

# ***Benefits & Methods for Quantifying Operational Risk***

*Perspectives from Decision Science*

**Webinar**

6 December 2018

**Presented to:**



**Presented by:**

**Carl Spetzler**

**Warwick Blyth**

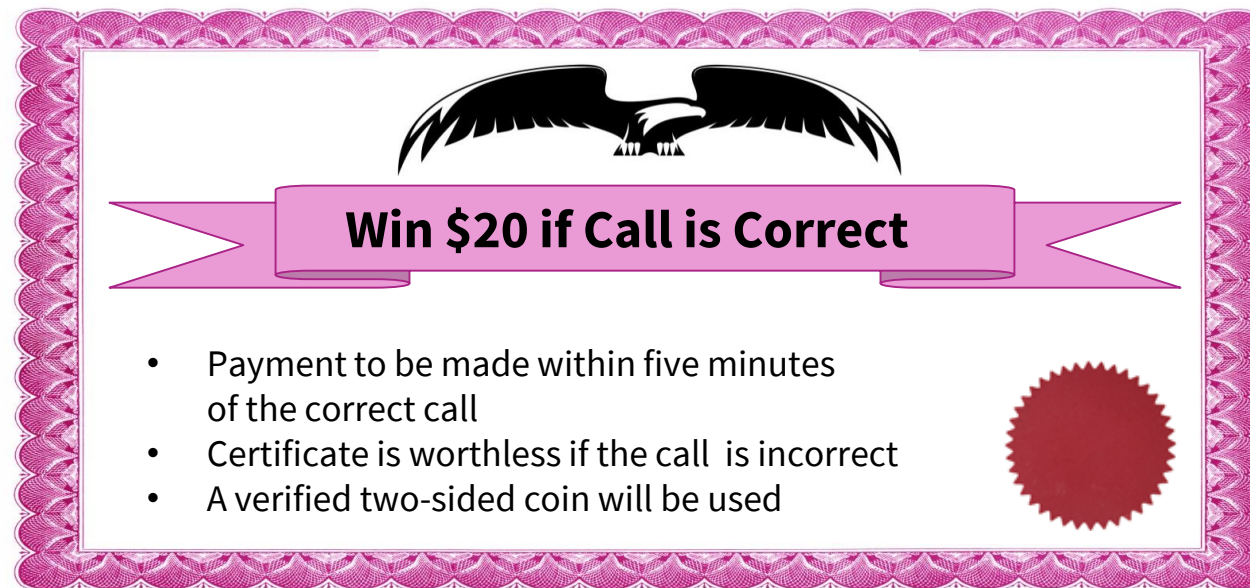


# Agenda

- **Risk & Opportunity: Opposite Sides of the Coin**
- Risk Prioritisation: Overcoming the Pitfalls of Heat Maps
- Characterising and Understanding Risk: Some Tools
- Final Thoughts

# What is a risk anyway? When is it an opportunity?

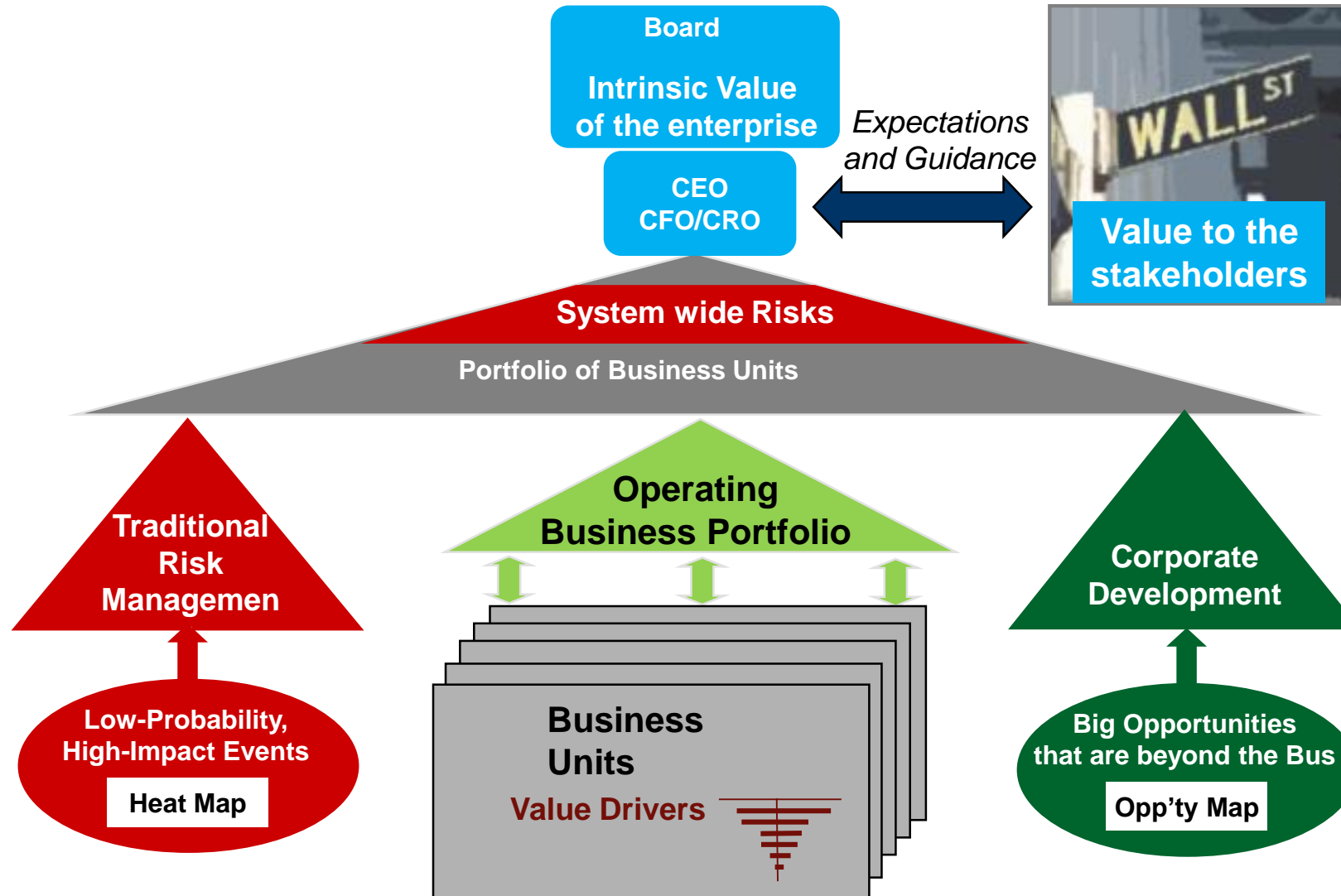
- I am offering a valuable instrument.
  - It is free.
  - Success is contingent on calling the flip of a coin correctly.
  - If the call is correct, the bearer receives \$ 20
  - If the call is incorrect, the instrument becomes worthless.



