **Inhauma Shipyard** – Brazil
- **Jurong Aracruz Shipyard (6)** – Vitoria, Brazil
- **Jurong Shipyard (6)** – Singapore
- **Keppel FELS** – Singapore
- **Malaysia Marine & Heavy Engineering (MMHE)** – Pasir Gudong, Malaysia
- **ONG's Hadrian Shipyard** – Wallsend, UK
- **PT Karimun Sembawang Shipyard** – Karimun Island, Indonesia
- **Sembawang Shipyard (6)** – Singapore

NEW BUILD SHIPYARDS - Hulls

- **Atlantico Sul Shipyard** – Brazil
- **BraFELS (5)** – Brazil
- **COSCO Shipyard Group** – Dalian Shipyard, Qidong Shipyard
- **Daewoo Shipbuilding & Marine Engineering (DSME)** – Geoje Island, South Korea
- **Dalian Shipbuilding Industry Offshore Co., Ltd. (DSIC)** – Dalian, China
- **EBR Shipyard** – Brazil
- **Hyundai Heavy Industries (HHI)** – Ulsan, South Korea
- **Jiangnan Shipyard** – Shanghai, China
- **Keppel FELS** – Singapore
- **L & T Ship Building Ltd** – Kattupalli Shipyard, India
- **Mitsui Engineering & Shipbuilding Co., Ltd.** – Chiba Works, Japan; Tamano Works, Japan
- **Qingdao Beihai** – China
- **Rio Grande 1 Shipyard** – Brazil
- **Samsung Heavy Industries (SHI) Geoje Shipyard,** – South Korea
- **Shanghai Waigaigiao Shipbuilding Co., Ltd. (7)** – China
- **Yantai-Raes** – Singapore

TOPSIDES Fabricators/Integrators

- **Atlantico Sul Shipyard** – Brazil
- **BraFELS (5)** – Brazil
- **Brasa Shipyard** – Brazil
- **DYNA-MAC** – Singapore
- **Daewoo Shipbuilding & Marine Engineering (DSME)** – Geoje Island, South Korea
- **Estaleiros do Brasil Ltda (EBR)** – Sao Jose do Norte,Brazil
- **Jurong Aracruz** – Brazil
- **Kiewit** – Corpus Christi, Texas
- **Maua Shipyard** – Brazil
- **ONG's Hadrian Shipyard** – Wallsend, UK
- **OSX Shipyard** – Brazil
- **PAENAL** – Angola, Africa
- **Profab** – Singapore
- **Rio Grande 1 Shipyard** – Brazil
- **Sembmarine SLP** – Lowestoft, UK
- **SMOE (6)** – Singapore
- **UTC Engenharia** – Brazil

CLASSIFICATION SOCIETIES & CVAs

- **ABS** – *Eagle.org*
- **Bureau Veritas Group** – *bureauveritas.com*
- **ClassNK** – *classNK.com*
- **DNV GL** – *dnvgl.com*
- **Lloyd's Register** – *Lg.org*
- **RS** – *Rs-class.org*

SPARS & SPAR ALTERNATIVES (2)

HULL DESIGNERS

- **Aker Solutions (1)** – Norway
- **Bennett Offshore (9)** – Houston & New Orleans
- **FloaTEC** – Houston, Texas
- **Houston Offshore Engineering (4)** – Houston, Texas
- **Technip** – Houston, Texas

TOPSIDES ENGINEERING

- **Aker Solutions (1)** – Norway
- **Audubon Engineering Solutions** – Houston, Texas
- **KBR** – Houston, Texas
- **McDermott** – Houston, Texas
- **Technip** – Houston, Texas
- **Wood Group Mustang** – Houston, Texas
- **WorleyParsons** – Houston, Texas

FABRICATORS Hull & Final Hull Assembly

- **Daewoo Shipbuilding & Marine Engineering (DSME)** – Geoje Island, South Korea
- **Gulf Marine Fabricators** – Ingleside, Texas
- **Hyundai Heavy Industries (HHI)** – Ulsan, South Korea
- **Kiewit** – Ingelside, Texas
- **Malaysia Marine & Heavy Engineering** – Pasir Gudang, Malaysia
- **McDermott** – Batam Island, Indonesia; Jebel Ali, UAE
- **Samsung Heavy Industries (SHI)** – Geoje Shipyard, South Korea
- **Technip** – Pori, Finland

