University of Stavanger

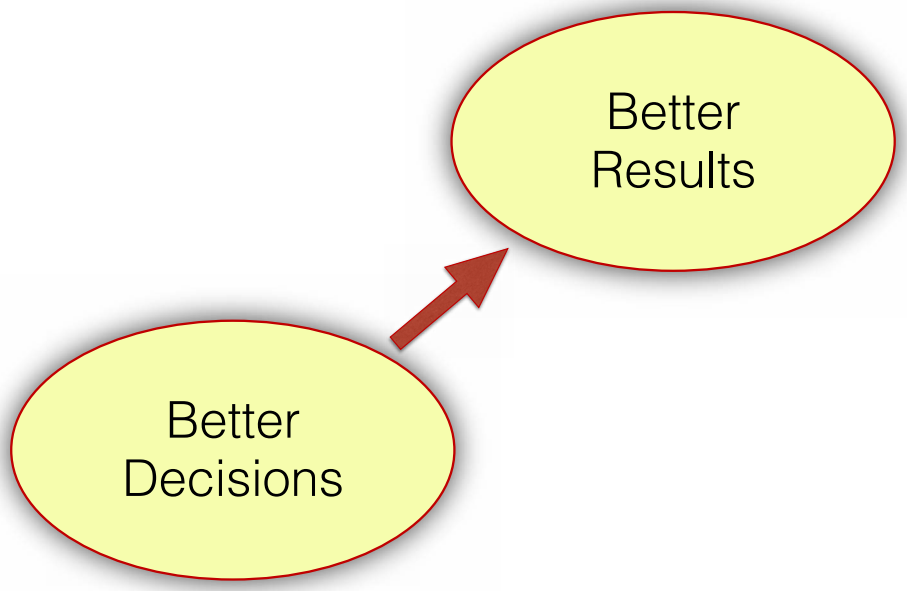
Decision Quality
What it is and Why it Matter?

Reidar B Bratvold
University of Stavanger
and
DecisionsDecisions

I am not a product of my circumstances.
I am a product of my decisions.

-- Stephen R. Covey

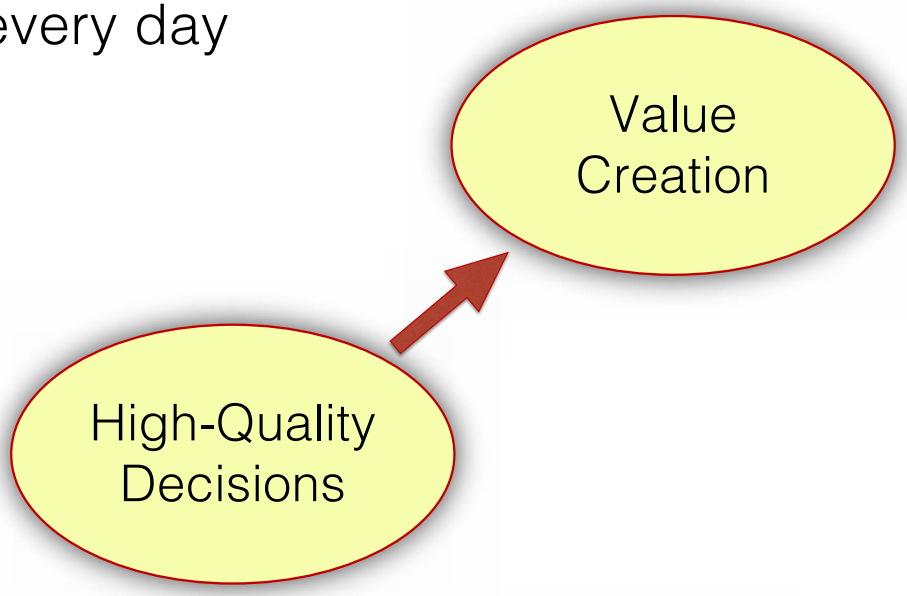
The only way you can purposefully influence your life, your family, your organization, your country or your world is through the decisions you make.



