The Astonishing Simplicity of Offshore Energy (commercial) RISK MANAGEMENT

George Grangeon

Contracts & Business Development Consultant – JBS Engineering Group

Continuing the **North Sea** Journey

Society of Petroleum Engineers
Aberdeen Section

SPE Aberdeen Simplified Series 2016

Demystifying the Oil & Gas Industry for Professionals

Aberdeen, February 3, 2016

Sponsored by

GE Oil & Gas

EXPRO

University of Aberdeen SPE Student Chapter Seminar

The New Face of Oil & Gas Industry

Aberdeen, February 5, 2016

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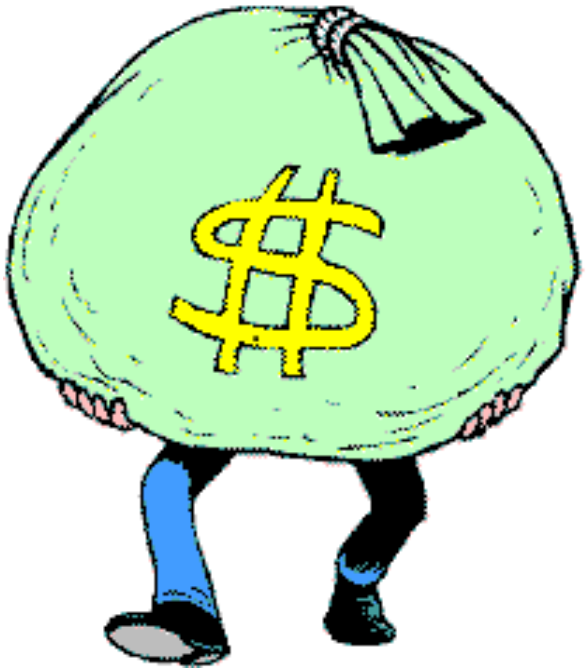
Risk Management & Collaboration
From a Business Perspective
in a
SIMPLIFIED CONTEXT OVERVIEW

Easy Money vs. Tight Money Proposition

Oil & Gas Industry - Part 1 - Where are we Now ?

A Project Management Strategy

Easy Money



The Case for Emphasising on Project Relationship Management :

Project owner – generally accepts additional costs, delays and revised specifications

Supply Chain – generally obtains concessions and maintains positive margins

In essence

"Throw money at the problem" – (the perceived traditional O&G philosophy)

Even though …

The Project is likely to exceed original cost and schedule estimates and deviate specs.

i.e …

Business as usual which does not build on collaborative risk management may result in sub-optimal project management, lack lessons learned and poor decision management

CONCLUSION

A Relationship Management Project strategy can indeed work as an **effective** form of collaboration, albeit often at the expense of project **efficiencies**.

Easy Money vs. Tight Money Proposition

Oil & Gas Industry - Part 1 - Where are we Now ?

A Project Management Strategy

Tight Money

The Case for *(expanding from)* Emphasising on Project Relationship Management :

Project owner – generally disputes additional costs, delays and revised specifications

Supply Chain – generally does not obtain concessions and margins erode

In essence

"No Money" – Project owner relies on Supply Chain accountability in delivering to agreed project objectives

i.e …

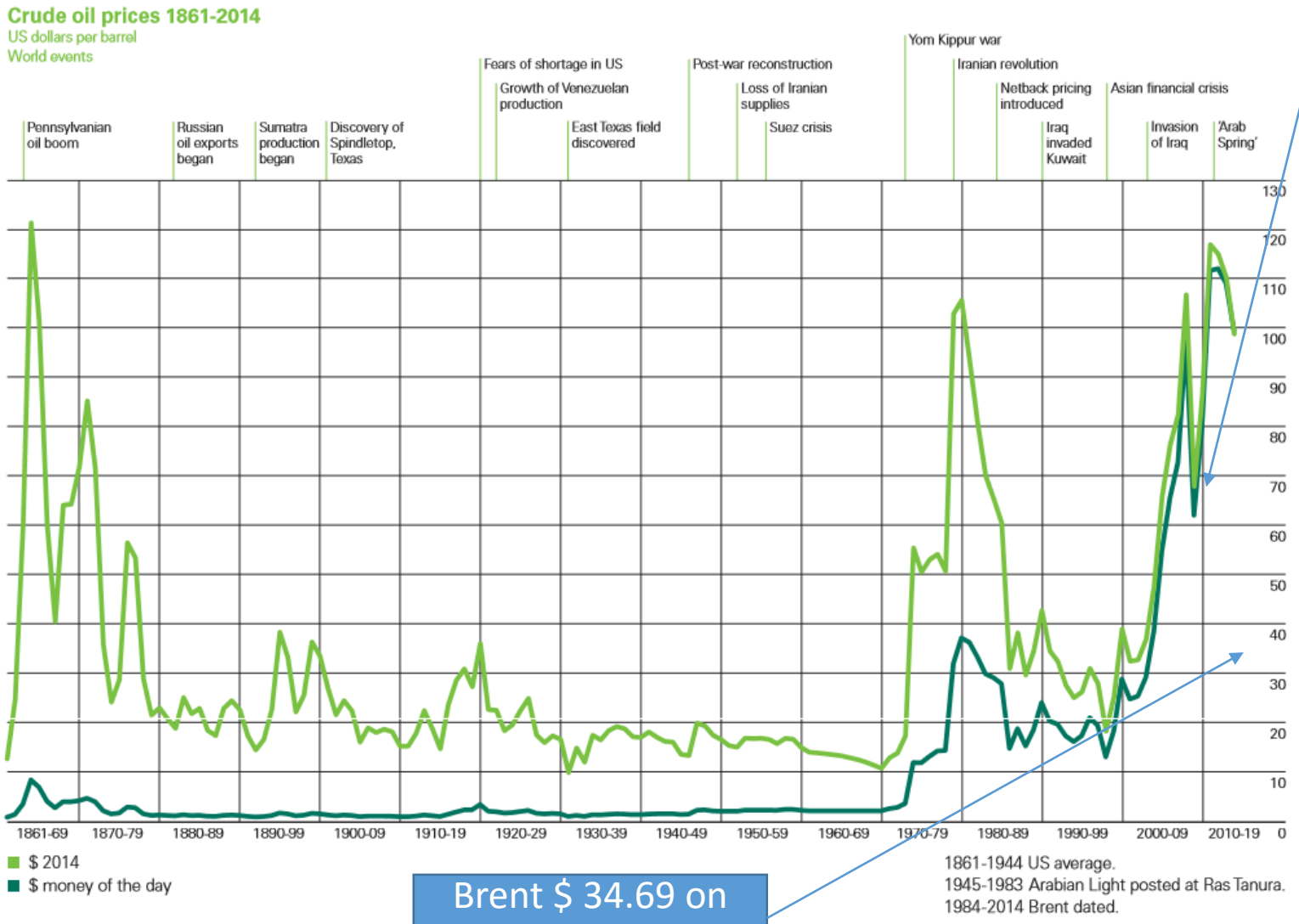
Business as usual which does not build on collaborative risk management is likely to fail in a tight money environment

CONCLUSION

A Relationship Management strategy is likely to fail in a tight money environment unless it develops into an **effective** collaborative risk management strategy because risk and collaboration enhance project **efficiencies** - improving the quality of project management, lessons learned and quality of decision management.

Easy Money vs. Tight Money Proposition

Part 2 Myth Busting – Oil is King vs. Oil is a Commodity



Brent $ 34.69 on February 2, 2016

Graph source : BP statistical report of world energy 2015

Energy Prices per **Million BTU** in January 2010

Gasoline	- $17.81
Propane	- $13.28
Natural gas	- $5.69
Coal – Northern Appalachia	- $2.08
Coal – Powder River Basin	- $0.56
Electricity	- $26.31
Corn ethanol	- $23.46

Source: The Price of Energy – Forbes Magazine Jan 26, 2010

There is an apparent direct correlation between oil prices and political events.

Hydrocarbons and Electricity appear to enjoy a convenience fee.

Ethanol received est. USD 17 Billion in US GOV subvention between 2005 and 2009.

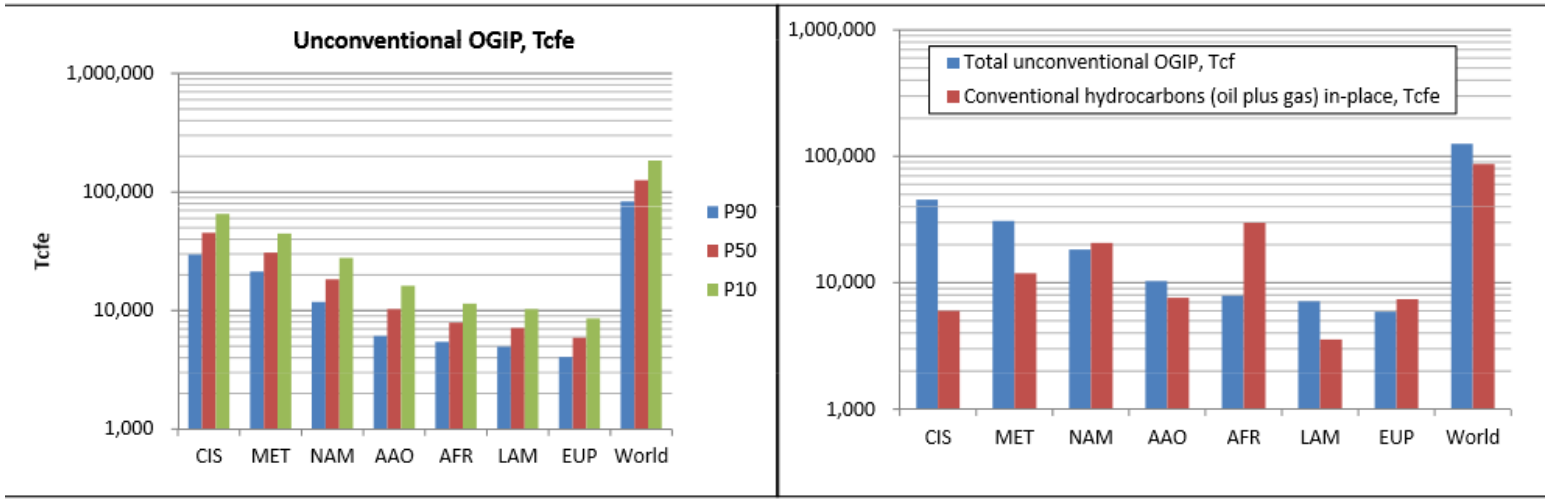
Thought: What is the market value of Hydrocarbons ?

