



TEEKAY PETROJARL

Maintenance and Operational Excellence

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ESRA – 04.04.2013



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Teekay Corporation

- » Founded 1973 by the late Torben Karlshoej
- » Transnational company with 6,800 employees
- » Transporter of more than 10% of the world's seaborne oil



The Teekay Fleet



Offshore

**10
FPSO's**

**40 Shuttle
Tankers**

**5
FSO's**

Conventional

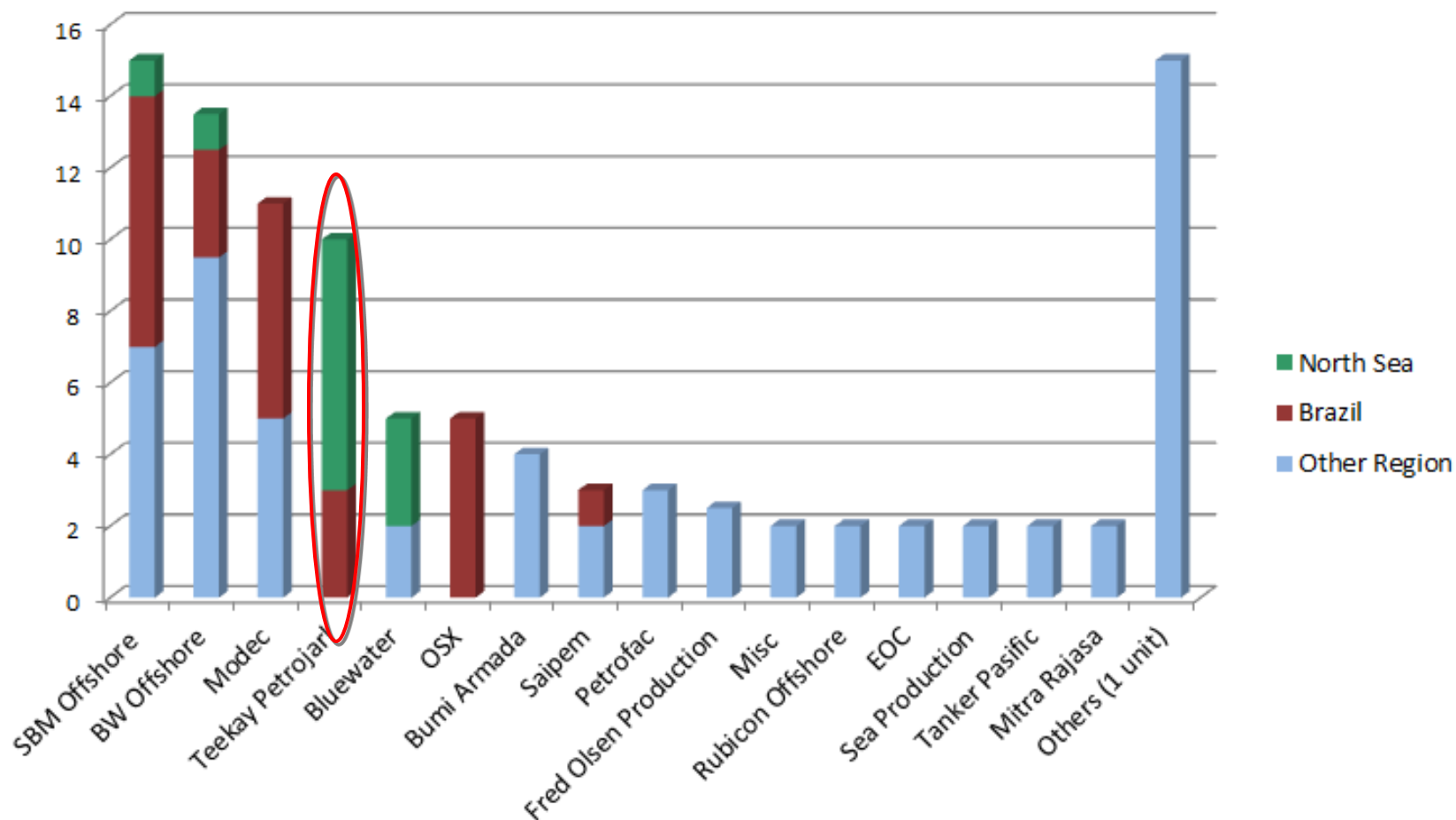
**62 Crude Oil
Tankers**

**26 Gas
Tankers**

**9 Product
Tankers**

Total of 153 Vessels

Teekay Petrojarl – A Major Player



Teekay Petrojarl - FPSO Fleet & Customers

Physical Map

AUSTRALIA
Bermuda
Study / AZORES



**Petrojarl Banff
(CNR)**



**Petrojarl
Foinaven (BP)**



**Petrojarl Knarr
(BG Norge)**



**Petrojarl Varg
(Talisman)**



**Sevan Voyageur
(E.ON Ruhrgas)**



**Sevan
Hummingbird
(Centrica Energy)**



**Petrojarl
Cidade de Itajai
(Petrobras)**



**Petrojarl
Cidade de Rio
das Ostras
(Petrobras)**



**Sevan Piranema
(Petrobras)**



**Petrojarl I
(StatoilHydro)**

June 2003

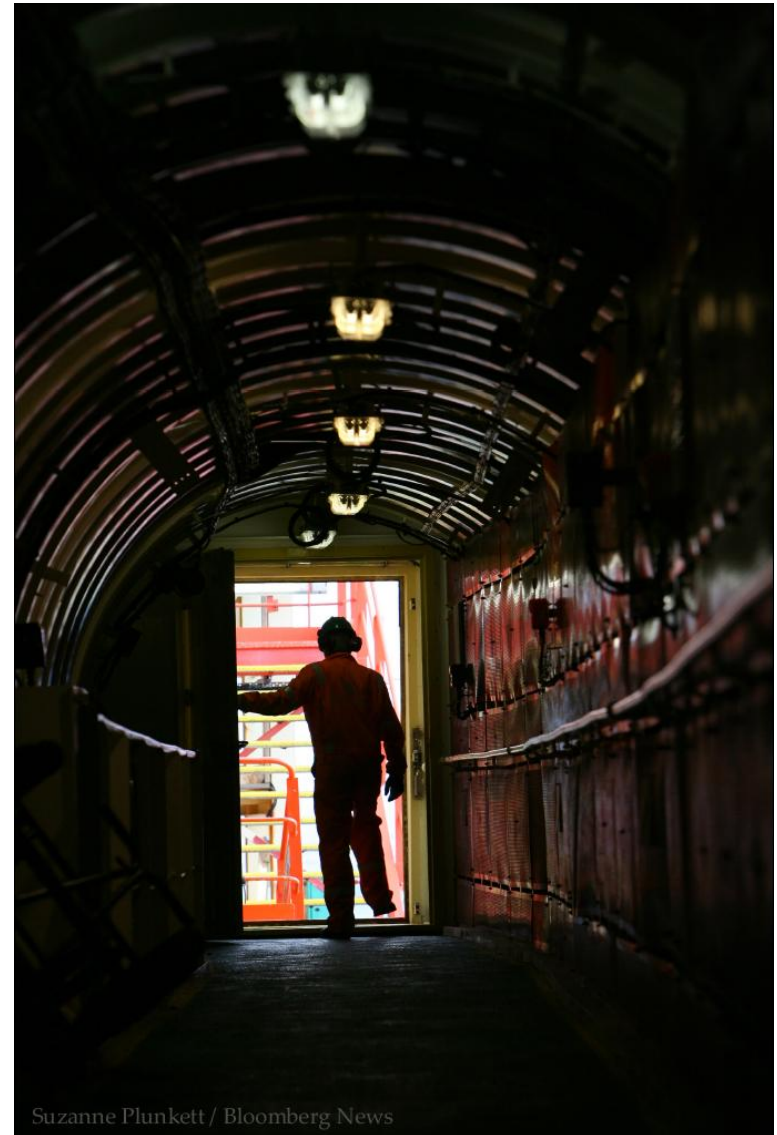
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Asset Integrity Management in TKPJ

Our definitions:

- » Asset Integrity is the ability of the asset to perform its required function effectively & efficiently whilst safeguarding health, safety & the environment
- » Asset Integrity Management is the means of ensuring that the people, systems, processes & resources are in place, are fit for purpose, and are being applied effectively over the whole lifecycle of the asset