The only control an organization has over its results is its decisions

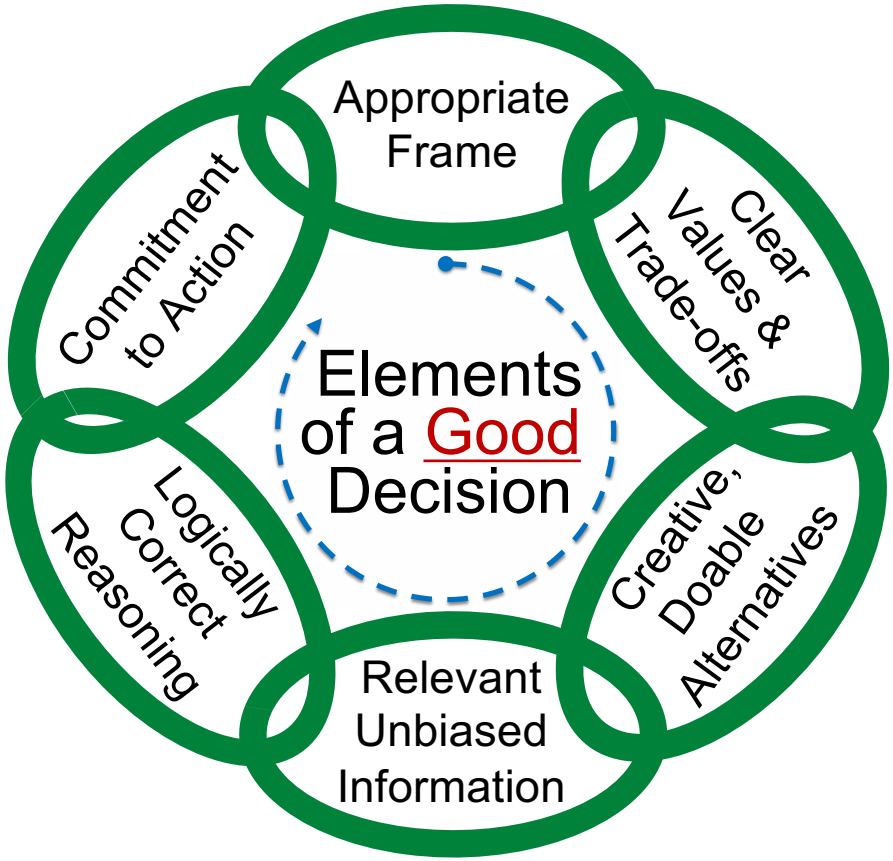
Many decisions are made in organizations every day

- Some, by themselves, are truly important to the organization's future
- Others, individually not so important, but collectively, they are – if the organization's decisions regularly are mediocre, it will not achieve its goals



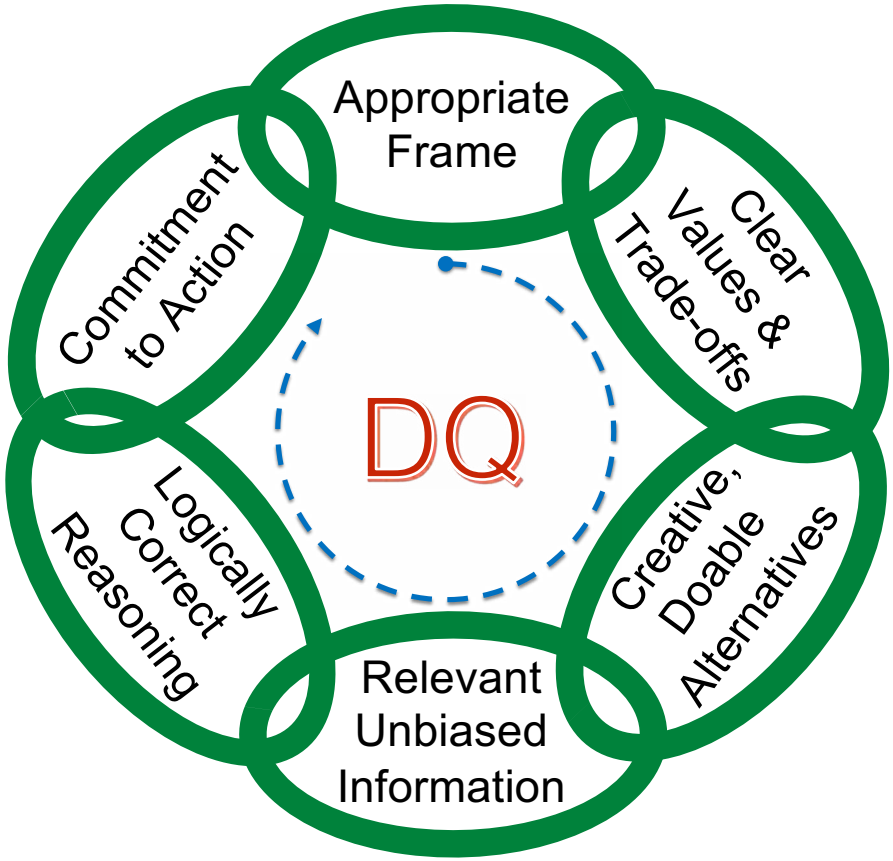
GIVEN WE CAN ONLY CONTROL OUR DECISIONS - WHY WOULDN'T WE WANT TO USE THE BEST METHOD WE CAN?