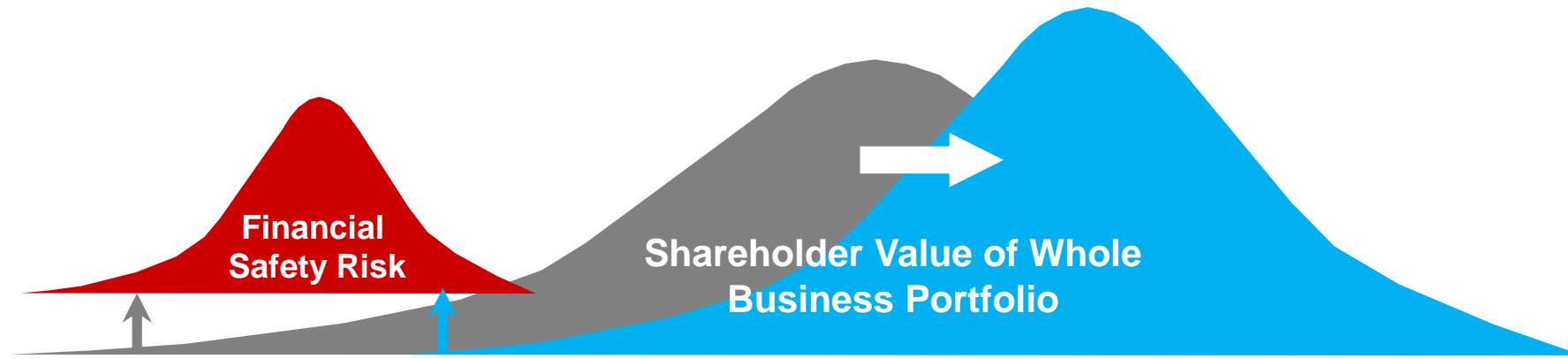
## Consider this ...

- Is the instrument worth something?
- Do you have a risk in accepting the offer?
- Assuming that you have accepted the offer and now you own it, do you have a risk?
- When did the opportunity change into a risk?

# The tools for characterizing and quantifying uncertainty are the same whether we are talking about traditional “risks” or opportunities.



# The primary goal of the CEO and Board is to shift the uncertainty to the right and reduce it.



- This includes all the upside and the downside opportunities
- Individual risks and opportunities are incremental changes to the whole value distribution
- Uncertainty management requires managers in different functional roles to handle specific strategic and operational risks.

# Decision analytic tools and methods can help the Risk Management process at various points.

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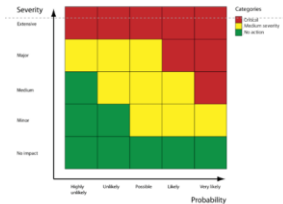
*What are the risks?*



**Enterprise level understanding of risk**  
**Risk Registers**  
**Business Tornado**

## 2. Assessment & Selection

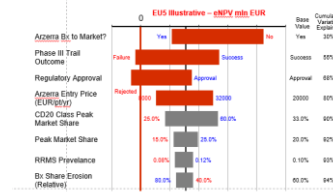
*What is the likelihood of the risk occurring?  
 How severe will the risk impact be?*



**Heat Maps**  
**Expected Loss**  
**Assessment Techniques**

## 3. Mitigation/Decisions

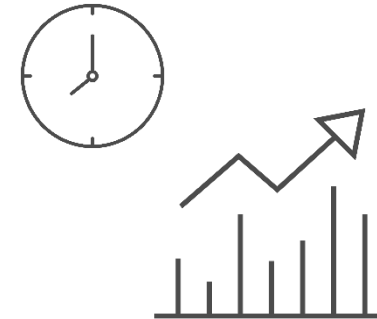
*What can we do to reduce the risk impact or likelihood of occurrence?*



**Influence Diagrams**  
**Opportunity Tornado**  
**Probabilistic Modelling**

## 4. Monitoring & Control

*Are the risk owners managing the risks?  
 Has the situation changed?  
 Are there new risks emerging?*



**Continuing management effort**

**Progressive Screening to Focus Resources on Highest Value Risks**

**1000s**

**Top 20 ~10 Decision Projects**

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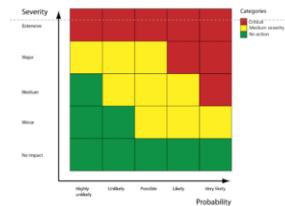
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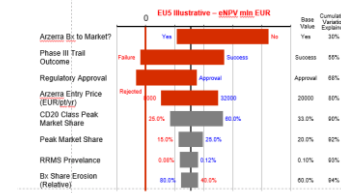
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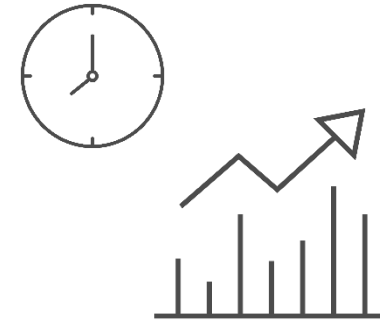
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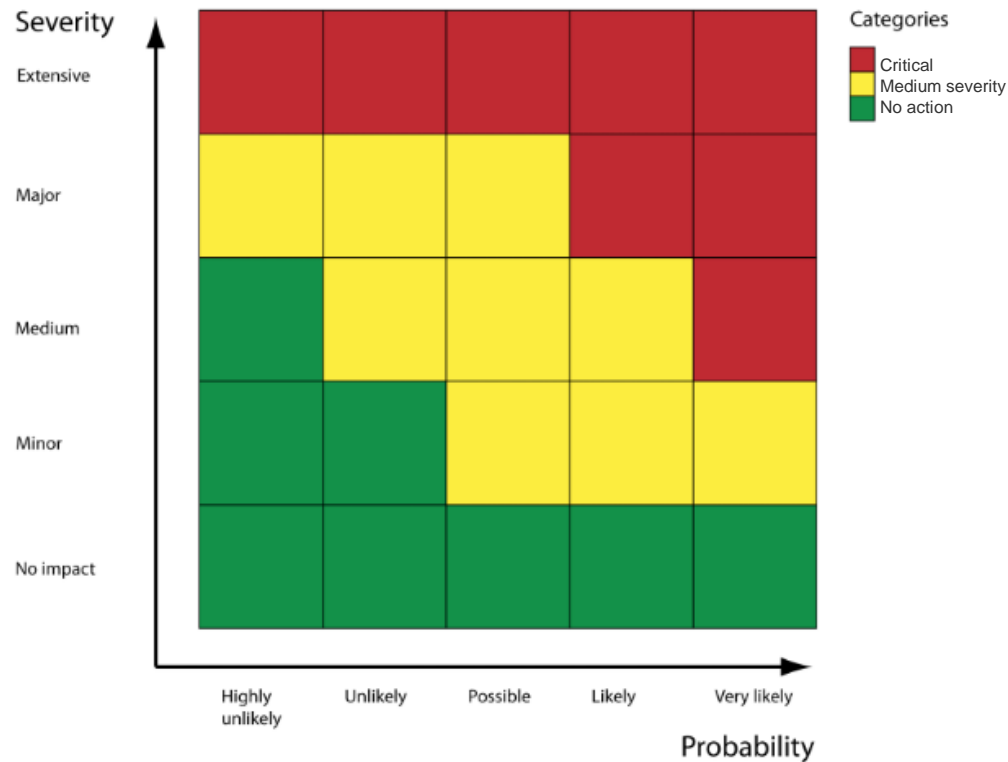
# **Poll:** How do you prioritize risks in your organization?