Asset Integrity Management in TKPJ

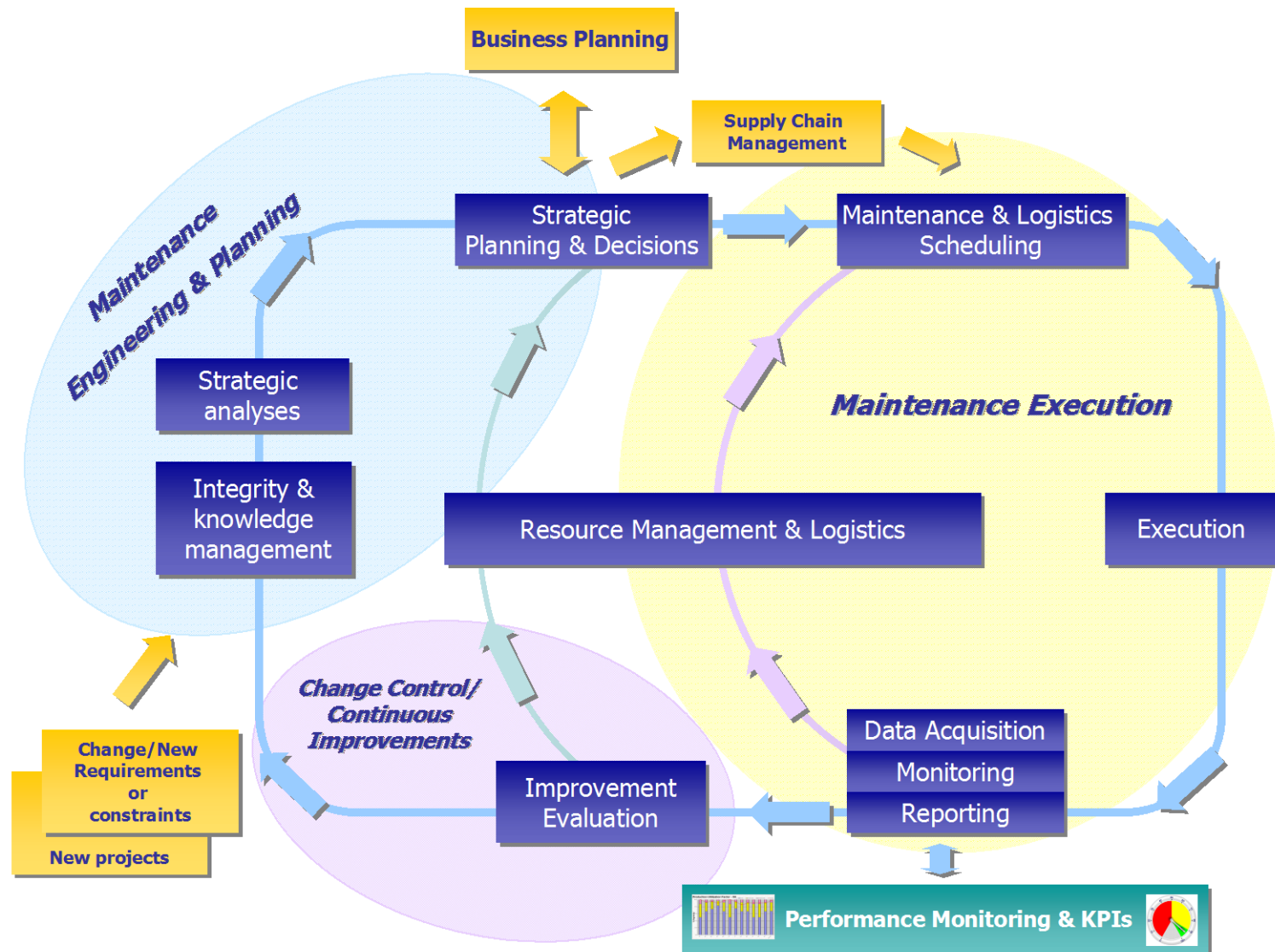
Asset Integrity Management

Objectives :

1. To reduce risk for major accidents to an accepted level
2. To ensure maximal production
3. To optimise maintenance and operation costs



Teekay Maintenance Management



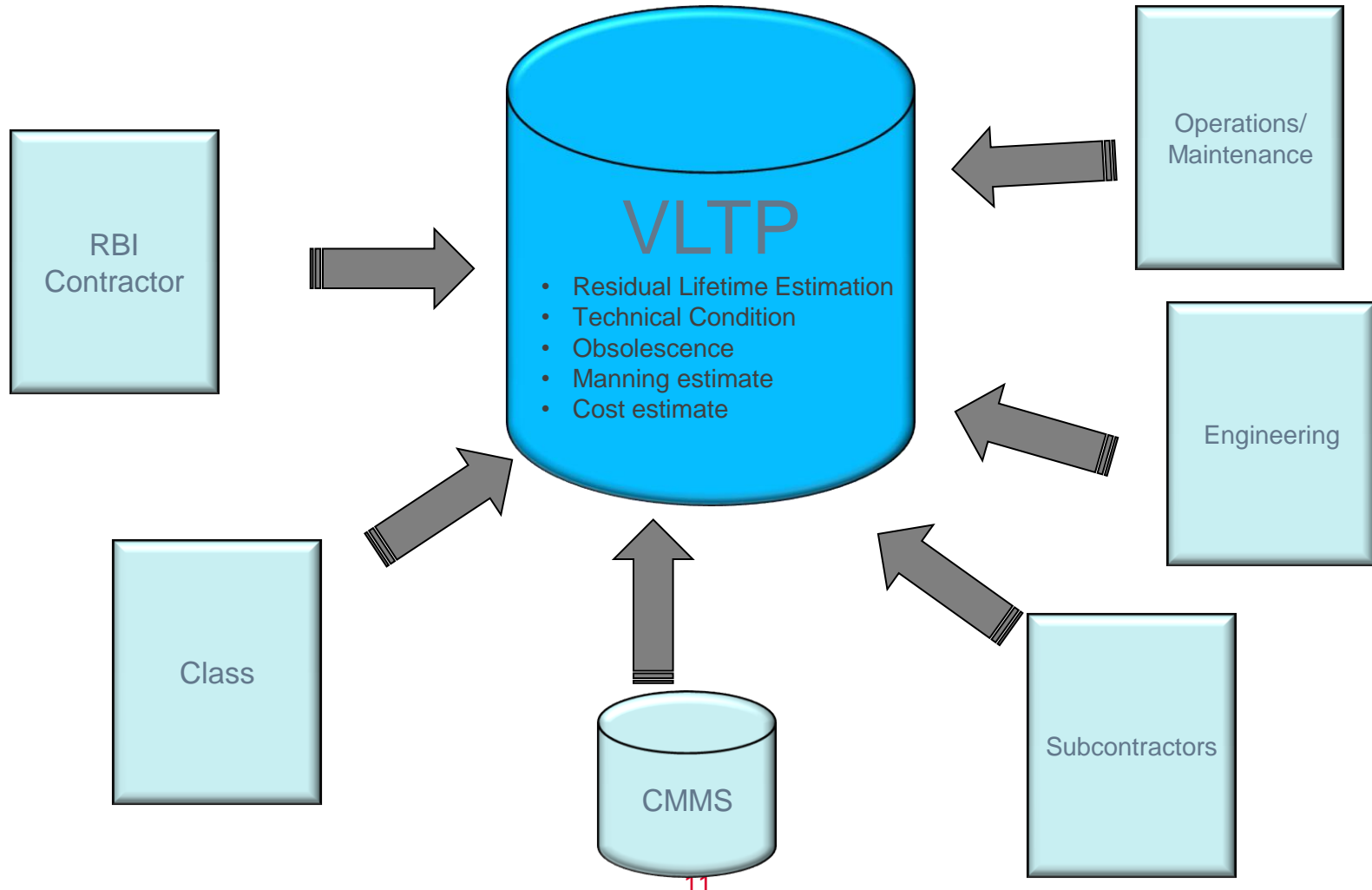
Key Asset Integrity Challenge Areas for TKPJ