The Decision Quality (DQ) Framework Shows us What "High-Quality" Looks like



- Based on the 300-year history of decision theory and more than four decades of modern-day application
- Consistent best practices in the field have shaped our understanding of decision quality
- Like economics and engineering (solid underlying foundation), with its standards, best practices, professional societies, etc.
- Applicable for all decisions, large or small

Achieving quality in each of the six elements produces quality in the overall decision



LIKE A CHAIN, THE OVERALL QUALITY IS NO STRONGER THAN THE WEAKEST LINK

ACHIEVING DQ IS THE GOAL OF THE DECISION-MAKING PROCESS

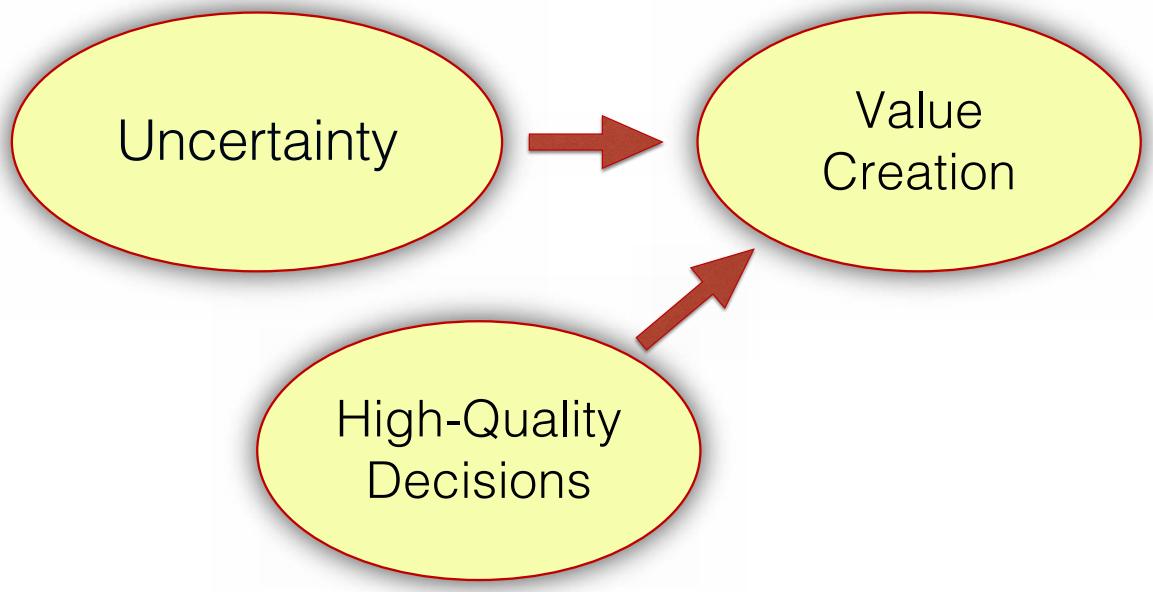
Ample empirical evidence shows that we are struggling to achieve DQ in complex and uncertain environments

- The ability to make good decisions is not inborn.
- Indeed, the ability to make good decisions is contrary to human nature.
- Sixty years of behavioral decision science research have revealed hundreds of biases that are part of human mental processes and social behaviors.
- Thus, although people widely believe they are inherently good decision-makers, this belief is an illusion—a dangerous one.

ILLUSION OF DQ

Confusing decision quality and outcome quality is endemic in most organizations

- The only control an organization has over its results is its decisions.
- The rest depends on things it cannot control:
  - decisions of others, "nature," chance, ...



THE QUALITY OF A DECISION SHOULD NOT BE JUDGED BY ITS OUTCOME.

Uncertainty: Definition (practical) & quantification

Not knowing if a proposition (statement, event, claim) is true or false.