- a) Not at all
- b) Adhoc/subjective approach
- c) Use a Heat Map/Risk Matrix (Red/Yellow/Green)
- d) Quantitative approach e.g. Expected Loss



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# Heat Maps (or Risk Matrices) are commonly used to assess and prioritize risks and are considered a “best practice” for this purpose.



## Purported Benefits of Heat Maps

- They are easy to create.
- They are easy to assess.
- They are easy to score.
- They improve communication!

*The risk matrix (heat map) is a strongly applicable tool for risk identification, risk analysis, and risk evaluation.*

**— ISO (International Organization for Standardization)**

## .. But there is relatively little theory behind “Heat Maps” and numerous practical flaws have been identified.

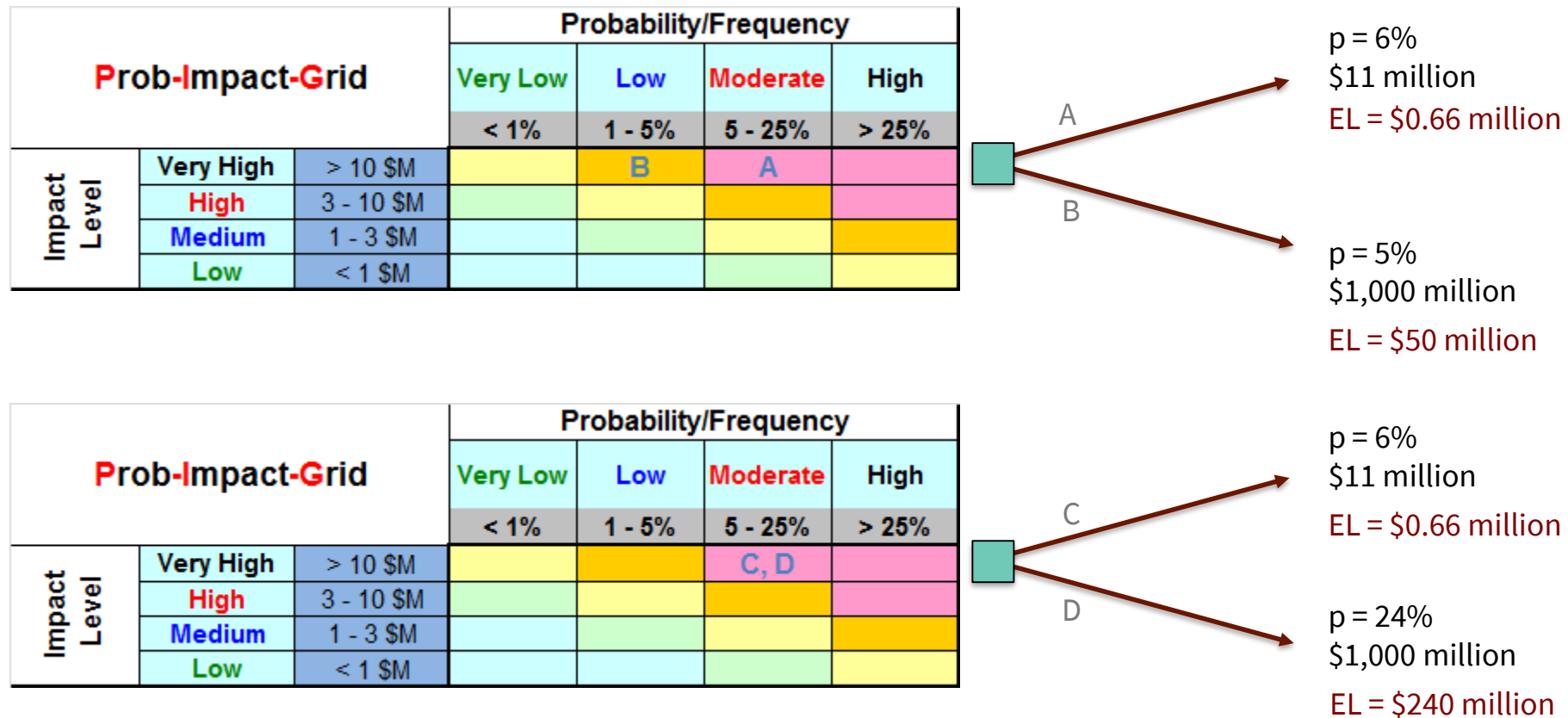
### 4 examples:

Flaw	Description
Risk Acceptance Inconsistency	Accepting risks that are worse than risks that are rejected
Range Compression (Lie Factor)	Gross distortions of the likelihood, but especially the consequence scale, which biases decision making
Centering Bias	The tendency of people to avoid extreme values or statements when presented with a choice.
Arbitrary Ranking	The risk ranking produced by a heat map is determined by <i>arbitrary</i> decisions regarding its construction, such as the number and size of categories and if one prefers to use large or small numbers to signify greater risks.

For more on this see the webinar by Eric Bickel (<https://sdg.com/webinars/webinar-the-pitfalls-of-heat-maps-powerful-alternative-risk-management-methods/>) or the “The Risk of Using Risk Matrices.” <https://www.onepetro.org/journal-paper/SPE-166269-PA>

# Example: Range Compression inconsistency.

Outcomes with vastly different consequences and likelihoods are often placed in the same position in the matrix, leading to gross inconsistency in the recommended action.