FABRICATORS Topsides

- **Daewoo Shipbuilding & Marine Engineering (DSME)** – Geoje Island, South Korea
- **Dragados** – Cadiz, Spain
- **Gulf Island Fabricators** – Houma, LA
- **Gulf Marine Fabricators** – Ingleside, Texas
- **Hyundai Heavy Industries (HHI)** – Ulsan, South Korea
- **Kiewit** – Ingelside, Texas
- **Kvaerner Stord AS** – Stord, Norway
- **McDermott** – Morgan City, LA; Tampico; Batam, Indonesia; Jebel Ali, UAE
- **MMHE** – Malaysia
- **Samsung Heavy Industries (SHI)** – Geoje Shipyard, South Korea
- **SMOE** – Singapore

Comparison of Execution Schedules

From start FEED to first oil

2017								2018												2019												2020											
M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

TRADITIONAL EPC CONTRACT STRATEGY (36 months from Start FEED to 1st Oil)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44

FEED (8)	Tender (4)	EPC Contract Execution (20)	Offshore (4)	1st Oil May 2020
Performed by FEED Contractor	Tender FEED Verification Negotiations EPC Contract	Detail Design (E) Procurement (P) Construction (C) Scope of Work: Platform Mechanical Complete (MC) and Ready for Sail	T&I HUC & Commissioning Tie-in	

ALLIANCE EXECUTION SCHEDULE - (29 months from Start FEED to 1st Oil)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44

FEED (7)	MLC Onshore Execution Phase (18)	Offshore (4)	1st Oil Oct 2019
Performed by the Alliance MLC Agreement in parallel Detail Design for LLI Detail Design for early MTOs	Earlier Design Freeze due to Design Work performed in FEED Phase Earlier Fabrication Start (April 2018) - 14 months Fabrication Period Earlier start onshore commissioning (Feb 2019). Reduced work offshore. Less time consuming routines for comments, approvals, correspondence etc	T&I HUC & Comm. Tie-in	NPV value creation

ALLIANCE EXECUTION SCHEDULE - Potential Further Improvement of Schedule (24 months from Start FEED to 1st Oil)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44

FEED (6)	MLC Onshore Execution Phase (14)	Offshore (4)	1st Oil May 2019
Re-use templates Same personnel Lessons Learnt	Start Design in parallel with FEED Improved execution methods (Lessons Learnt) Re-use of facilities, equipment and key personnel Integration of long term suppliers and subcontractors Implementation of "WHP Factory" (portfolio strategy)	More work performed onshore	NPV value creation Effects of industrialization and standardization Learning curves improve efficiency and quality

A few Questions:

Collaboration versus competition

Is the new organizational developments innovations in itself, adaption to new Technological developments?

Or just cyclical responses based on power relations between suppliers and operators?

What does iEPCI mean for innovation? : inside EPC-providers, second tire supply firms, research milieu, start ups.

What is the business strategy of Norwegian suppliers regarding the governance of their production supply-chains?

To what degree and in what way does the participation in technological challenging projects abroad affect the industry's innovative capabilities on projects on the Norwegian continental shelf?

Are there barriers in form of path dependency, technological standards or other forms of institutional and socio-economic structures that prevent or promote certain kind of technology and contractual relations in the supply chain?

In policy terms, is the current Norwegian institutional setting, which previously nurtured the industry, still relevant and effective?

Can the Norwegian example help us understand how states and multinational companies (MNC) play a role in promoting economic development in general and industry upgrading in particular?

How do such choices shape the supply chain architecture and governance at home and abroad?

How do top suppliers and sub-suppliers' internationalization strategies converge?

How different Norwegian top suppliers are from their foreign competitors in organizing their supply chains?