- Example propositions
  - the Russia-Ukraine war will end before 1 Jan 2026
  - the project cost will be $40 million
  - The oil reserves in the new field are 80 million barrels
- Uncertainty is quantified by probability - a way of encoding the extent to which our information and reason support the truth/falsity of a statement/claim/event
  - identify possible events/outcomes of interest (unambiguously defining each)
  - assign a probability to each possibility to reflect the extent to which our information supports its truth

Ambiguity and its resolution

- What is your probability (degree of belief) that Reidar is a "wine-drinker"?
- The event "wine-drinker" is ambiguous. It could mean
  - prefers wine to beer
  - drinks a glass of wine once per week
  - drinks 2 glass of wine a day
  - drinks 2 bottles a day ☺
- The precise definition of the event/statement/outcome can be critical to determining our degree of belief (probability) in its truth.

WE MUST REMOVE ANY AMBIGUITY IN THE DEFINITION OF THE PROPOSITIONS (EVENTS, OUTCOMES) TO WHICH WE WISH TO ASSIGN PROBABILITIES.

Risk: Some Definitions – there are many others

- OED:
  - hazard, danger; exposure to mischance or peril. The chance or hazard of commercial loss.
- O&G Exploration: probability of a dry hole ("failure")
  - quantified on a scale of zero to one
- Project Management: probability x magnitude of outcome
  - quantified in the units of the outcome ($, barrels, days, …)
- Finance & Economics: "volatility" – the fact that prices, returns, … go up and down (i.e. they are uncertain!)
  - quantified by the standard deviation of the variability of past returns
  - applied to future prices etc, it's really uncertainty
  - (elsewhere in finance, risk is the potential for a permanent loss)
- Different disciplines have different definitions – make sure you know what is meant in your organization!

Risk in Decision Analysis/Decision Quality

Simply, a specific event that, if it occurred, would have sufficiently undesirable impact on the DM's objectives that it merits explicit consideration in the decision-making

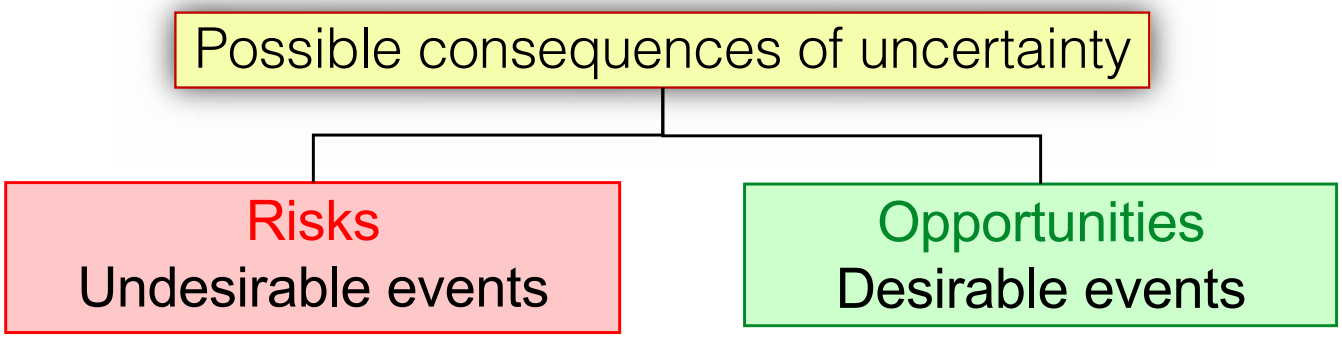
Uncertainty
(I'm just observing the outcome)

Risk
(I will lose $10 if it's tails)

You can have Uncertainty without Risk, but not vice versa

- In addressing risk, first (just like any other uncertainty) clearly define the specific event – and state to whom, and to what objective, it is a risk.
- Then assign it a probability and assess whether there is greater value in
  - living with it
  - taking actions to mitigate it, and/or
  - creating options to respond to it, if it occurs