## So what should we do?

*“it seems clear to us that RMs should not be used for decisions of any consequence..... Our best chance for providing high-quality risk-management decisions is to apply the well-developed and consistent set of processes and tools embodied in decision science*

*- Thomas et al in “The Risk of Using Risk Matrices”*

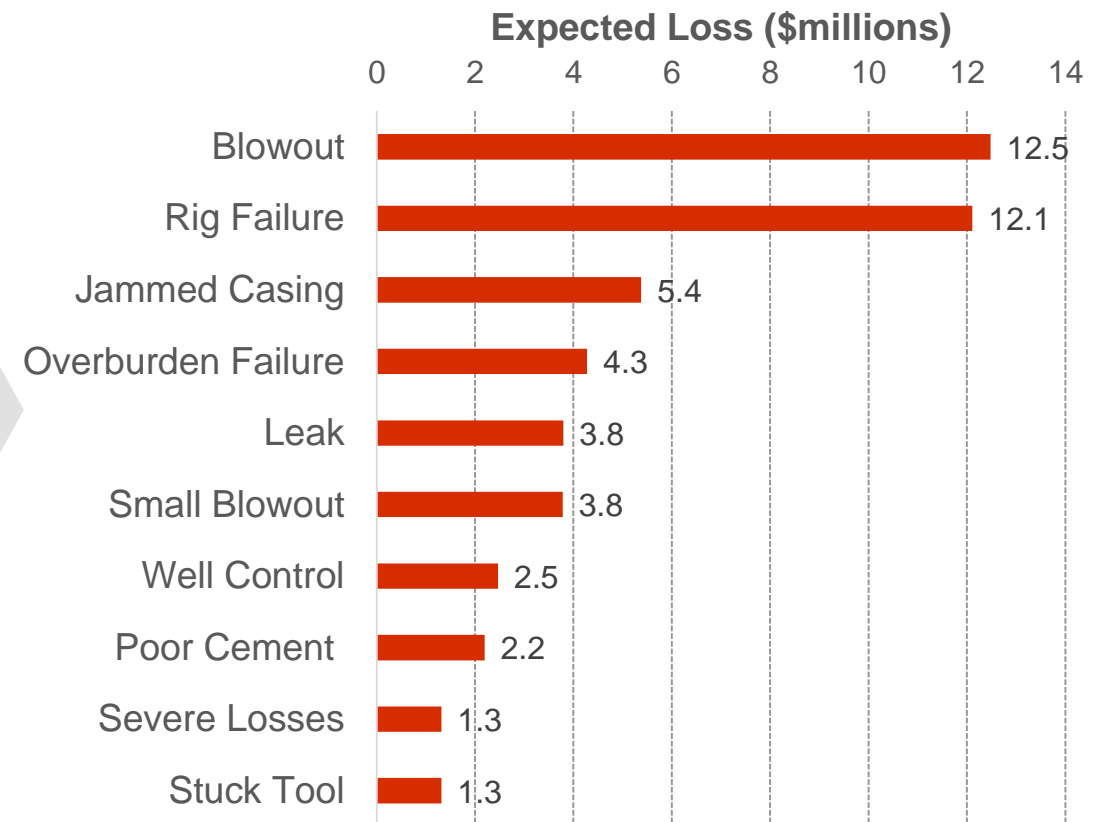
**Risk registers can easily be modified so that instead of using ordinal scales like 1-5, experts learn how to subjectively assess quantities behind them.**

Replace	With
Likelihood ratings on scales of 1 to 5 or “Low”, “Medium”, “High”	Estimated probability (0%-100%) the risk event will occur in a given period of time.
Impact ratings on scales of 1 to 5 of “Low”, “Medium”, “High”	An estimate of the average monetized loss resulting from the event <b>OR</b> A range estimate of the monetized loss e.g. 80% confidence interval of the monetized loss, or P10-P50-P90 assessment of the loss.

## Subjective assessment of probabilities and monetized outcomes allows prioritization of risks by their “expected” or probability-weighted loss.

Event Name	Probability Event Occurs (Annual)	Event Outcome (\$millions)	Expected Loss (\$millions)
Severe Losses	40%	3	1.3
Well Control	10%	25	2.5
Blowout	5%	250	12.5
Small Blowout	15%	25	3.8
Leak	20%	19	3.8
Rig Failure	30%	40	12.1
Overburden Penetration	8%	53	4.3
Jammed Casing	60%	9	5.4
Stuck Tool	40%	3	1.3
Poor Cement	2%	110	2.2

Sorted by descending EL

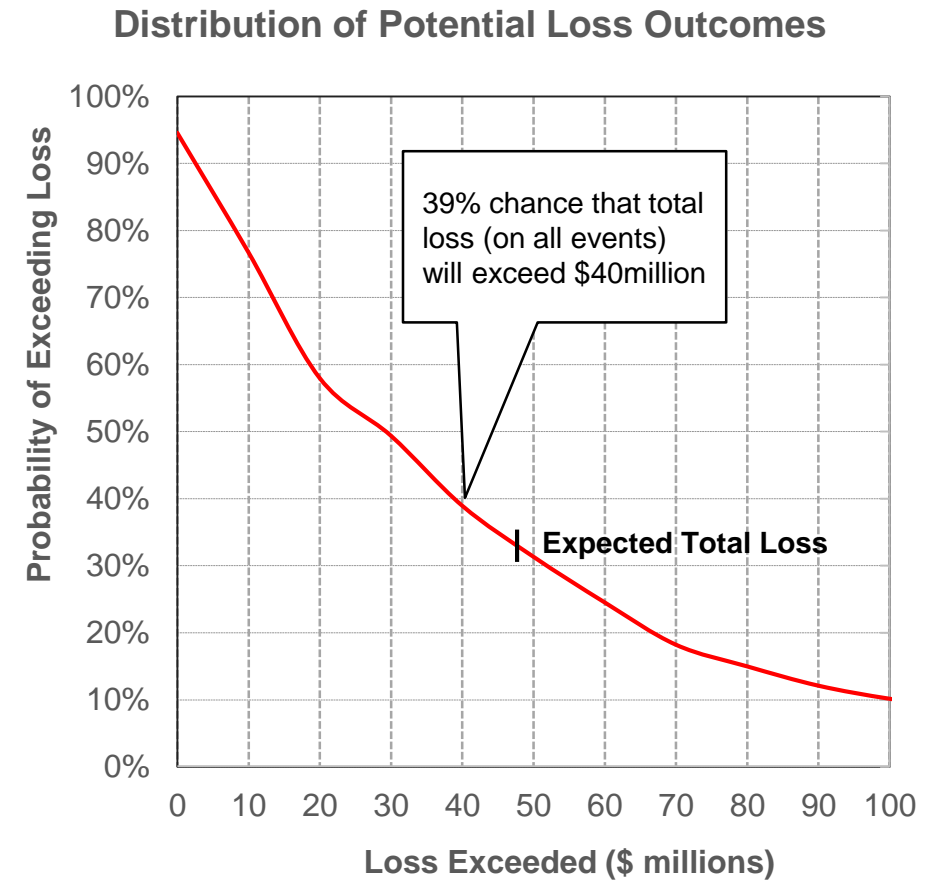


***“Expected loss” can be adjusted for risk appetite to provide an upper bound on how much you’d be prepared to invest to mitigate or fully offset the risk.***

## Assessing risks with actual assessments enables other tools that create useful visualisations of total portfolio risk.