Easy Money vs. Tight Money Proposition

Part 2 Myth Busting – Oil is Finite vs. Oil is Infinite

Worldwide Conventional And Unconventional Resources Are Essentially Infinite

P10/P50/P90 correspond to 377, 219 and 146 years at current consumption



"Conclusions
From using published assessments of 26 North American basins, published global assessments, and resource-triangle-based methodology presented in this paper, we have developed a global estimate of unconventional gas in place with quantifying the uncertainty and conclude the following:
1. Estimated global unconventional OGIP ranges from 83,300 Tcf(P90) to 184,200 Tcf(P10). The P50 of our global unconventional OGIP assessments (125,700 Tcf) is 4 times greater than Rogner's estimate of 32,600 Tcf."

Dong, Z., Holditch, S., McVay, D., & Ayers, W. B. (2012, October 1). Global Unconventional Gas Resource Assessment. Society of Petroleum Engineers. doi:10.2118/148365-PA

Worldwide Conventional and Unconventional resources estimates show an essentially unlimited resource.

Fact: Technology advances have lead to drilling, completion and production gains

Fact: Average Oil and Gas production rates per active rig have improved by a factor of 3.5

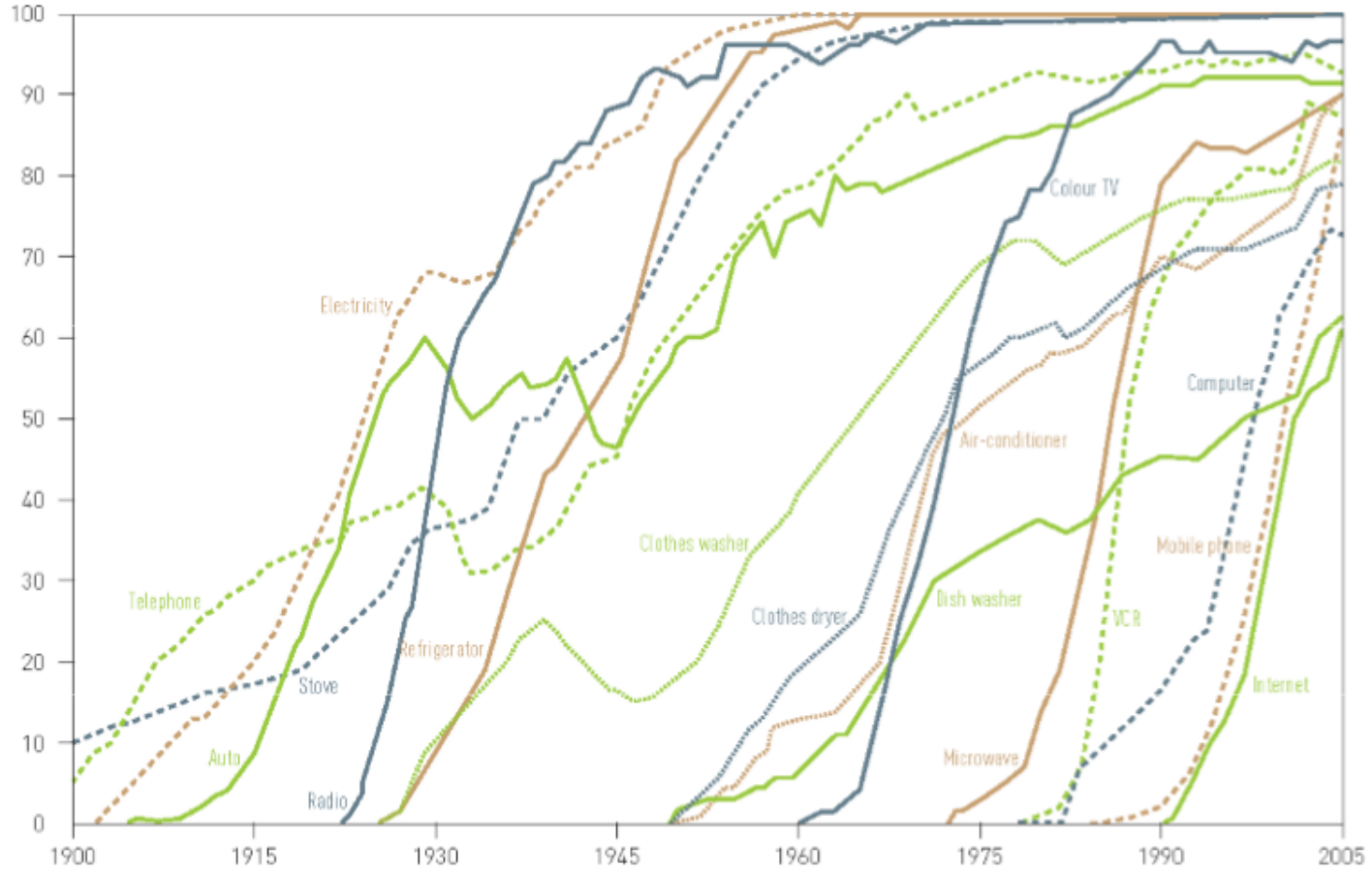
It has been reported in the press that some unconventional producers in the United States, have manged to lower production costs to USD 25/bbl. through technology and operational improvements

Thought: What is the market value of Oil ?

Graph source : Iskander Diyashev
"The World Without Oil" presentation SPE Aberdeen 23/10/2015

Easy Money vs. Tight Money Proposition

Part 2 Myth Busting – Oil is King vs. Disruptive Technologies



Technology adoption curves for a range of modern innovations. Theoretical take-off point at 16% market penetration. (Rogers 1962)

http://www.dtpli.vic.gov.au/__data/assets/pdf_file/0010/220402/Electric-Vehicle-trial-mid-term-report.pdf

The slope of the curve of market penetration for new technologies is getting steeper from 35 to 45 year to 15 years or less.

Thought: Circa 75% of oil production is used for transportation and heating.

Fact: Considerable developments in capacitators for electric car batteries.

Fact: Considerable developments in renewable technology (solar, wind, nuclear fusion).

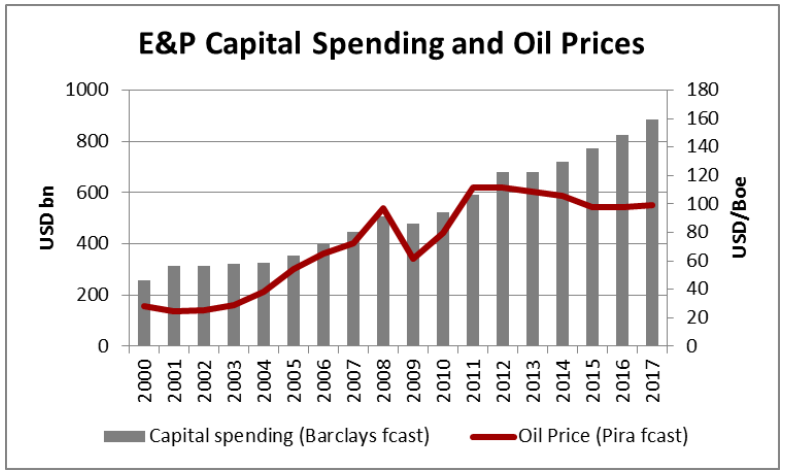
ExxonMobil forecasts 25% energy demand increase from 2014 to 2040.

Thought: is Oil and Gas heading toward extinction as an energy source, in a similar manner that Oil & Gas gradually replaced whale oil for illumination in the 19th and 20th century ?

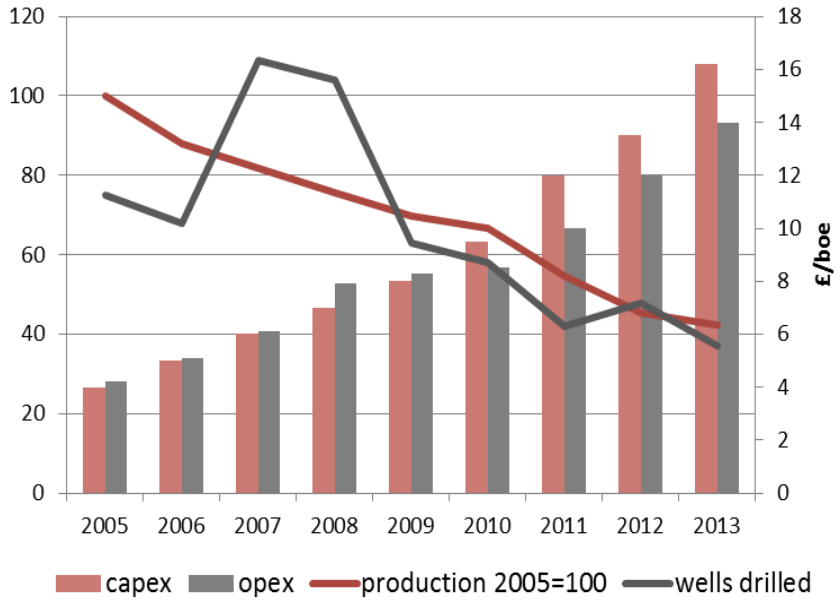
Graph source : Iskander Diyashev
"The World Without Oil" presentation SPE Aberdeen 23/10/2015

Easy Money vs. Tight Money Proposition

Part 3 – will easy money return to the UKCS Oil & Gas industry ?



Main indicators of UKCS performance



In June 2014 under a flat prices scenario, the proposed model predicted continual cost inflation and ballooning capital expenditure.

In 2016 prices have dropped dramatically and some reports indicate that the **UKCS has become the most expensive basin to operate in**.