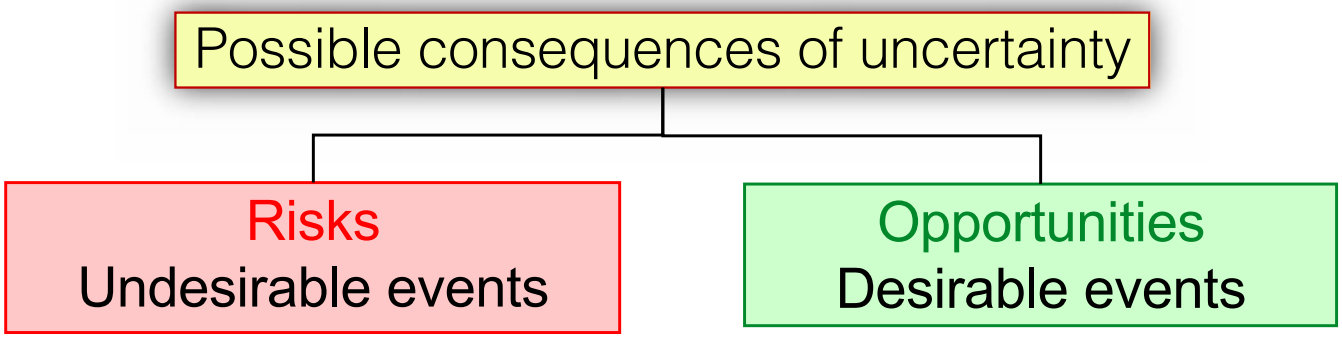
Risk isn't the only possible consequence of uncertainty



- Opportunity is often overlooked as a means of creating value from uncertainty
  - a biased approach that will lead to worse outcomes than are possible
- Just like risk, clearly define the event, assign a probability and assess whether there is greater value in living with it, or creating options to capture it, if it occurs

DA/DQ DOES NOT EMPHASIZE THE DISTINCTION BETWEEN RISKS AND OPPORTUNITIES (OR THEIR "MANAGEMENT") – BOTH ARE JUST EVENTS THAT MERIT EXPLICIT CONSIDERATION

Risk isn't the only possible consequence of uncertainty



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AND OPPORTUNITIES (
EVENTS THAT MERIT EXPLICIT CONS

"RISK MATRICES" ARE (DELIBERATELY) NOT PART OF THE DECISION ANALYST'S TOOLKIT !!

A risk matrix is a graphical representation of the likelihood (probability) and consequence (severity) of an event.

TABLE 1. Typical industry (success) risk assessment matrix

Probability		Likelihood indices
> 40%	1	Likely
20–40%	2	Occasional
10–20%	3	Seldom
5–10%	4	Unlikely
< 5%	5	Remote
< 1%	6	Rare

Consequence indices (examples can be adjusted for local costs)	6	5	4	3	2	1
	Incidental	Minor	Moderate	Major	Severe	Catastrophic
Consequence description (rig or equipment damage/downtime, mechanical damage/downtime)	Half day lost ($100K)	Day lost ($100K–$250K)	Loss of hole section ($250K–$1M)	Loss of more than 1 hole section ($1M–$5M)	Loss of well ($2M–$20M)	Loss of rig (> $20M)

* Source: World Oil, Oct 2010

Risk are ranked by the magnitude of the risk score

Event : Fluid losses occur in hole section (12-14 in)		
Outcome	**Consequence (Million US$)**	**Probability**
Severe Losses	1-5	40%
Well Control	5-20	10%
Blowout	>20	5%

The consequences and probability for each outcome is provided by subject matter experts (SME), conditioned on their knowledge and relevant data.

Probability	P - Rating	P - Indices						
> 40%	6	Likely						
20% < p <= 40%	5	Occasional				Severe Losses		
10% < p <= 20%	4	Seldom						
5% < p <= 10%	3	Unlikely					Well Control	
1% < p <= 5%	2	Remote						Blowout
<=1%	1	Rare						
Consequence Rating			1	2	3	4	5	6
Consequence Indices			Incidental	Minor	Moderate	Major	Severe	Catastrophic
Consequence Cost			<=$100K	$100K - $250K	$250K - $1MM	$1MM - $5MM	$5MM - $20MM	>$20MM

Risk score is the product of probability and consequence

Outcome	Risk Score	Rank
Severe Losses	20	1
Well Control	15	2
Blowout	12	3

The use of risk matrices is virtually universal across many industries and is considered a “best practice.”

- Their application is documented in numerous papers.
- The deployment of RMs is widely advocated by
  - risk managers, training courses, consulting firms, textbooks, project management standards, and risk standards and guides.

Presenting the results in a risk matrix (heat map) is an effective way of showing the distribution of risks for different components in a process unit without numerical values.