Event Name	Probability Event Occurs (Annual)	Event Outcome (\$millions)		Expected Loss (\$millions)
		P10	P90	
Severe Losses	40%	2	5	1.3
Well Control	10%	20	30	2.5
Blowout	5%	205	300	12.5
Small Blowout	15%	10	50	3.8
Leak	20%	4	50	3.8
Rig Failure	30%	18	75	12.1
Overburden Penetration	8%	52	55	4.3
Jammed Casing	60%	8	10	5.4
Stuck Tool	40%	2	5	1.3
Poor Cement	2%	100	120	2.2

Monte Carlo Analysis



*This can be particularly useful if, for example, you wanted to understand total exposure to a category of risk e.g. cyber risk events.*



## Some practical considerations:

- In the case of very large risk registers it may not be essential to undertake the overhead of quantifying all the risks – a screening system to triage risk can be helpful.
  - This is necessarily subjective and really focuses on identifying lower priority risks
- Quantification is inherently subjective as are the common ordinal scale ratings.
  - What we are trying to do is capture a mental model in a consistent framework that supports clear and high quality decision making.
- Subjective assessments are subject to cognitive biases; calibration training can significantly improve expert performance in these assessments.
  - Assessments can also be assisted with data and/or analytical models which can be developed selectively to inform the process.

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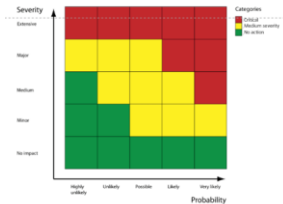
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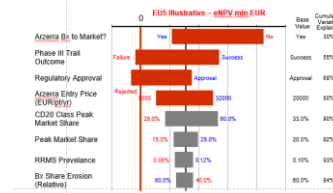
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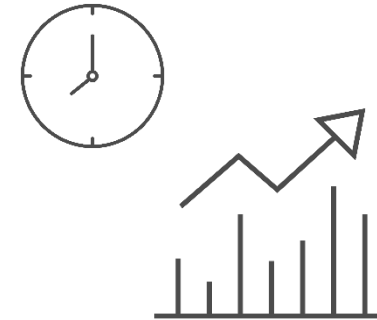
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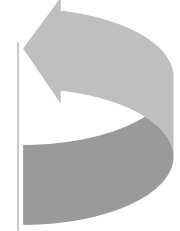