Christopher Bird analyzed this data in June 2014, correctly predicting the following :

- ✓ **More capital discipline at company level**
- ✓ **Large CAPEX need opens door for new financial investors**

HOWEVER

- ✓ **New instruments are more demanding and tailored to investors' RISK PREFERENCES**

Assumption: it is unlikely that the UKCS and more generally the O&G Offshore Industry will remain sustainable without a paradigm shift toward collaborative risk management to improve the quality of Decision Management

Graphs and data sources extracted from a presentation to O&G UK titled:
MAXIMISING ECONOMIC RETURN IN THE UK
by Christopher Bird, CEO MOL UK Group on 11th of June 2014

Easy Money vs. Tight Money Proposition

Part 3 – Offshore Wind

Offshore Oil & Wind Energy Equivalence	Unit	Unit / USD		Conversions		Unit Cost kWh		Retail Price
		(LOW)	(HIGH)	MM BTU	kWh	(LOW)	(HIGH)	kWh
Oil *(Price)*	boe	$ 34.69		5.551	1699.41	**$ 0.020**		**$ 0.250**
Offshore Wind *(Cost)*	kWh	$ 0.22	$ 0.30	0.003	1.00	**$ 0.216**	**$ 0.302**	

The assumptions of the previous slide seem to hold true for both Wind and the Hydrocarbons Offshore Energy Industries

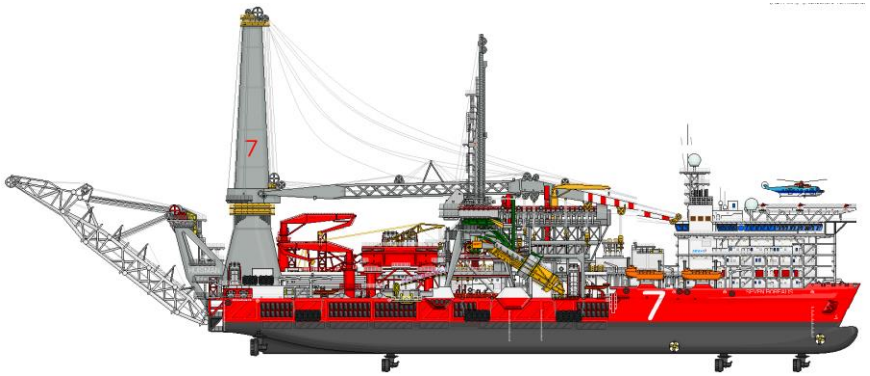
- ✓ **Large CAPEX need opens door for new financial investors**
- ✓ **More capital discipline at company level**
- ✓ **New instruments are more demanding and tailored to investors' RISK PREFERENCES**

Various factors are contributing toward increased investments in Offshore Wind despite the relative high costs and tight margins in offshore wind.

Offshore Wind operators have pushed back on the traditional offshore risk allocation models demanding increased Supply Chain accountability.

Tale data sources:
Oil Price based on Brent Price February 2, 2016
Offshore Wind Cost based on Low and High UK LCOE estimates in 2010
Energy Retail Price from Scottish Hydro on February 2,2016 for central Aberdeen
GBP 1.00 = USD 1.44 on February 2, 2016

$$\text{LCOE} = \frac{\text{sum of costs over lifetime}}{\text{sum of electrical energy produced over lifetime}} = \frac{\sum_{t=1}^{n} \frac{I_t + M_t + F_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$



Easy Money vs. Tight Money Proposition

The VUCA World Proposition*

68 Projects deferred total capex spend 380 BN
Delayed spend from 2016 to 2020 170 BN
2.9 M bdp deferred production to at least 2020
Average Gross breakeven of delayed projects $ 62 boe

Volatility **V** Vision
Uncertainty **U** Understanding
Complexity **C** Collaboration
Ambiguity **A** Agility

Would you agree that The Stone Age did not end because the Earth ran out of Stones ?

Would you agree that "*Imagination is more important than knowledge*" (Albert Einstein) ?

*Data extracted from a presentation delivered at Subsea Expo:
by Christopher Bird, CEO MOL UK Group on 3rd of February 2016

Reasoning Simplified

Risk Management and Reasoning

Two Questions

What is the business of Offshore Energy Operators ?
What is the business of the Supply Chain to Offshore Energy Operators ?

One Answer

The purpose of business is to generate financial returns to remunerate costs and satisfy shareholder returns.

Question

Is it generally accepted that in business there is a direct correlation between risk and potential financial returns ?

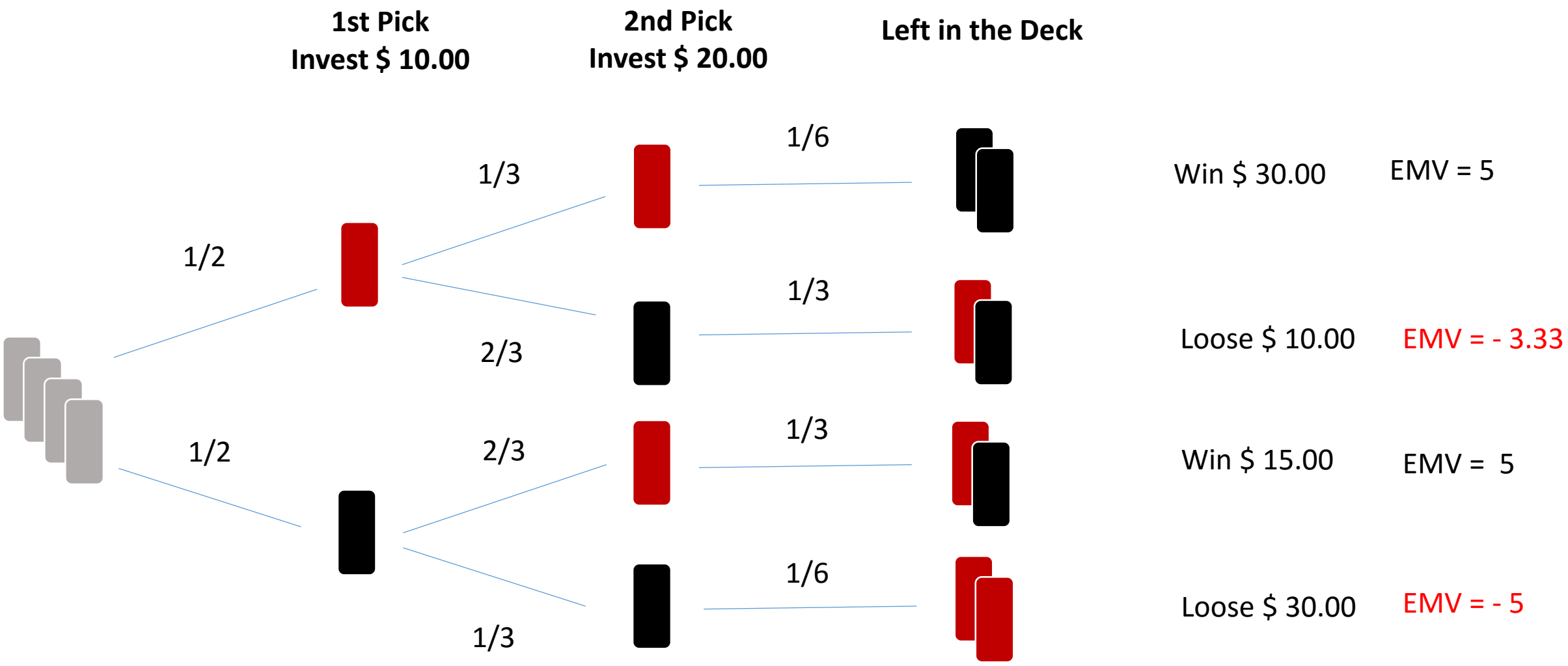
Answer

Yes, there is generally a direct correlation between risk and potential financial returns (reward).

Postulate in conclusion:

Offshore Energy Operators and Supply Chain are in the business of Managing Risk

What is Risk Management



Probabilities

Why do we use reasoning, probabilities and mathematics ?

Door 1

Door 2

Door 3

Behind one of these doors there is a speedboat worth $ 30,000 – please pick a door for free

After you have picked a door I will open another door for you that does not hide the speedboat if you give me $ 5

Given the new information given to you for $ 5, will you elect to stick your original choice or switch ?

Why have you chosen to stick your first choice or switch ?

Probabilities – The Monty Hall Problem

Mathematically – the dedicated strategy should be switch !