- Harsh environment & challenging operations
- Significant prolongations to expected duration of contracts from extended tail-end production
- Re-deployment of units
- How to handle unforeseen events

How to obtain the full picture of the integrity of the vessels?

Solution?

Many different sources for asset integrity information



Utilization of LifeTimePlan

- » State of the vessel (major 10 Y activities)
- » Technical condition
- » Remaining lifetime
- » Repair/Modification/Renewal evaluation
- » Long term planning of activities
- » Budget process
- » Input to Asset Tracker (business model)
- » Input to docking planning

TKPJ Vessel Lifetime Plan



Vessel Lifetime Plan

Foinaven

?



Activity list | Verify new activity | Estimation | Budget approval | Realization

Design/Actual
Lifetime data

Replacement
calculations

LCC
calculations

Operating cost
calculations

Activity record

Changed By:

ID	151	Activity registration date	17.06.2011
Status	Accepted	Implementation Year- earliest	2011
SFI	44	Implementation Year- latest	2015
Category	Process		
SFI_Name	WATER TREATMENT SYSTEM / PWRI		
Tagnr	Piping		
Description of actions needed	Replace all piping due to internal corrosion. More detailed inspection in 2011 to be performed to specify which part of the system to be replaced when.		

Reasons for request

- ☐ Prod./Regularity/Capacity issue
☐ Safety issue
☐ Cost issue
☒ Tech. Cond issue
☐ Obsolescence issue
☐ Class requirement issue
- Increasing internal and external corrosion



Total cost pr Year

NOK	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
32,6	0,2		10,8	10,8	10,8								

Total POB pr Year

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
5		360	360	360								

POB	Internal Hours	Shut Down Work	Slow Down	Hot Work	Life Extension Scope
1085					Y

Design Lifetime Year
 Design End Of Lifetime Year
 Expected Lifetime Year
 Due Date For Upgrades Year

ID	Date	Signature	Type	Description	
151	20.06.2011	SRA	Note	01.02.2011; Force will do an new inspection in febr 2011 to specify extent	0(0)

Record: 1 of 1

No Filter Search

Consequenses:

Examples of VLTP

ID	Status	SFI	Category	SFName	Tagnr	Description	Earliest	Latest
249	Accepted	41	Process	PROCESS FLOW TRAIN 1 (A)		Painting Program 6 Y program	2009	2015
151	Accepted	44	Process	WATER TREATMENT SYSTEM / PWRI	Piping	Replace all piping due to internal corrosion. More detailed in	2011	2015
193	Accepted	66	Machinery Main Component & ICSS	GENERATORS FOR POWER PLANT		Program for onshore change out/repair all 8 generators du	2011	2015
228	Accepted	81	Ballast, bilge, fire fighting, ESD, PSD, HIF	EMERGENCY ALARMS- FIRE FIGHTINGS AND ES		Deluge piping main deck to be replaced. Started in 2008 - o	2008	2013
225	Accepted	80	Ballast, bilge, fire fighting, ESD, PSD, HIF	BALLAST AND BILGE SYSTEM	Piping	Piping around pumps have internal corrosion, many spools	2014	2015
200	Accepted	72	Utility	COOLING WATER - SEA & FRESH WATER SYST		Seawater system - sea chest: port and starboard main se	2011	2011
250	Accepted	41	Process	PROCESS FLOW TRAIN 1 (A)		Services required to painting program, see act. ID 249	2009	2015
153	Accepted	44	Process	WATER TREATMENT SYSTEM / PWRI	Piping	Open Drain piping - no regular inspection program today. C	2011	2011
139	Accepted	43	Process	GENERAL - GAS COMPRESSION AND GAS TRE	04-C-003	Replace machinery protection system (GE fanuc) due to ob	2012	2015
172	Accepted	53	Cargo, lifesaving, mooring, lifting, naviga	MOORING AND ANCHORING EQUIPMENT (INCLU		Mooring system to be replaced in 3-4 years	2013	2014
245	Accepted	25	Hull	TURRET CONSTRUCTION		Repair turret from findings from fatigue review	2015	2017
198	Accepted	69	Machinery Main Component & ICSS	ENGINE/PROSESS/DECK CONTROL - ICSS (SIEM		Woodward Control and monitoring system - Upgrade of sy	2011	2012
163	Accepted	46	Process	RELIEF AND FLARE SYSTEM / CLOSED DRAIN	6"-DC-15	Replace remaining piping not beeing part of replacement pi	2013	2014
194	Accepted	66	Machinery Main Component & ICSS	GENERATORS FOR POWER PLANT		Preparation and installation work for generators change o	2011	2015
138	Accepted	43	Process	GENERAL - GAS COMPRESSION AND GAS TRE	04-C-003	Dry gas seal problem issue - too short lifetime	2011	2013
136	Accepted	43	Process	GENERAL - GAS COMPRESSION AND GAS TRE	Gas com	Replace gas injection line (to swivel)	2012	2014
104	Accepted	24	Hull	HULL - FORE PART		Need for fatigue analysis of fore part.	2014	2016
182	Accepted	61	Machinery Main Component & ICSS	MANOUEVERING MACHINERY	MP-TTE0	Thruster replaced in 2009, due to internal leakages. Can e	2015	2016
192	Accepted	64	Machinery Main Component & ICSS	STEAM & BOILER PLANT		BMS system, Control & burner System: New system to be	2011	2012
165	Accepted	50	Cargo, lifesaving, mooring, lifting, naviga	CRUDE OIL STORAGE AND DISCHARGE SYSTE		Metering - ObsolenceFlow computer to be replaced 2011	2012	2012