Continuing management effort

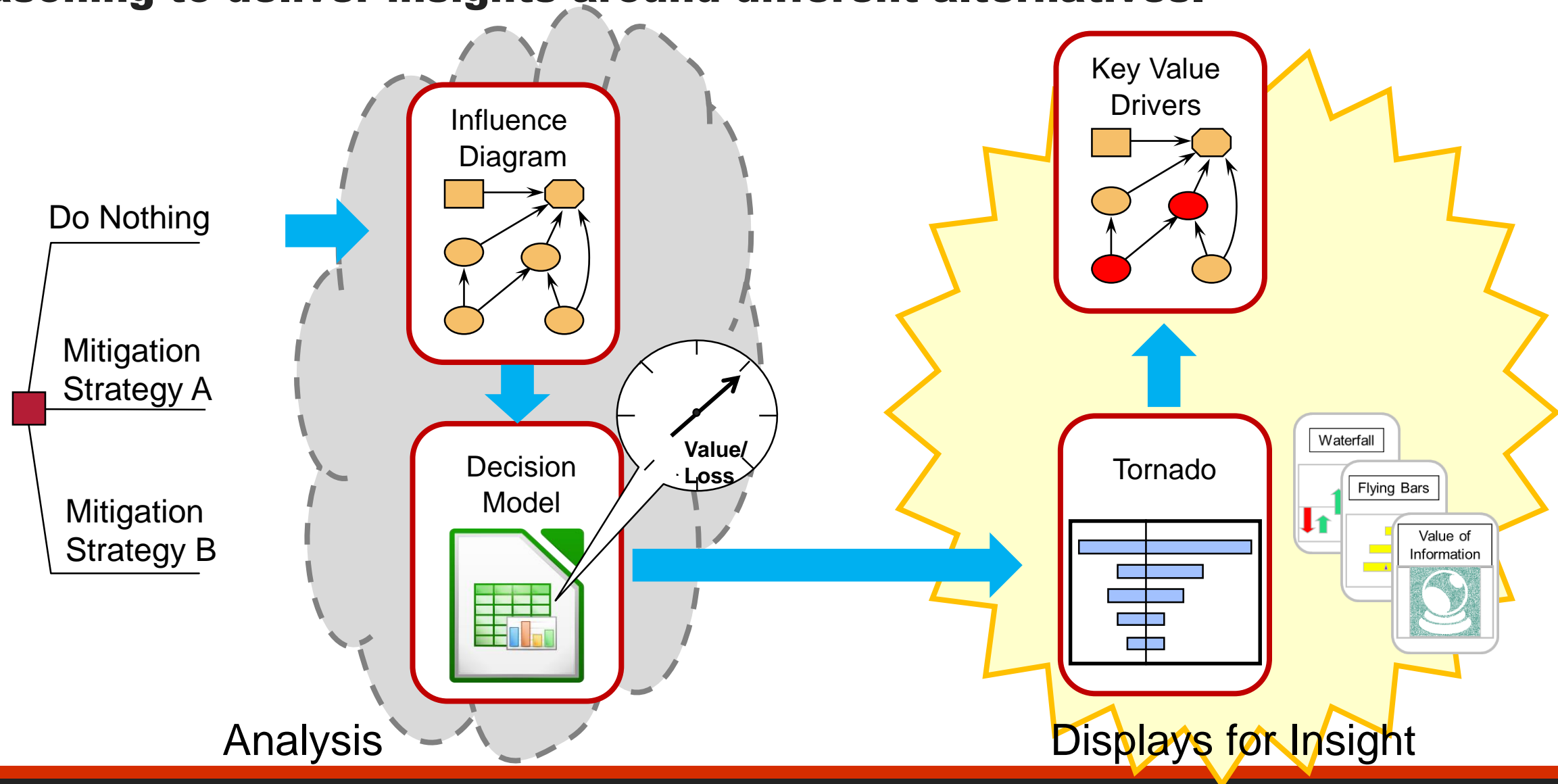
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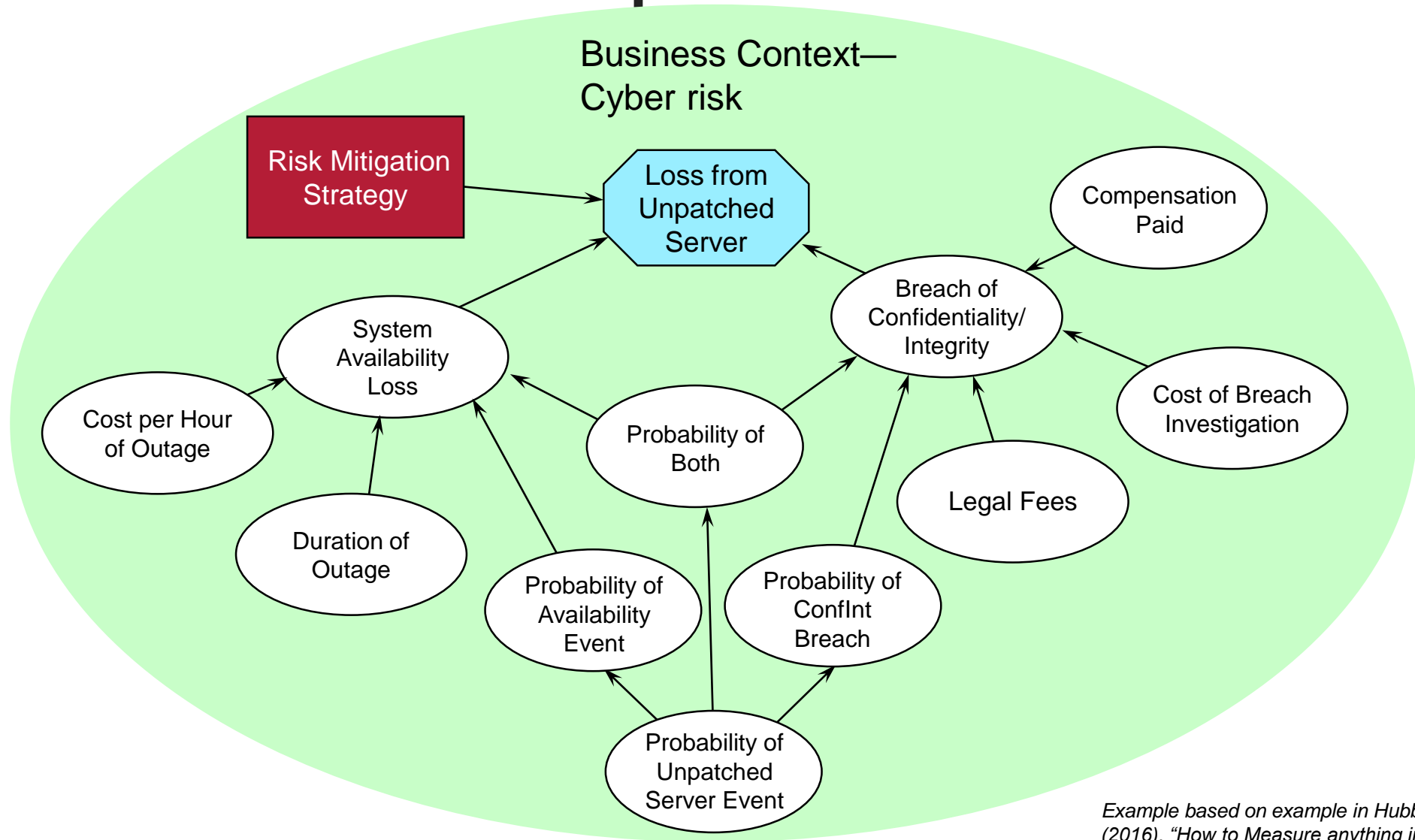
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**In complex situations, decision makers rely on analysts to use reasoning to deliver insights around different alternatives.**