Door 1 | **Door 2** | **Door 3**

Pick door 1 

1/3 Probability

MH Opens door 2 

2/3 Probability

2/3 Probability

MH Opens door 1 

2/3 Probability

Pick door 2 

1/3 Probability

2/3 Probability

2/3 Probability

MH Opens door 1 

2/3 Probability

OR MH Opens door 1 

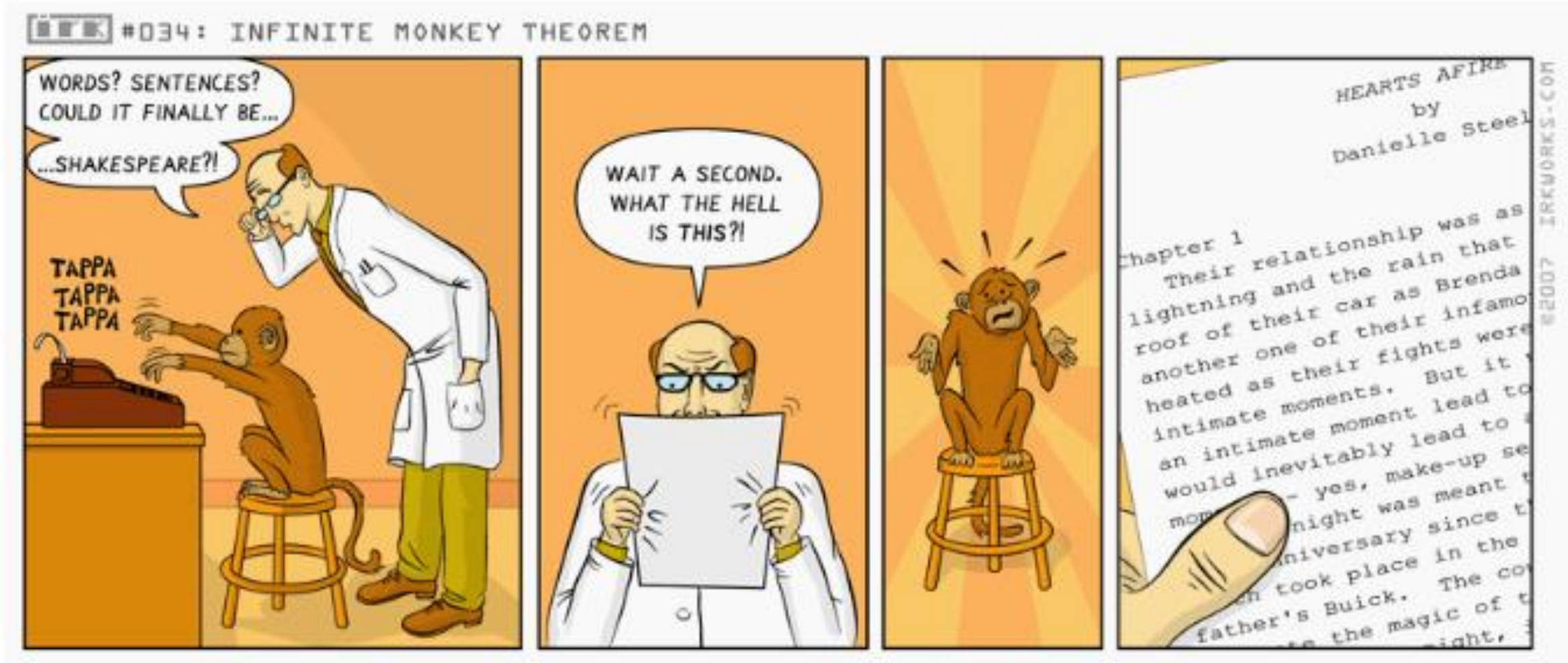
Pick door 3 

1/3 Probability

Switch should be your strategy because over time you stand 2/3 probability of winning

Probabilities

The risk of Analysis Paralysis

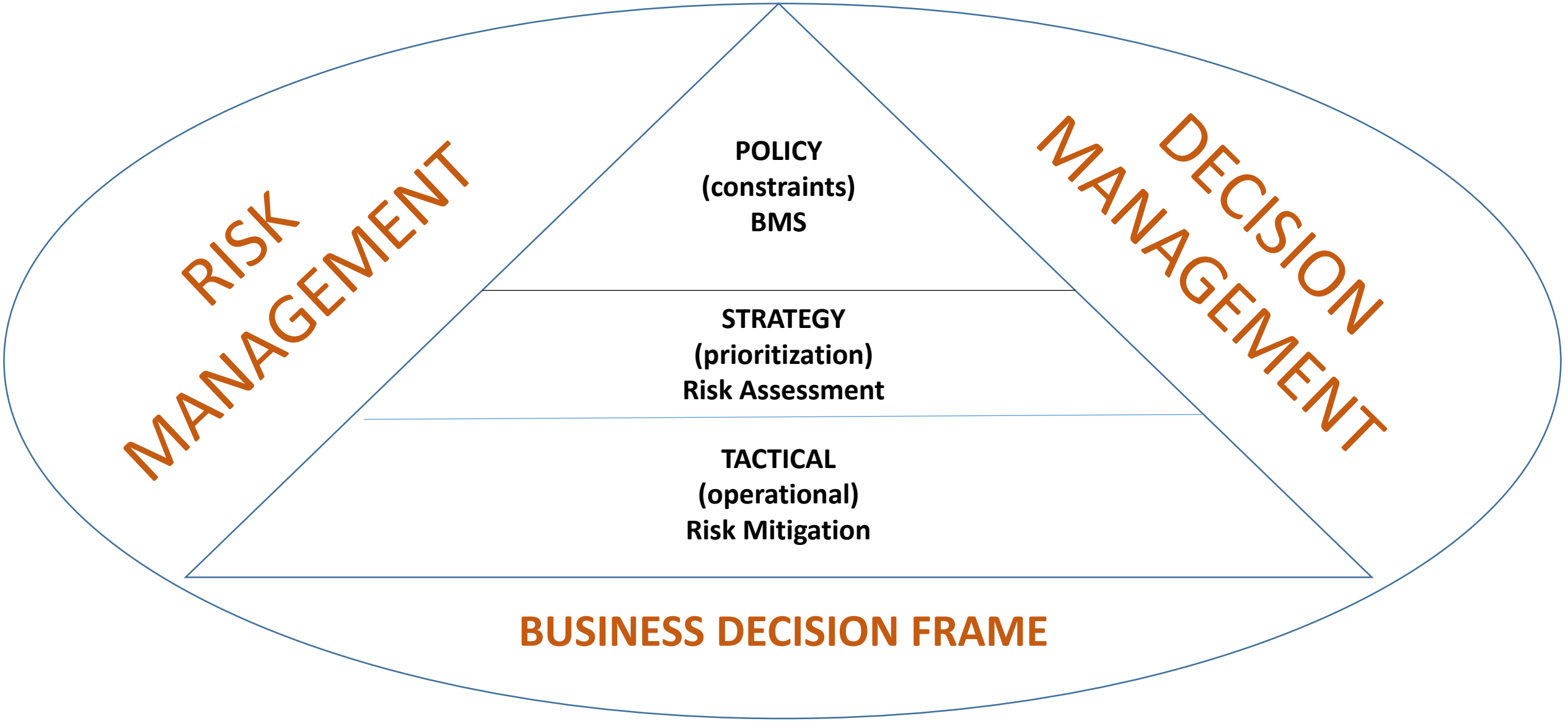


The Infinite Monkey Theorem is a proposition that an unlimited number of monkeys, given typewriters and sufficient time, will eventually produce a particular text, such as Hamlet or even the complete works of Shakespeare.

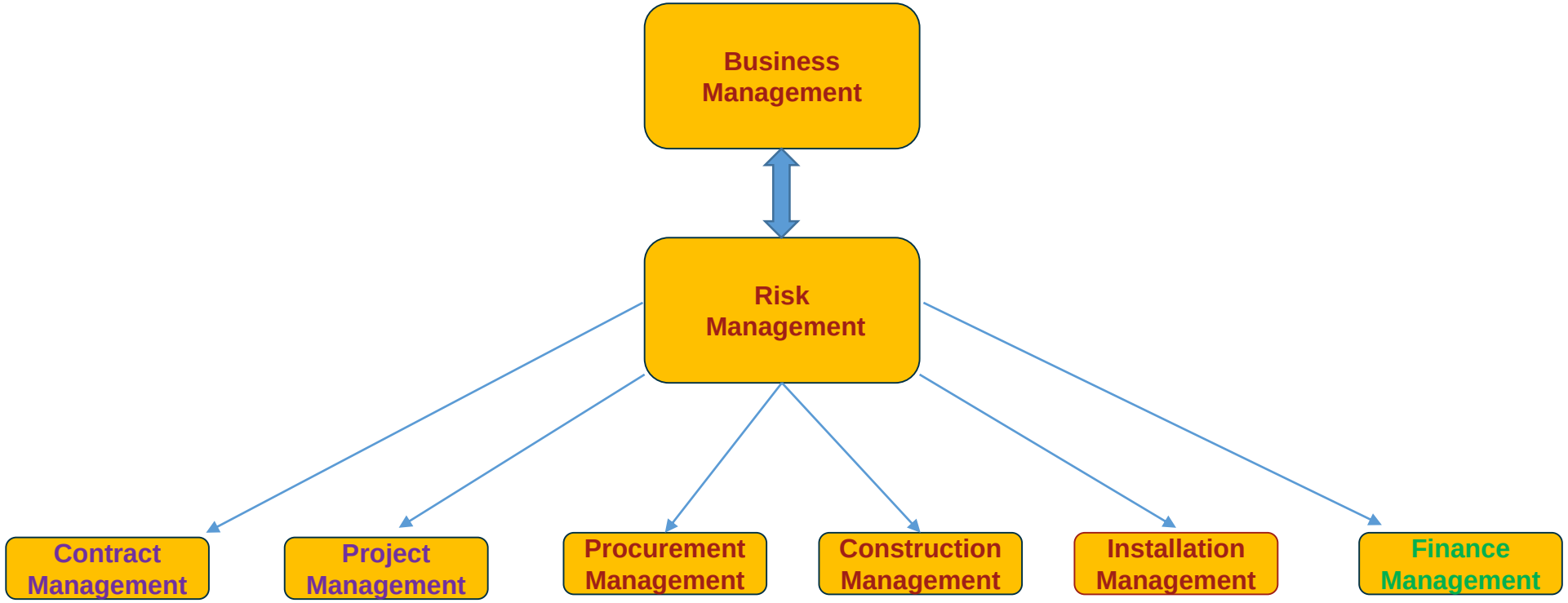
Business Risk Management

Business Decision Management

What is Quality Decision Management



Quality Decision Management



Offshore Energy Operators and Supply Chain are in the business of Managing Risk

Business Contracts

THE LAW AND BUSINESS CONTRACTS

BUYING A CHOCOLATE BAR AT THE SUPERMAKET (LAW)

BUYING AN OFFSHORE ENERGY ARCHITECTURE (CONTRACT & LAW)

Offshore Energy Industry – Risk Management – Contracting Principles

A Contract guides a formal business relationship between a buyer and a seller

A Company's Contracting Principles reflect its Risk Acceptance and desired Risk Allocation

A Contract frames the accepted Risk Allocation between contracting parties

The International Marine Contractors Association (IMCA)

FAIR * *Risk Allocation goals*

IMCA principles summarize the most common allocation philosophy desired by Offshore Project Contractors

Fair *(not equal)* and realistic distribution of risk in proportion to relative rewards

Allocation of risk – to the party best placed to assume

Insure – sufficient scope of cover

Reasonable – avoid 'duplicate' assumptions of risk and minimise potential for dispute