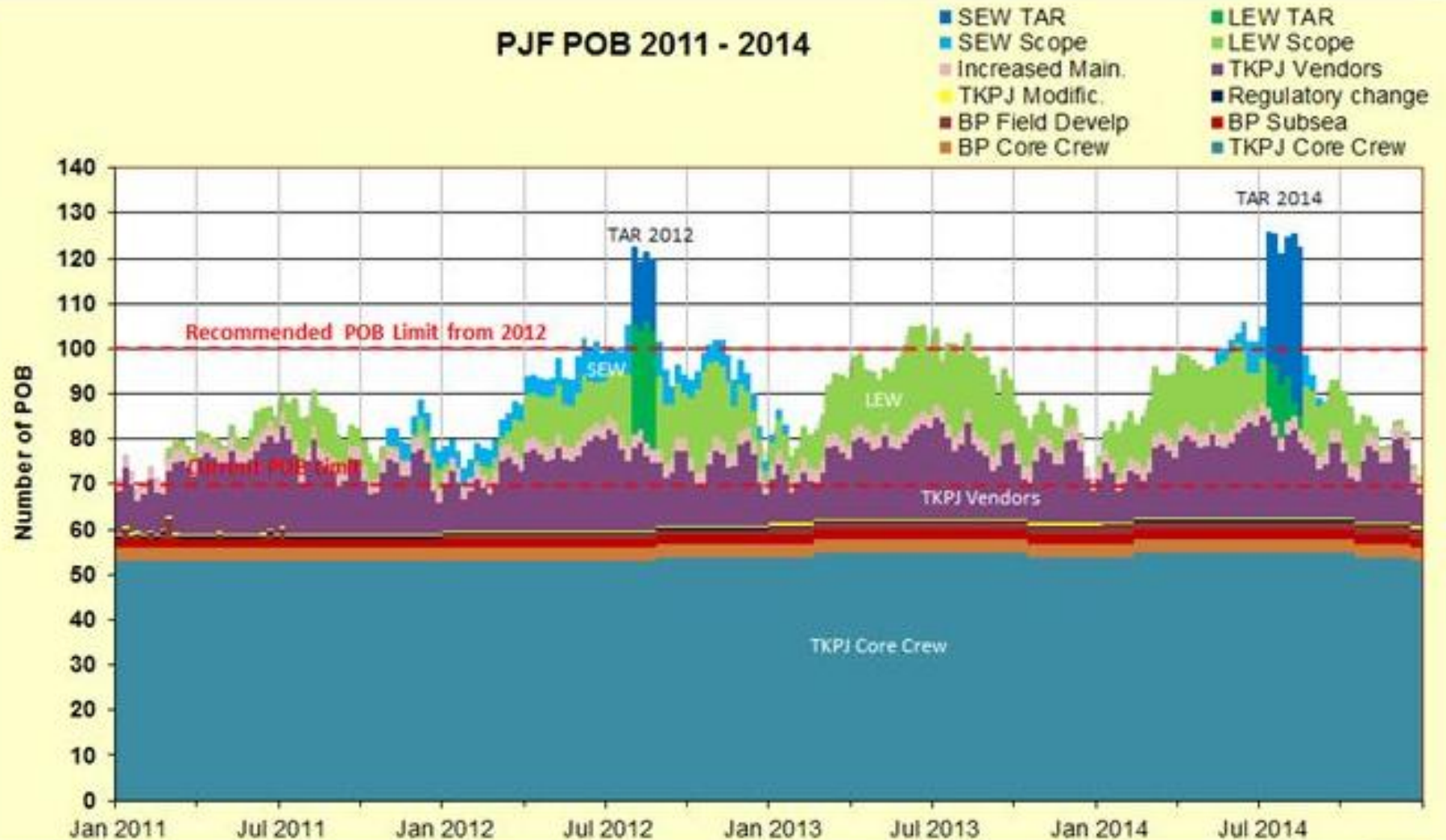
Case Petrojarl Foinaven

- ▶ On Foinaven field since 1996
- ▶ New contract in 2009
- ▶ 10 + years extension on field without going to dock
- ▶ Extensive upgrade activities



PJF – justification for accommodation and lifeboats

PJF POB 2011 - 2014



Case Petrojarl Banff

- ▶ Incident in December 2011
 - ▶ 5 anchor chains broke in storm beyond design criteria
- ▶ At yard in September 2012
- ▶ Back on field Mid 2013
- ▶ Field abandonment date is uncertain
- ▶ Opportunities:
 - ▶ What to do during yard stay?
 - ▶ Estimated residual lifetime and obsolescence are issues