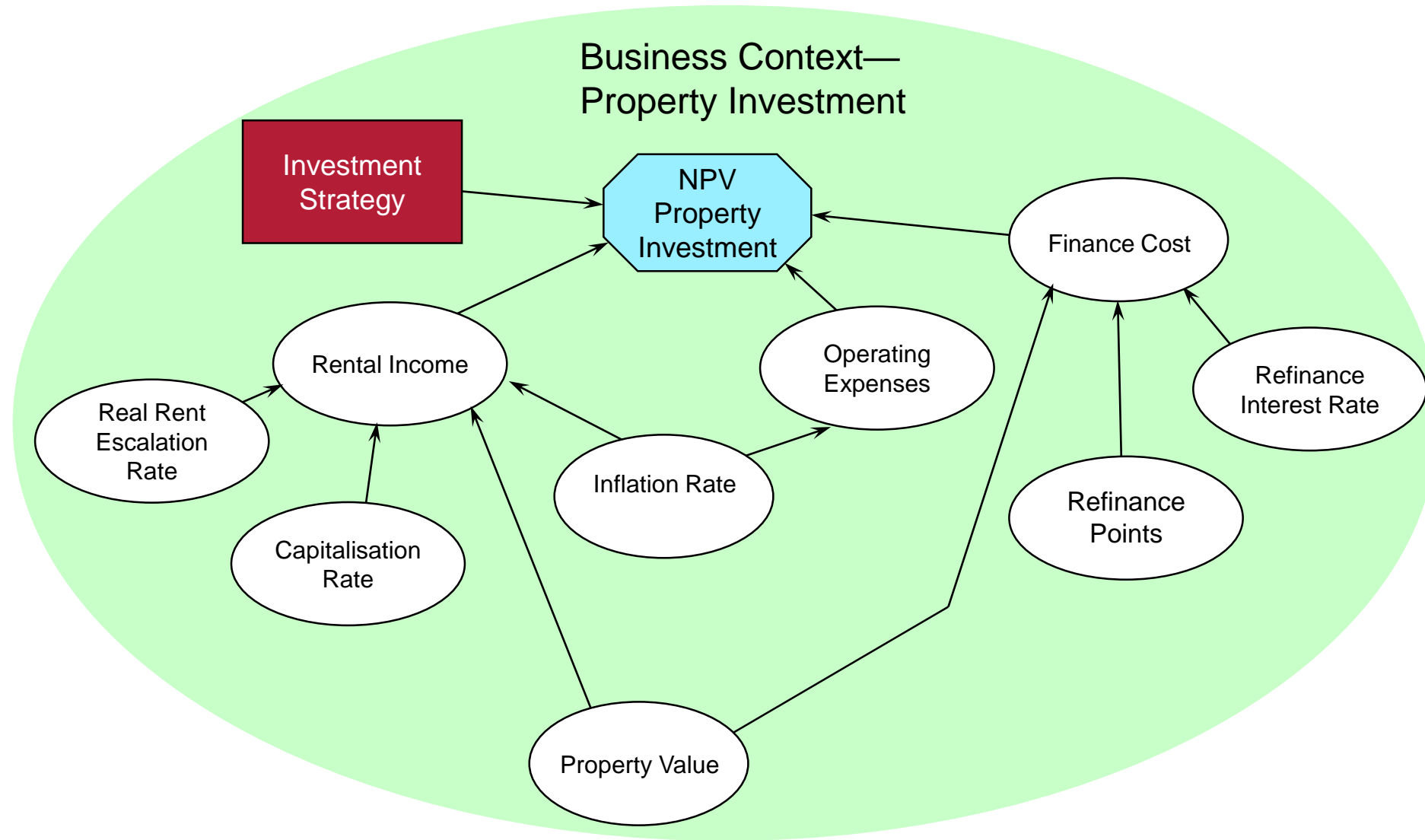


# Influence diagrams help us to structure an analysis and decompose the problem to a level where sound input assessments can be made.



Example based on example in Hubbard & Seierson (2016), "How to Measure anything in Cybersecurity Risk."

# To illustrate the modelling process we are going to use a simple property investment example.



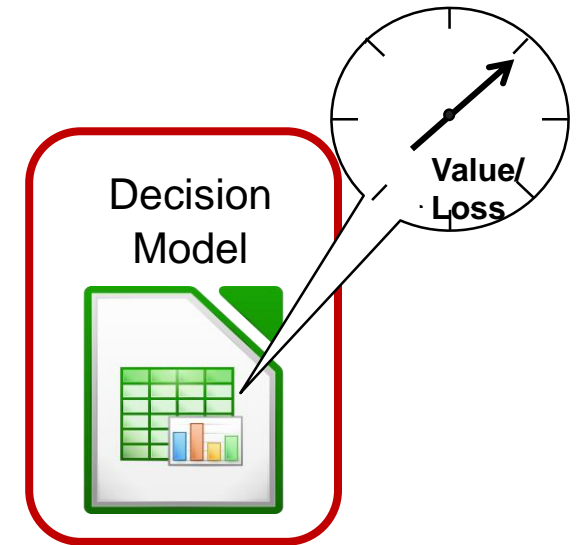
# Inputs to decision models are uncertain and experts are asked to specify P10-P50-P90 ranges on their assessments.

You judge that there is only a 10% probability that the variable will be less than or equal to this value.

... there is a 50% probability ... less than or equal to this value.

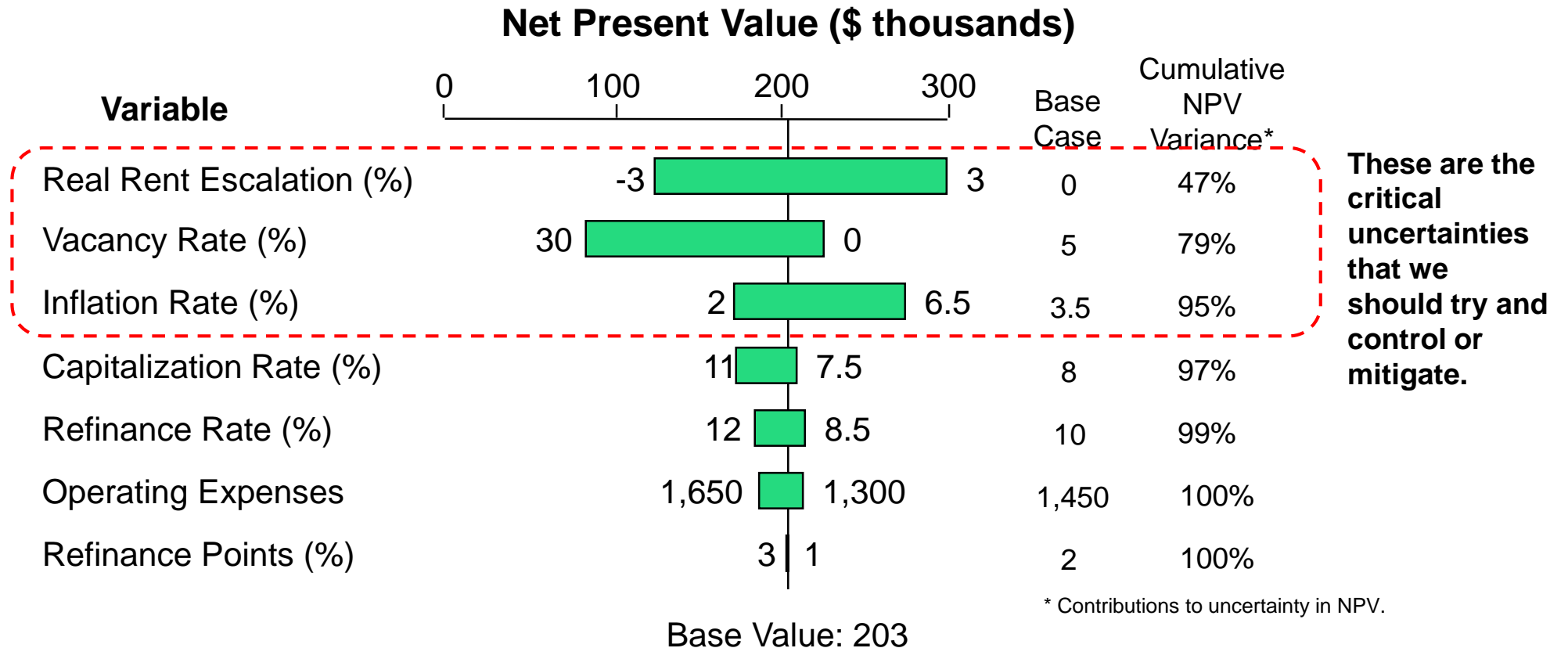
... there is only a 10% probability ... greater than this value.