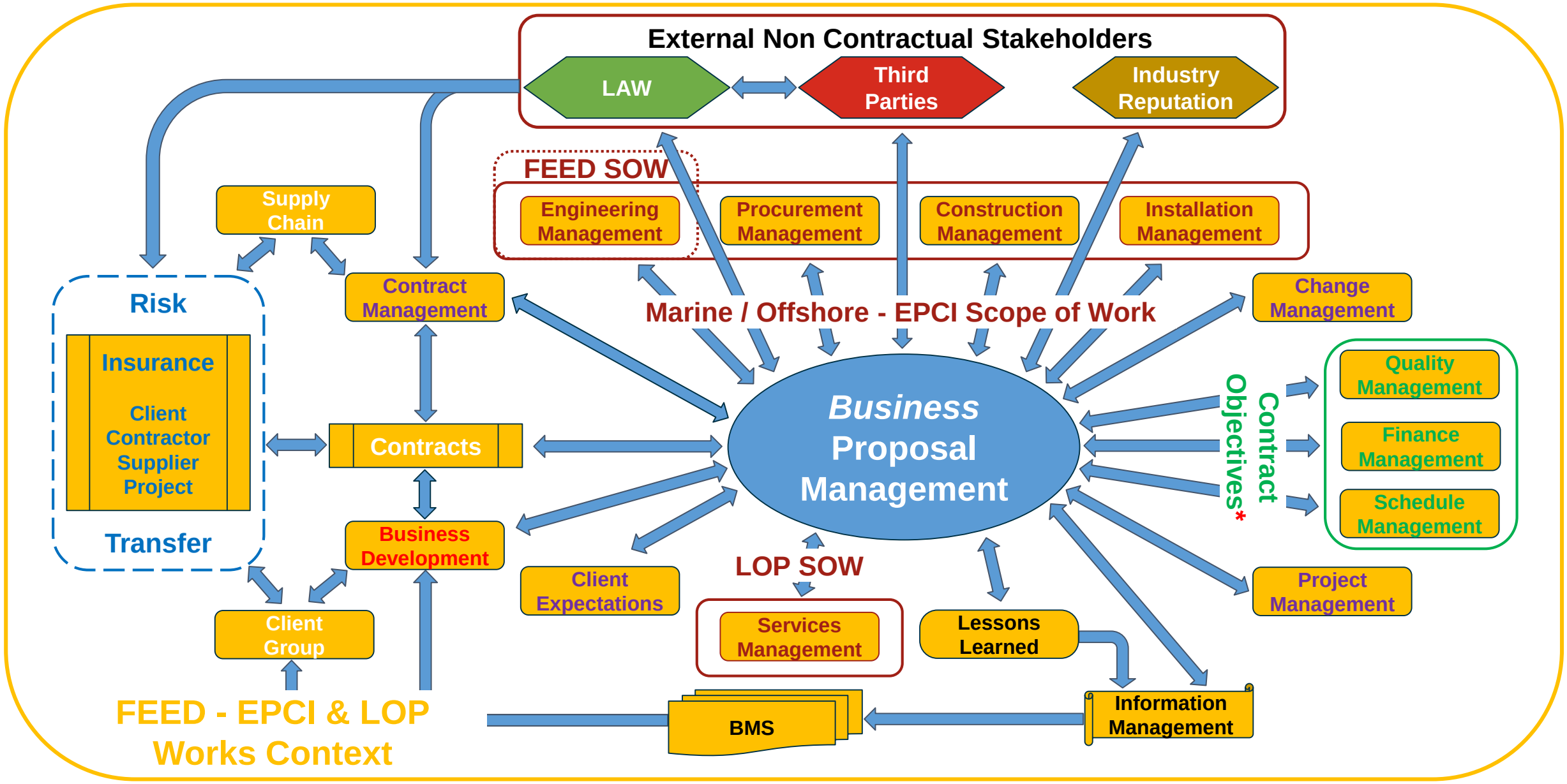
**Source – IMCA contracting principles*

(Risk and Contract work group)

The traditional Risk Allocation model is however being increasingly challenged by Offshore Oil & Gas and Offshore Wind Industry who are demanding increasing Supply Chain accountability

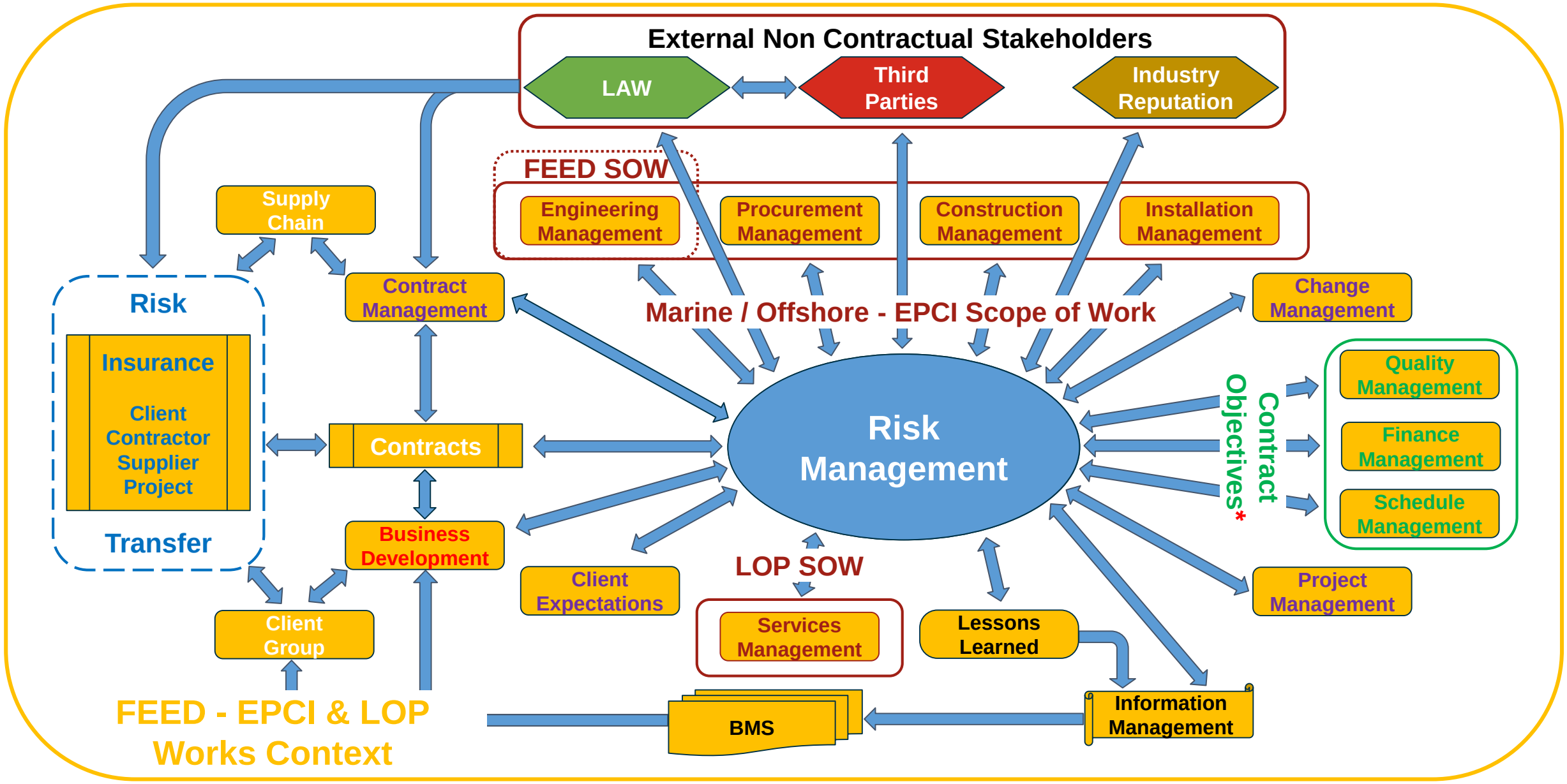
Offshore Energy Business Case & Project Risk Management Simplified

Proposal Management – FEED - EPCI & Life of Project



* Contract Objectives should align with Project Objectives * *

Project - Management – FEED - EPCI & Life of Project



* Contract Objectives should align with Project Objectives * *

* * Risk Management is Meeting or Exceeding Project Objectives

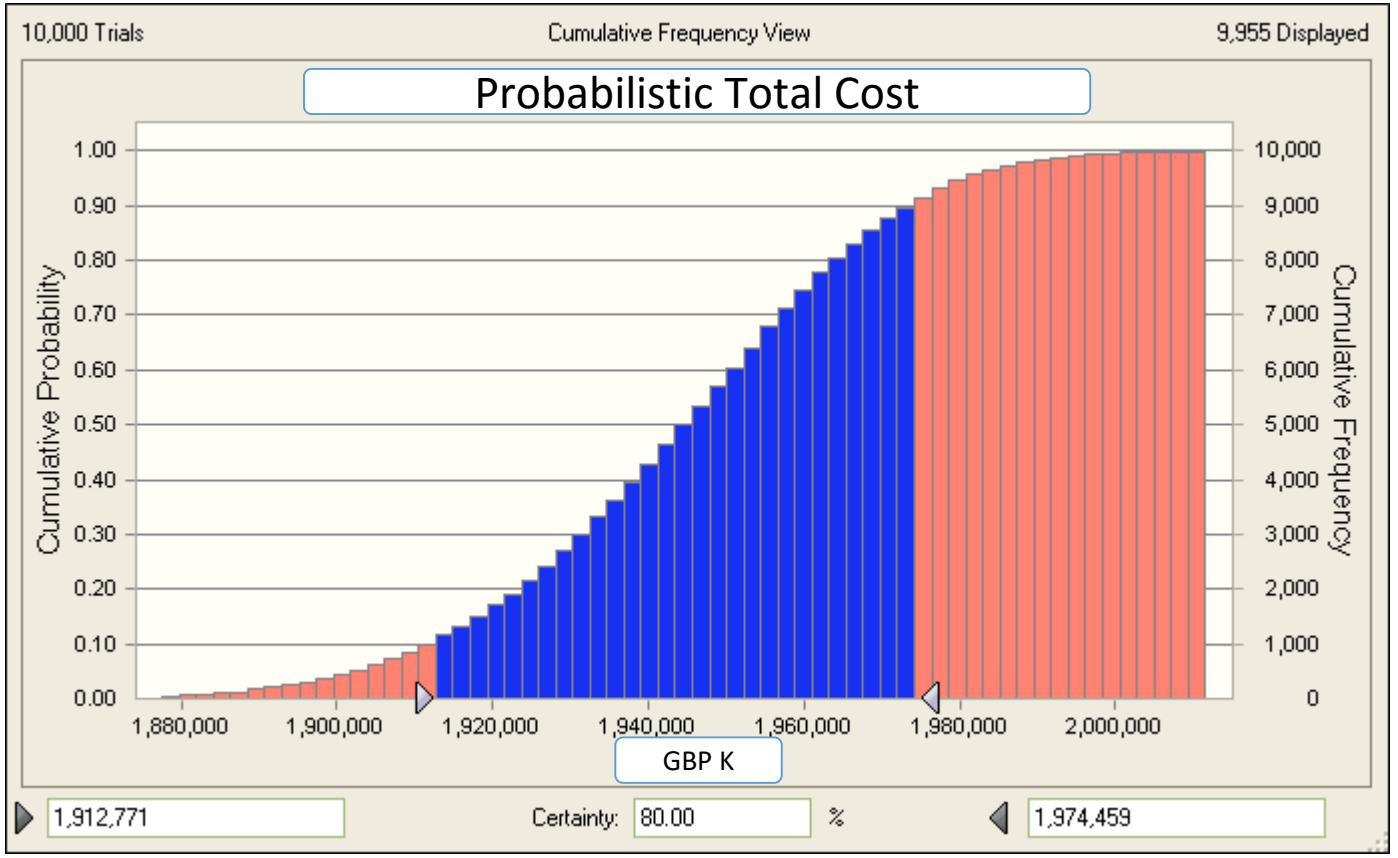
Note : There are extra slides in the simplified mechanics of Risk Management in this presentation