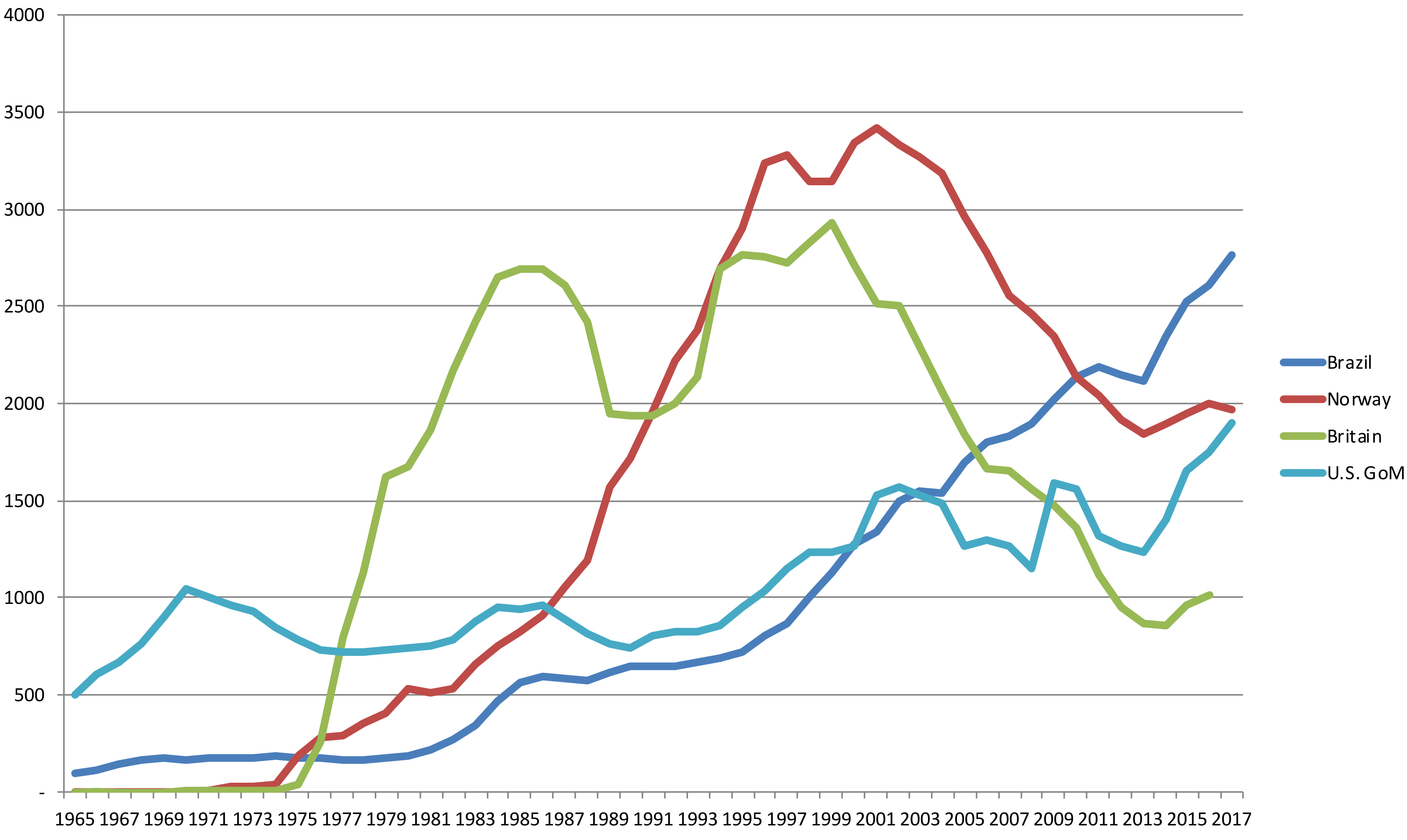
What are the consequences of different supply chain architectures for technological transfer and innovation?

What do the nationality of ownership, and geographical location of headquarters and R& D facilities mean in this new environment?

Are we still moving towards a situation in which MNCs in the oil sector have become neutral technological "upgraders" in all the localities they operate, independent of origin?

Are we experiencing the rise of a new phase of protectionism in which national

Statfjord A



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1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
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U.S. GoM

From start FEED to first oil

2017								2018												2019												2020											
M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

TRADITIONAL EPC CONTRACT STRATEGY (36 months from Start FEED to 1st Oil)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

FEED (8)	Tender (4)	EPC Contract Execution (20)	Offshore (4)	1st Oil May 2020
Performed by FEED Contractor	Tender FEED Verification Negotiations EPC Contract	Detail Design (E) Procurement (P) Construction (C) Scope of Work: Platform Mechanical Complete (MC) and Ready for Sail	T&I HUC & Commissioning Tie-in	

ALLIANCE EXECUTION SCHEDULE - (29 months from Start FEED to 1st Oil)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

FEED (7)	MLC Onshore Execution Phase (18)	Offshore (4)	1st Oil Oct 2019
Performed by the Alliance MLC Agreement in parallel Detail Design for LLI Detail Design for early MTOs	Earlier Design Freeze due to Design Work performed in FEED Phase Earlier Fabrication Start (April 2018) - 14 months Fabrication Period Earlier start onshore commissioning (Feb 2019). Reduced work offshore. Less time consuming routines for comments, approvals, correspondence etc	T&I HUC & Comm. Tie-in	NPV value creation

ALLIANCE EXECUTION SCHEDULE - Potential Further Improvement of Schedule (24 months from Start FEED to 1st Oil)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

FEED (6)	MLC Onshore Execution Phase (14)	Offshore (4)	1st Oil May 2019
Re-use templates Same personnel Lessons Learnt	Start Design in parallel with FEED Improved execution methods (Lessons Learnt) Re-use of facilities, equipment and key personnel Integration of long term suppliers and subcontractors Implementation of "WHP Factory" (portfolio strategy)	More work performed onshore	NPV value creation Effects of industrialization and standardization Learning curves improve efficiency and quality

KVÆRNER