22	Uncertainties			
23				
24	Description	Low	Base	High
25		P10	P50	P90
26	Vacancy Rate	0%	5%	30%
27	Real Rent Escalation	-3%	0%	3%
28	Operating Expenses (\$000)	\$1,300	\$1,450	\$1,650
29	Points to Refinance	1.0%	2.0%	3.0%
30	Discount Rate	5.0%	8.5%	10.0%
31	Inflation	2.0%	3.5%	6.5%
32	Capitalization Rate	7.5%	8.0%	11.0%
33	Interest Rate at Refinance	8.5%	10.0%	12.0%



***We typically build decision models with spreadsheets; in the Risk Management world there is a lot of potential to build libraries of models to analyse specific types of recurrent risks.***

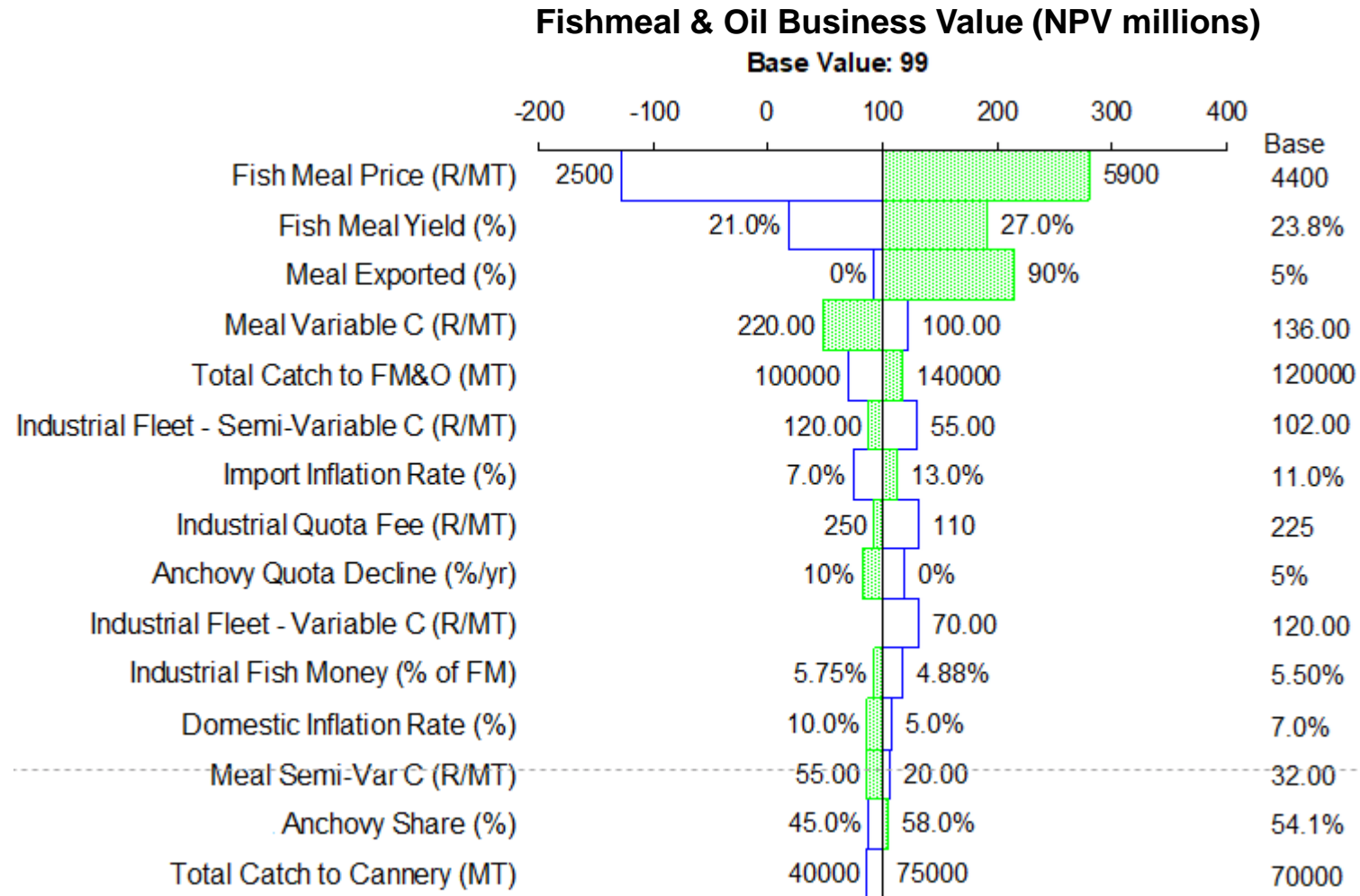
## A “tornado diagram” graphically depicts the variables’ contributions to uncertainty in overall value/loss.



- Each variable is changed from low to high inputs, with all other variables at their base-case values.



# Understanding the Tornado for the business as a whole can help teams identify value and risk mitigation opportunities.



*In this example business value was doubled in 12 months by redirecting teams from a cost to a yield and export focus.*

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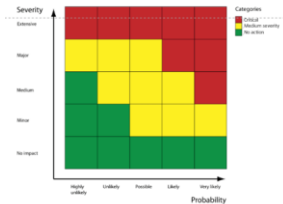
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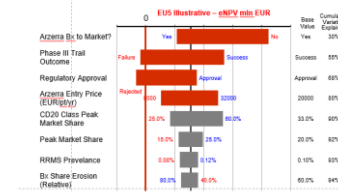
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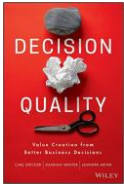
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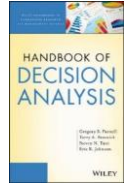
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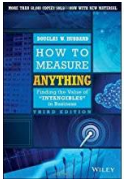
## Some additional resources:



- **Decision Quality** book by Carl Spetzler et al.



- **Handbook of Decision Analysis** by Greg Parnell, Steve Tani et al



- **How to Measure Anything** by Doug Hubbard.
- Thomas, Philip, Reidar Bratvold, and J. Eric Bickel. 2014. "The Risk of Using Risk Matrices."  
<https://www.onepetro.org/journal-paper/SPE-166269-PA>

- SDG Website: <https://sdg.com/thought-leadership/resources-hub/>
- Decision professional associations
  - SDP <https://www.decisionprofessionals.com/>
  - EDPN (Europe) [www.edpn.org/](http://www.edpn.org/)
- SDG leaders teach strategic decision making in courses with The University of Texas at Austin.
  - <https://www.mcombs.utexas.edu/execed/earn-a-certificate/strategic-decision-and-risk-management-certificate>



# SDG is committed to helping our clients improve the quality of their decisions and their decision processes around Risk Management.



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