- THANK YOU -

ANY QUESTIONS

Additional Extra Slides Below

Extra Slides - Pricing Uncertainties & Risks



Determining Contingencies – building an analysis model

Extra Slides - Pricing Uncertainties & Risks

Is it correct to state that a budget is **measurement** of the estimated Cost, Time & the Resources required to execute a Project ?

What is the meaning of a **measurement** ?

"Any measurement that you make without the knowledge of its uncertainty is completely meaningless"

Professor Walter Lewin,
Professor of Physics at MIT

Extra Slides - Pricing Uncertainties & Risks

What is the meaning of a **Risk Assessment** ?

What is a **Model** ?

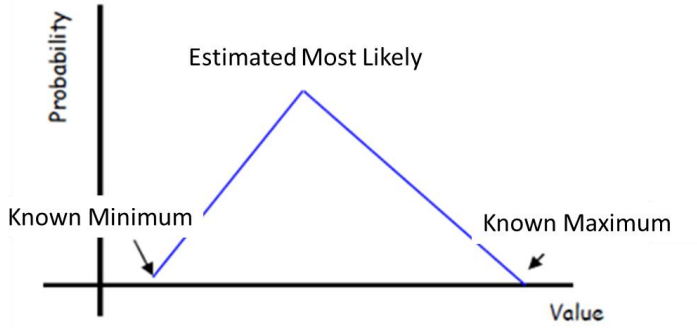
In Risk Management, **Models** are used for **Risk Assessment**

"all models are wrong, but some are useful"

George E. P. Box,
Mathematician / Statistician

Extra Slides - Pricing Uncertainties & Risks

Four Basic Distribution Functions Simplified



1 - Triangular 3 Point Estimate - Used when a best Most Likely estimate is known within a range to a known Minimum and a known Maximum.

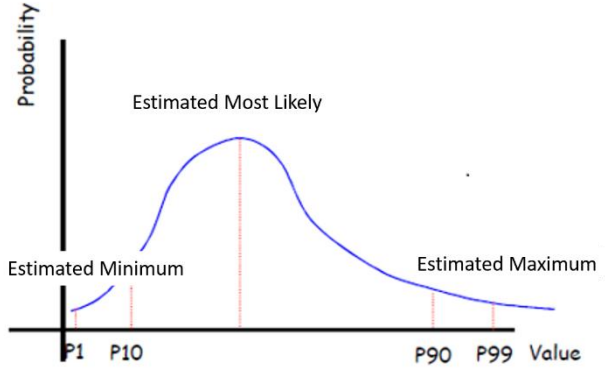
What is an example of a Triangular Distribution

Remember: "***all models are wrong***, ***but some are useful***."

Roll of 2 Dice		
Sum	Probability	
2	2.78%	Known Minimum
3	5.56%	
4	8.33%	
5	11.11%	
6	13.89%	
7	16.67%	Known Likely / Peak
8	13.89%	
9	11.11%	
10	8.33%	
11	5.56%	
12	2.78%	Known Maximum

Extra Slides - Pricing Uncertainties & Risks

Four Basic Distribution Functions Simplified



2 - Beta Pert 3 Point Estimate – Used when a resulting value is forecast to lie within a range specified by an estimated Minimum and an estimated Maximum and assumption that the resulting value will tend to concentrate in the vicinity of the estimated Most Likely value.

What is an example of a Beta Pert Distribution

Duration of Travel	
Day	Time
1	9 min
2	22 min
3	18 min
4	20 min
5	45 min
6	19 min
7	15 min
8	10 min
9	20 min
10	21 min
11	19 min

Likely Minimum

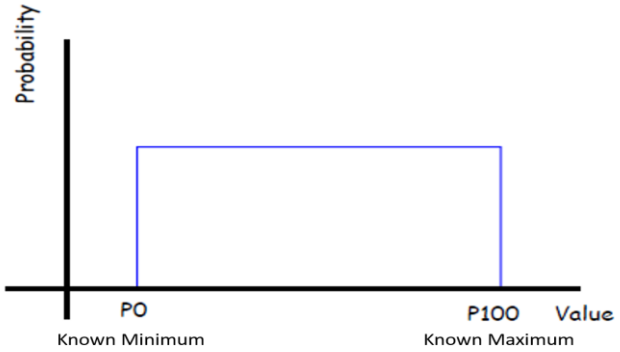
Likely Maximum

Likely Value
20 Minutes

Remember: "***all models are wrong***, ***but some are useful***."

Extra Slides - Pricing Uncertainties & Risks

Four Basic Distribution Functions Simplified



3 - Uniform – Used when a Minimum and Maximum values are known and the Most Likely value is unknown and may occur with equal probability between the known Minimum and Maximum values

What is an example of a Uniform Distribution

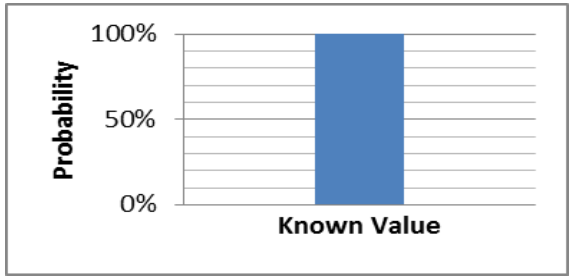
What is the Likely duration of the ride ?

Maximum and Minimum ?

You tell me … ???