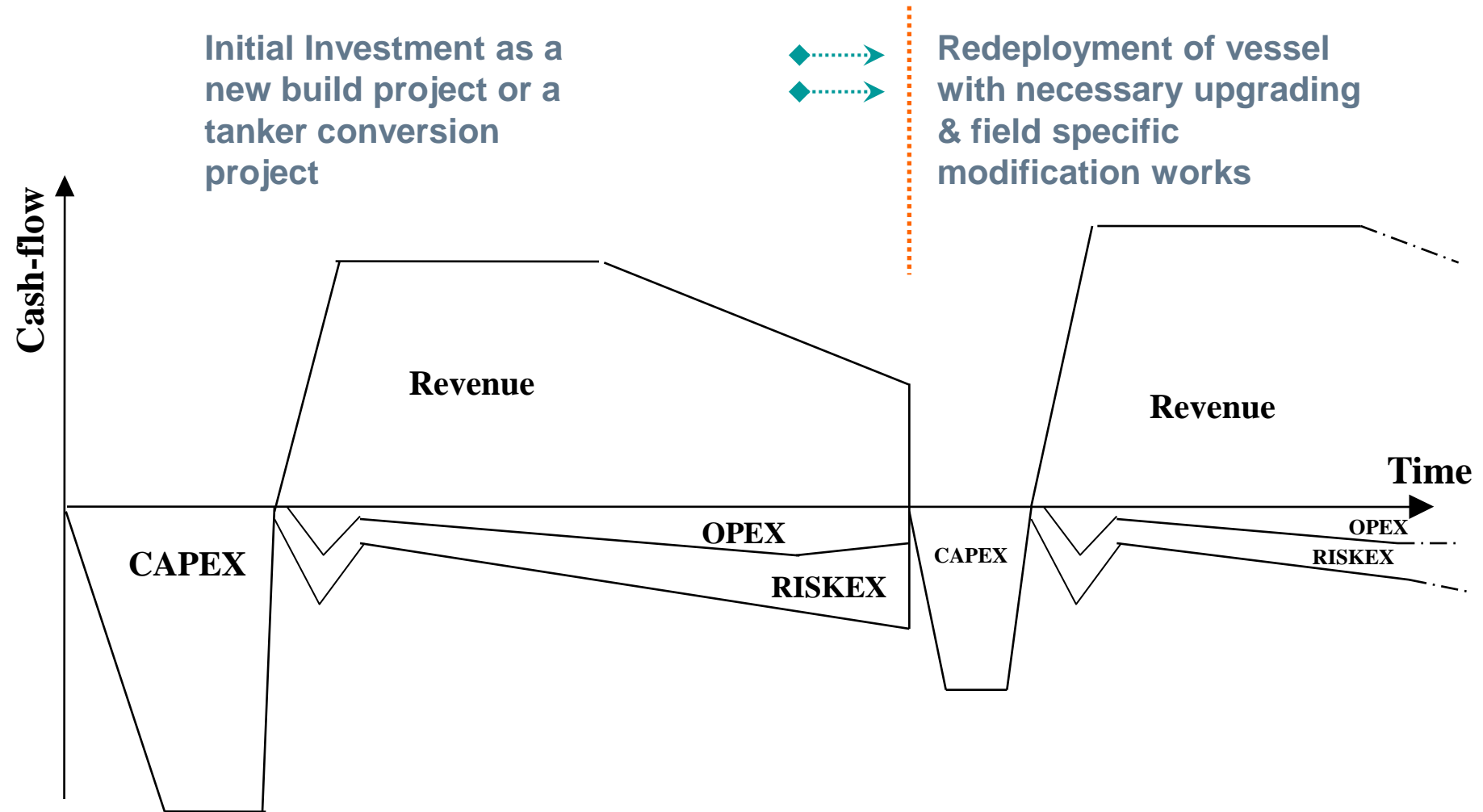


Case Petrojarl I

- ▶ Over 25 years in service on 10 fields
- ▶ Old lady with a lot of ageing issues
- ▶ Leaving Glitne field Q2 2013
- ▶ A number of opportunities are considered for re-deployment
- ▶ Very important to have a good overview of the asset integrity status.