Extra Slides - Pricing Uncertainties & Risks

Four Basic Distribution Functions Simplified



4 – Single Point - is a discreet distribution with a known impact value

What is an example of a Single Point Distribution

HEADS

Two sides of the same coin …

TAILS

Extra Slides - Pricing Uncertainties & Risks

Quantitative Risk Assessment

Example modified & adapted from actual Offshore Energy Works Contract

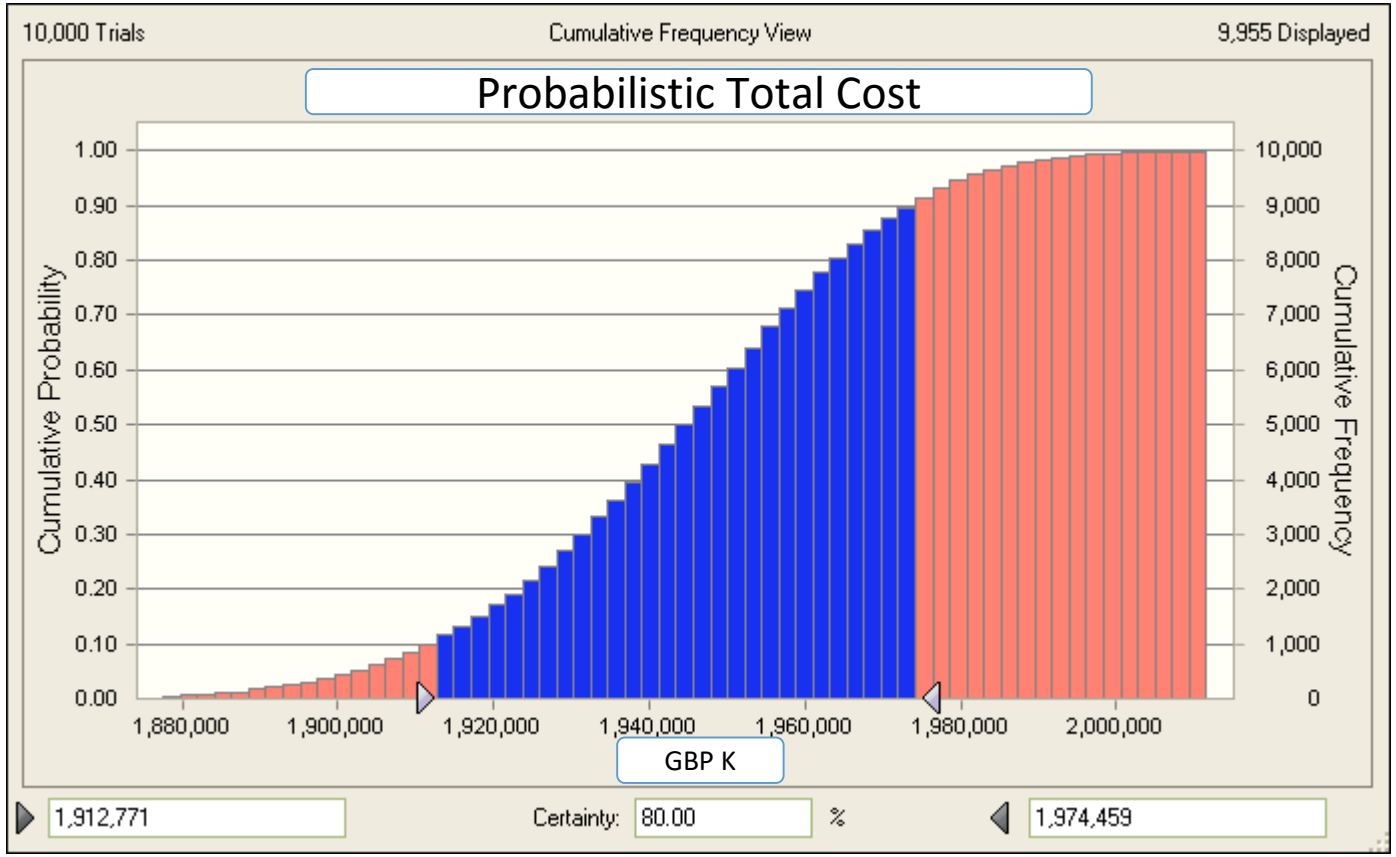
A	OPERATIONS												MINIMUM		LIKELY		MAXIMUM	
Activity A1	Activity Name & WBS WBS - EV002722E01A	Prob	Unit	Unit Cost K GBP	Unit Use K GBP	Budget K GBP	MIN	LIKELY	MAX	P	X		Schedule	Cost K GBP	Schedule	Cost K GBP	Schedule	Cost K GBP
Vessel - Campaign - The Grampian Opportunity																		
A1-01	Mobilization	U	£ / day	£ 229	day 4.1	£ 939	0.95	1.00	1.05		1		day 3.9	£ 892	day 4.1	£ 939	day 4.3	£ 986
A1-02	Preparatory Works	U	£ / day	£ 229	day 3.0	£ 687	0.95	1.00	1.20		1		day 2.9	£ 653	day 3.0	£ 687	day 3.6	£ 824
A1-03	Trenching	U	£ / day	£ 229	day 6.7	£ 1,534	0.95	1.00	1.05		1		day 6.4	£ 1,458	day 6.7	£ 1,534	day 7.0	£ 1,611
A1-05	Installation Clamps	U	£ / day	£ 229	day 8.9	£ 2,038	0.95	1.00	1.20		1		day 8.5	£ 1,936	day 8.9	£ 2,038	day 10.7	£ 2,446
A1-06	Preparatory Works	U	£ / day	£ 229	day 3.0	£ 687	0.95	1.00	1.20		1		day 2.9	£ 653	day 3.0	£ 687	day 3.6	£ 824
A1-07	Demobilization	U	£ / day	£ 229	day 2.0	£ 458	0.95	1.00	1.15		1		day 1.9	£ 435	day 2.0	£ 458	day 2.3	£ 527
Vessel - Downtime - The Grampian Opportunity																		
A1-18	Vessel Breakdown	0.1	£ / day	£ 308	day 31.0	N-A	0.95	1.00	1.20	0.1%	0		day 29.5	£ 9,071	day 31.0	£ 9,548	day 37.2	£ 11,458
A1-19	Weather Risk	0.2	£ / day	£ 229	day 31.0	N-A	0.95	1.00	1.20	35%	0		day 29.5	£ 6,744	day 31.0	£ 7,099	day 37.2	£ 8,519
Vessel - Downtime - The Grampian Opportunity																		
A1-21	Fuel Rechargeable (Rate 1)	U	£ / m3	£ 0.251	m3 2,369	£ 595	0.95	1.00	1.20		1		N-A	£ 565	N-A	£ 595	N-A	£ 714
Vessel - Personnel & Assets - The Grampian Opportunity																		
A1-26	Project Engineer	U	£ / hour	£ 0.177	hour 157.9	£ 28	0.95	1.00	1.20		1		day 150	£ 27	day 158	£ 28	day 189	£ 34
A1-31	Dive Supervisor	U	Lump	£ 74	Lump	£ 74	0.95	1.00	1.20		1		N-A	£ 70	N-A	£ 74	N-A	£ 89
B	PROJECT MANAGEMENT																	
B1-01	Project Manager	U	£ / hour	£ 0.124	hour 7,753	£ 961	0.95	1.00	1.20		1		N-A	£ 913	N-A	£ 961	N-A	£ 1,154
B1-02	Contracts Manager	U	£ / hour	£ 0.102	hour 7,345	£ 749	0.95	1.00	1.20		1		N-A	£ 712	N-A	£ 749	N-A	£ 899
B1-03	Risk Manager (corporate O/H)	U	£ / hour	£ 0.117	hour 1,296	£ 152	0.95	1.00	1.20		1		N-A	£ 144	N-A	£ 152	N-A	£ 182
B1-11	Document Control	U	£ / hour	£ 0.051	hour 7,289	£ 372	0.95	1.00	1.20		1		N-A	£ 353	N-A	£ 372	N-A	£ 446
C	ENGINEERING																	
C1	WBS - EN002722E01C																	
C1-1	George Grangeon A	U	£ / hour	£ 0.189	hour 161.0	£ 0	0.90	1.00	1.15		1		day 145	£ 27	day 161	£ 30	day 185	£ 35

G	DISCRETE RISKS	Impact Cost K GBP	P	X
G-01	80% Probability underestimated procurement costs by 5% because of missed items	£ 2,537.697	80%	0
G-02	90% Probability that logistics and transportation costs are underestimated by 10%	£ 0.618	90%	0
G-03	5% Probability of fabrication delays resulting in additional costs of 1,000 K	£ 1,000.000	5%	0

Extra Slides - Pricing Uncertainties & Risks

Quantitative Risk Assessment - S curves – Monte Carlo Analysis

Example modified & adapted from actual Offshore Energy Works Contract



Example (if) : Deterministic Total Cost ≈ 1,930,000
Probabilistic Total Cost (P80) ≈ 1,965,000
P80 Cost Contingency ≈ + 35,000 and Deterministic Total Cost ≈ P30

Extra Slides –Qualitative Assessments

Qualitative Risk Assessment
Step 1 - Risk Scoring Scheme Matrix

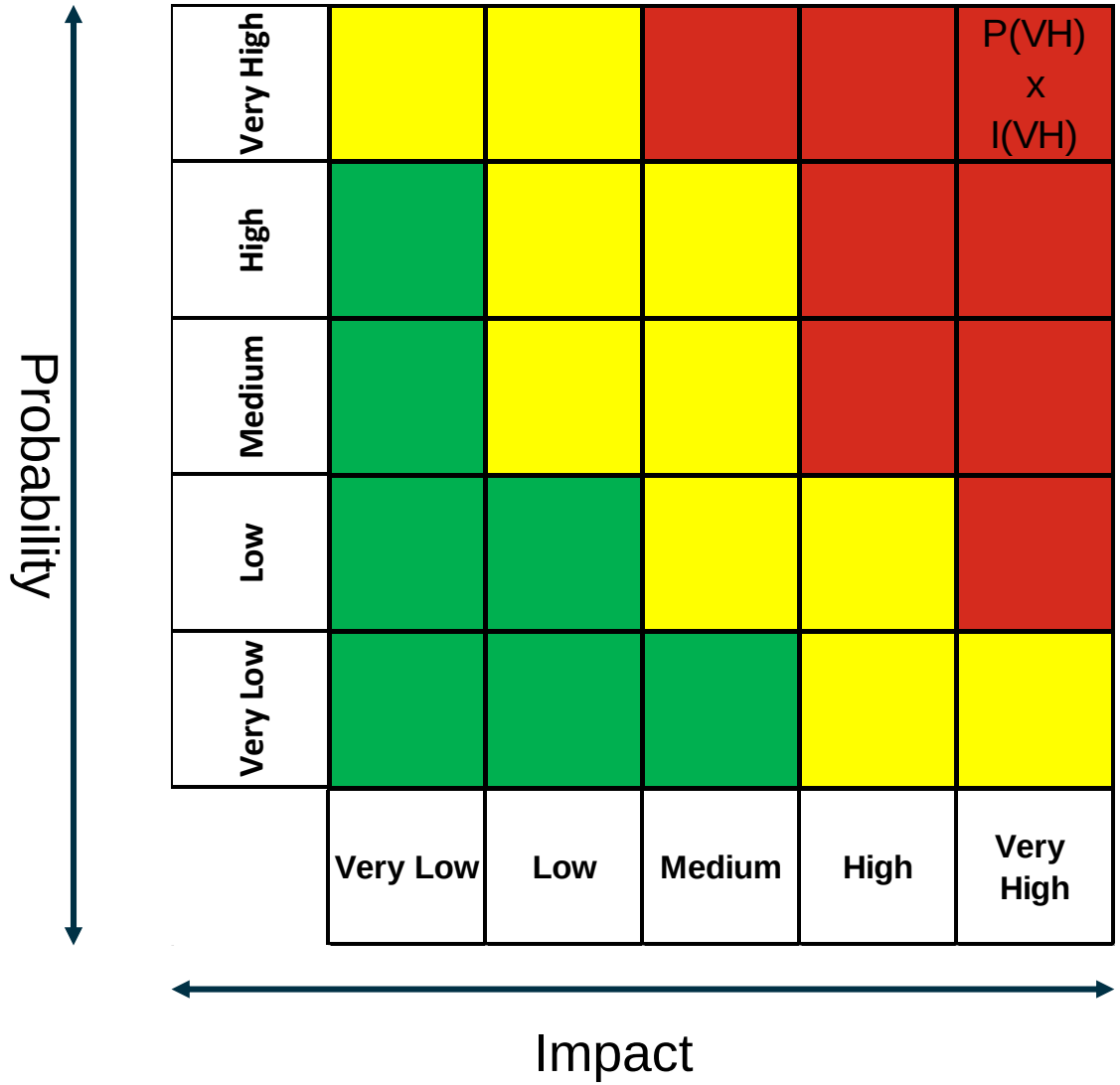
Probability

QUALITATIVE ASSEESSMENT CRITERIA				
Nomenclature	**Probability**	**Cost Impact**	**Schedule Impact**	**Quality Impact**
VERY HIGH	**> XX % Occurrence is almost inevitable**	**> XX % Of Expected Returns**	**> XX Days Delay**	**Failure to achieve XX Specification**
HIGH	**XX % - XX % Occurrence is probable**	**XX % - XX % Of Expected Returns**	**XX - XX Days Delay**	**Failure to achieve XX Specification**
MEDIUM	**XX % - XX % Occurrence is possible**	**XX % - XX % Of Expected Returns**	**XX - XX Days Delay**	**Failure to achieve XX Specification**
LOW	**XX % - XX % Occurrence is low but credible**	**XX % - XX % Of Expected Returns**	**XX - XX Days Delay**	**Failure to achieve XX Specification but within Tolerance**
VERY LOW	**< XX % Occurrence is not credible**	**< XX % Of Expected Returns**	**< XX Days Delay**	**Minor deviation from XX Specification**

Impact

Extra Slides – Qualitative Assessments

Qualitative Risk Assessment
Step 2 – Risk Heat Map



The Qualitative Risk Assessment Risk Heat Map is determined in accordance with the key (parameters) defined in the Qualitative Assessment **Risk Scoring Scheme Matrix**

Scoring Example :

if Probability Very High = 5
If Impact Very High = 5
Score = 25

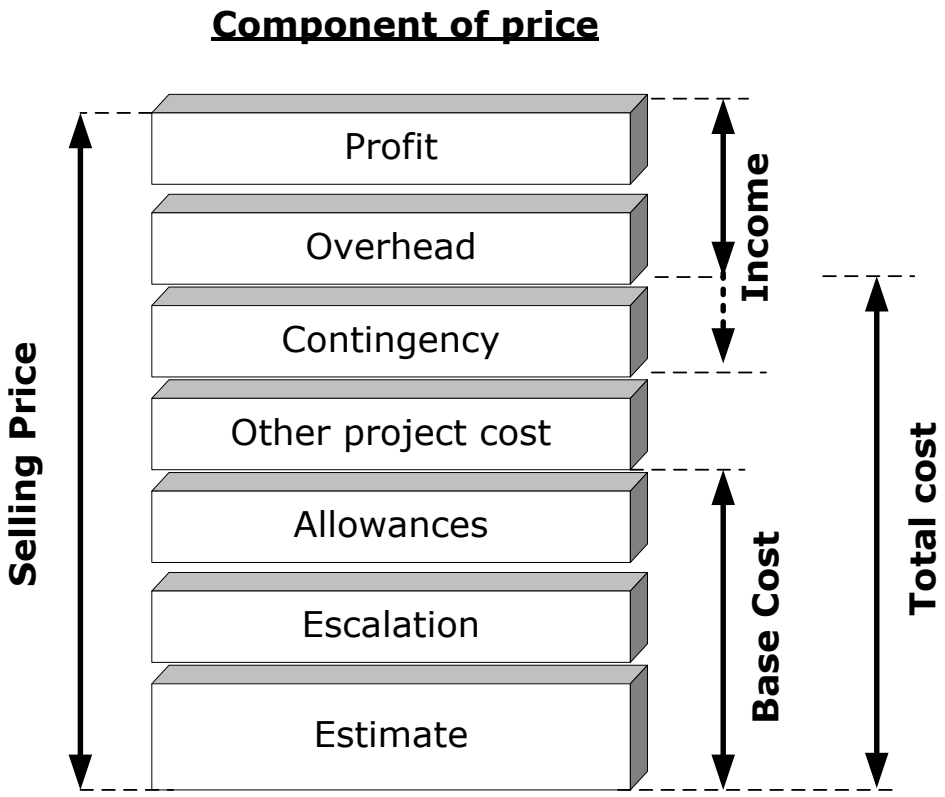
Extra Slides – Financial Management

Selling Price – Cost - Income & Profit

The **Selling Price** is made up of two main components Cost and Income.

Cost comprises the project cost estimate, escalation, allowances and other project costs;

Income comprises profit & overhead.



Contingency is treated as a risk and therefore it can either be a Cost or an opportunity for additional profit and as such be treated as Income.

Extra Slides – Financial Management

Selling Price – Cost

Estimate: is determined in accordance with the level of knowledge and pricing maturity of the company for the specific project deliveries.

Allowances: is the **provision of a sum of money** to cover variations to a project cost estimate (cost allowances) and /or project schedule (duration allowances) which based on past knowledge and experience **we can anticipate** will be required to complete that scope of work.

Escalation: is determined in accordance with the level of knowledge and pricing maturity of the company for the specific project deliveries.

Other Project Costs: These are additional costs which are generally attributed to specific contract conditions and/or other financial requirements.

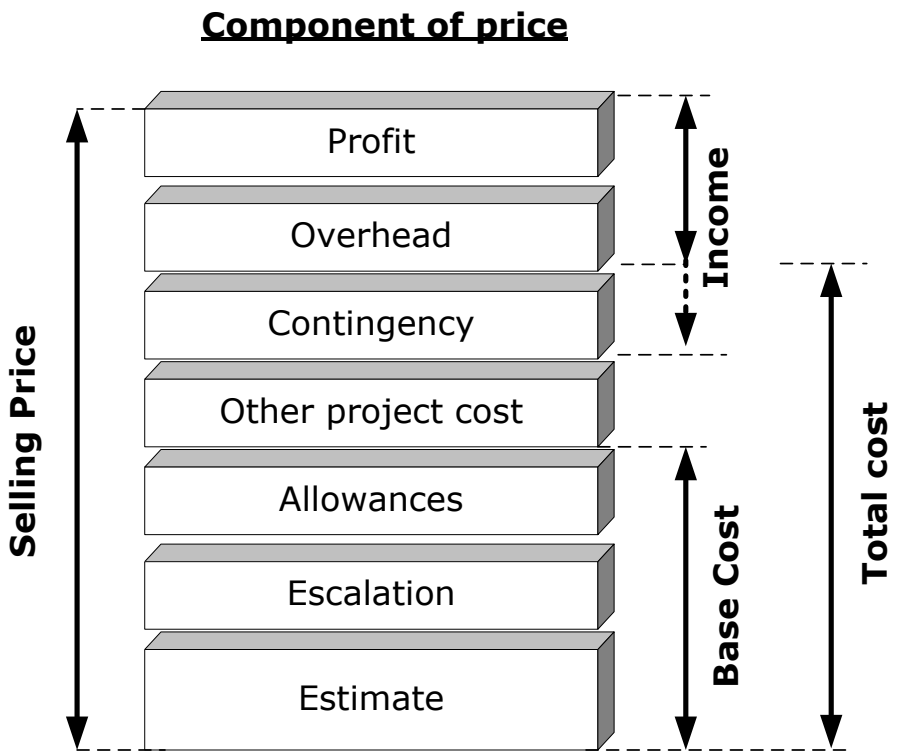
Contingency: *is treated as a risk and therefore it can either be a Cost or an opportunity for additional profit and as such be treated as Income.*

Extra Slides – Financial Management

Selling Price – Income & Profit

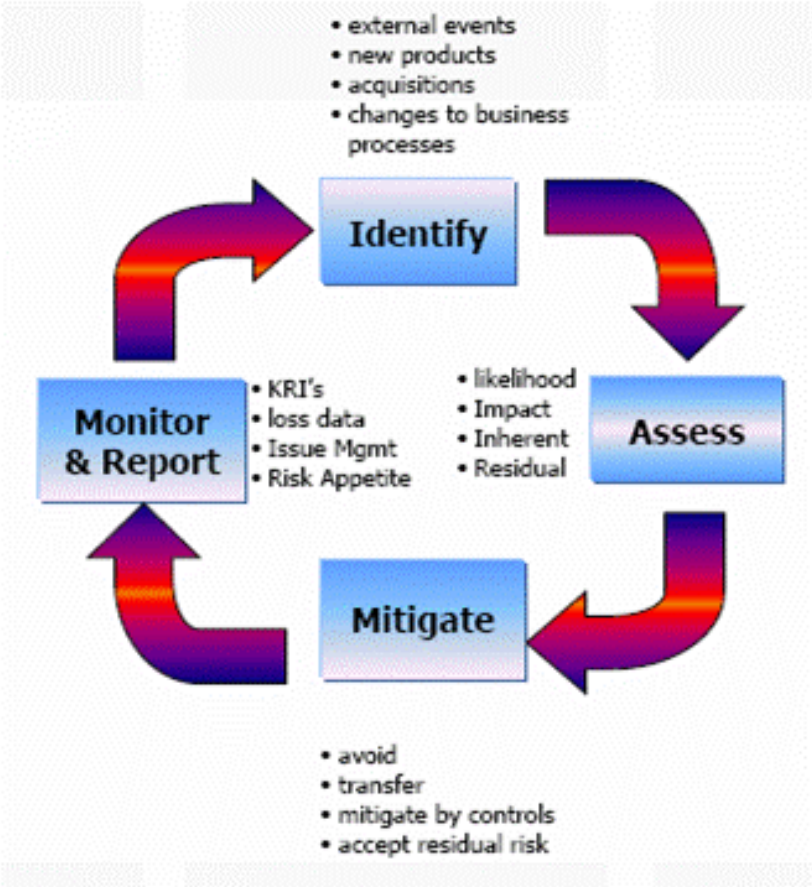
Overheads: are generally Territory Overheads and/or Corporate Overheads.

Profit: is the margin added either as a percentage or otherwise to arrive at the Client Selling Price. Review and approval of the selling price is decided by the Tender Board in light of market conditions and Company workload / performance.



Contingency *is treated as a risk and therefore it can either be a Cost or an opportunity for additional profit and as such be treated as Income.*

Extra Slides – Risk Management Plan



If you don't frequently review your project Risk Management Plan you should probably review your project Decision Management Quality

Thank You

George Grangeon
Contracts & Business Development Consultant

george.grangeon@jbsengineering.co.uk

Sea-Axe JBS Subsea

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