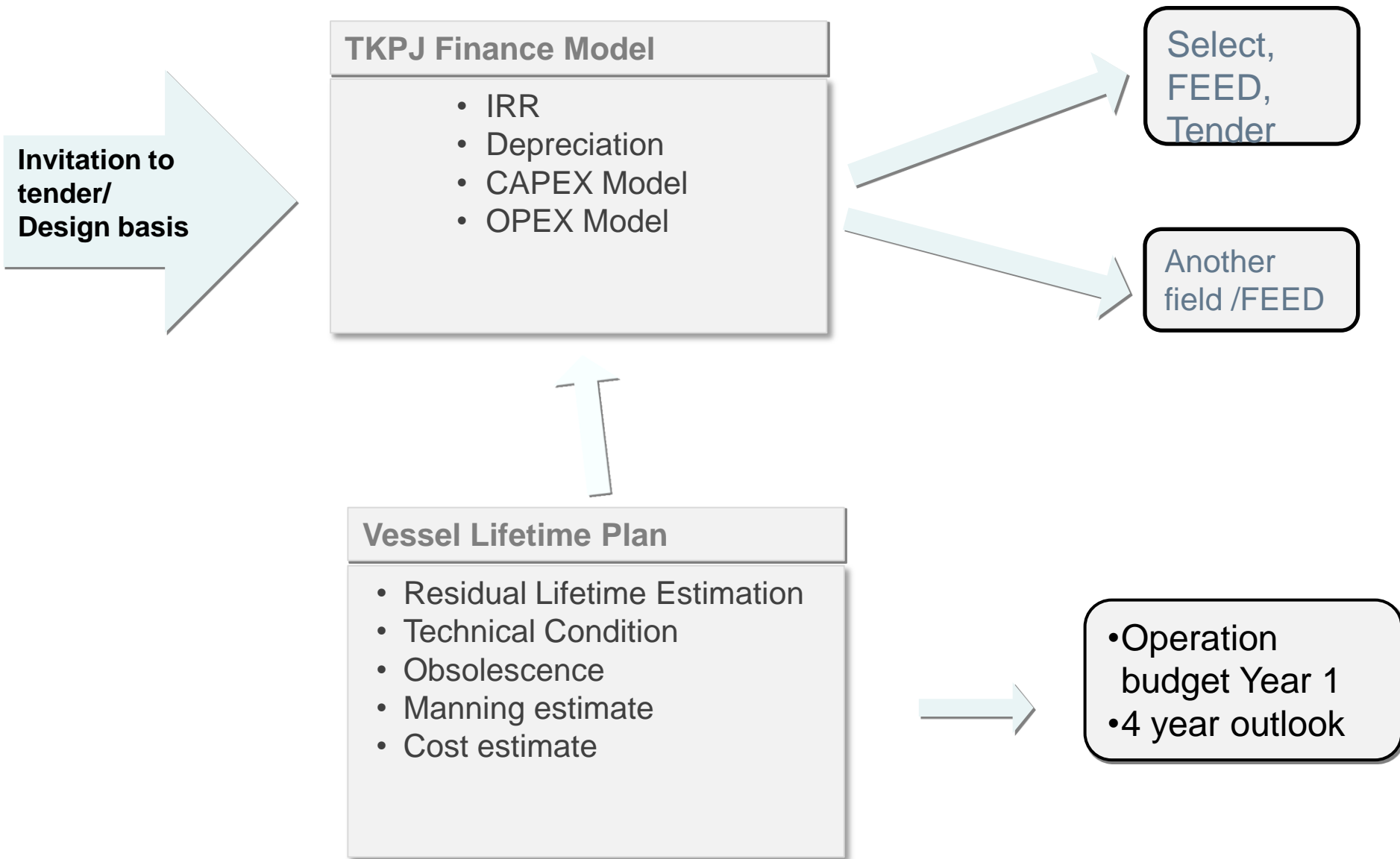


A pragmatic view on FPSO Asset Management

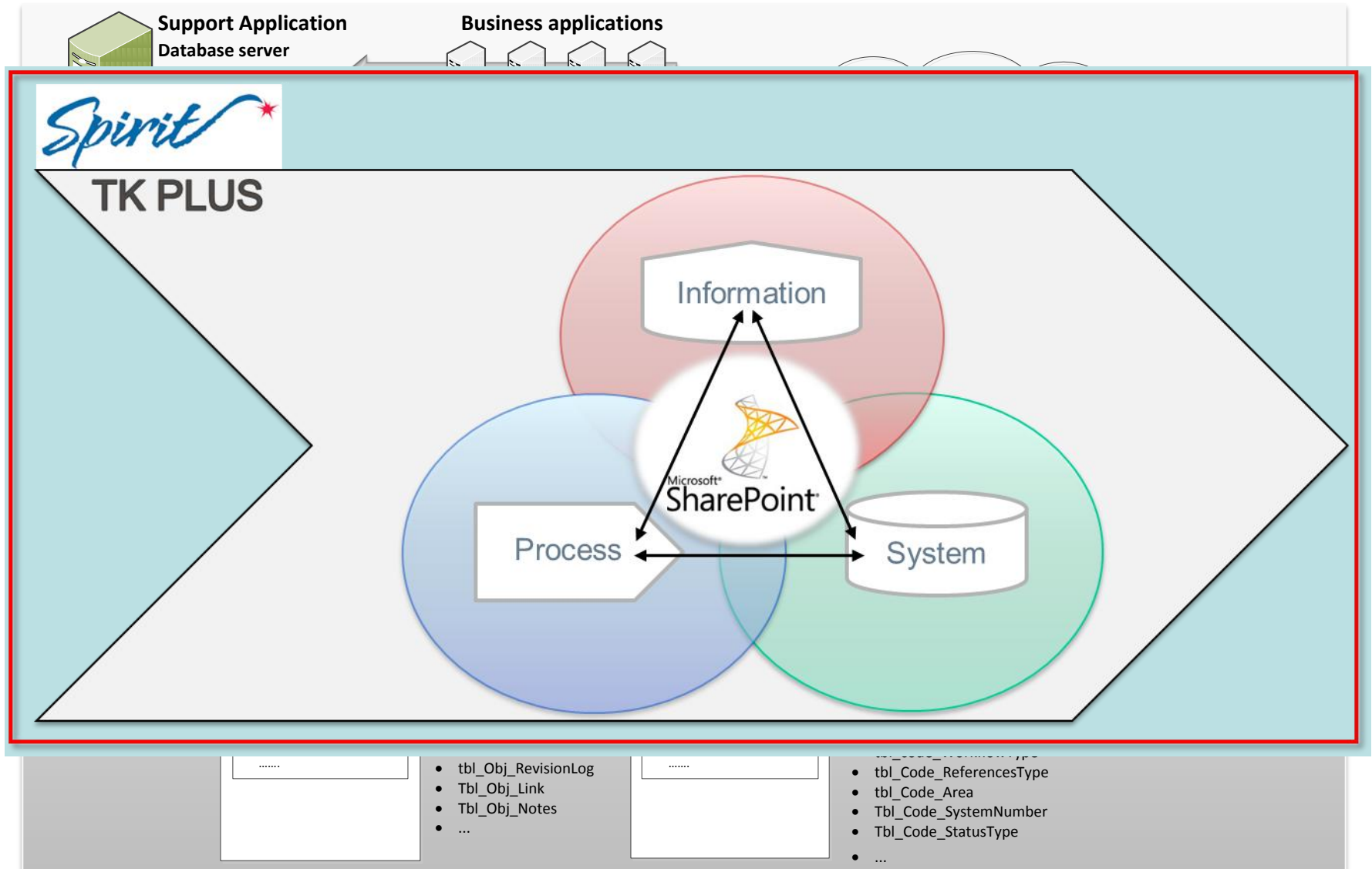


Maximizing Profit = Max {Revenue - CAPEX - OPEX - RISKEX}

TKPJ Business model in redeployments



Future development



Concluding Remarks

- » Improving further within the areas of Asset Management and Integrity Management is seen as key to strengthen our position as World Class Operator of mobile production units.
- » Success is not expected to come easy and will require strong focus on organizational agility and good leadership.



**Thank You for Your
Attention !**



**WE AIM TO BE SEEN AS A ROLE
MODEL IN OPERATIONAL
EXCELLENCE WITHIN OUR INDUSTRY
AND SOCIETY AT LARGE!"**

SVERRE W. STENVAAG
Senior Vice President Operations, Teekay Petrojarl ASA