-- API (American Petroleum Institute)

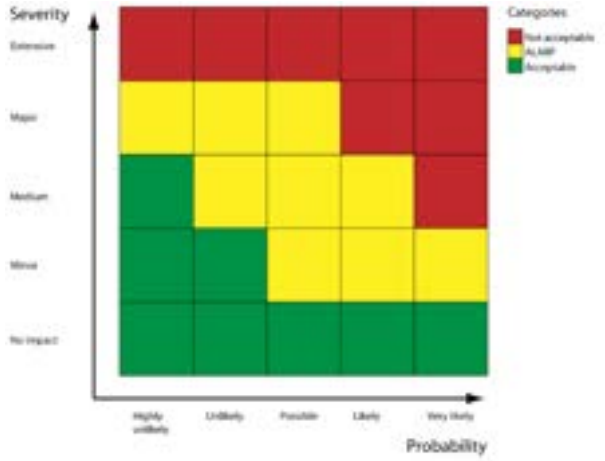
The risk matrix (heat map) is a strongly applicable tool for risk identification, risk analysis, and risk evaluation.

-- ISO (International Organization for Standardization)

Many view the creation of risk matrices as synonymous with risk management.

Risk matrices are purported to offer many benefits

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



HOW DO WE KNOW THEY WORK?

DANGEROUS TO ASSUME THAT WHAT IS EASY TO CREATE, ASSESS, AND SCORE IS ALSO ACCURATE OR USEFUL.

DO RMS IMPROVE COMMUNICATION ABOUT THE RIGHTS THINGS?

Despite their popularity, RMs provide arbitrary risk rankings and risk management policies.

- There is no published scientific research or empirical evidence showing that RMs actually help in managing risk or improving risk related decision making.
- There is scientific research documenting a number of flaws imbedded in RMs (read our paper for details).
- These flaws are inherent to the RM's design and cannot be corrected.
- We will illustrate two flaws – both leading to arbitrary risk rankings – documented in our paper:
  1. Risk ranking reversal resulting from reversing the category scales.
  2. Risk ranking instability resulting from small changes in category ranges.

Reversing the category scales reverses the risk ranking

Probability	P - Rating Descending	P - Rating Ascending	P - Indices
> 40%	1	6	Likely
20% < p <= 40%	2	5	Occasional
10% < p <= 20%	3	4	Seldom
5% < p <= 10%	4	3	Unlikely
1% < p <= 5%	5	2	Remote
<=1%	6	1	Rare

Consequence Rating Ascending	1	2	3	4	5	6
Consequence Rating Descending	6	5	4	3	2	1
Consequence Indices	Incidental	Minor	Moderate	Major	Severe	Catastrophic
Consequence Cost	<=$100K	$100K - $250K	$250K - $1MM	$1MM - $5MM	$5MM - $20MM	>$20MM

Severe Losses

Well Control

Blowout

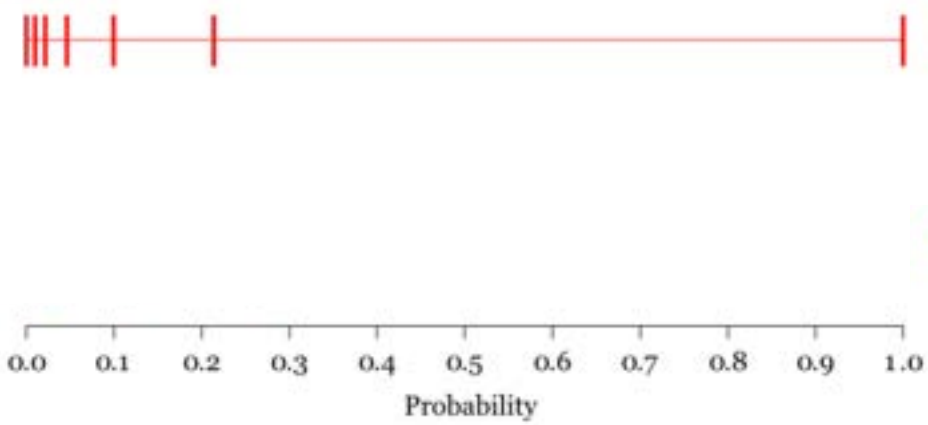
- The resulting risk ranking is a function of whether an increasing or decreasing scale is used.

Outcome	Risk Score	Rank (Ascending)
Severe Losses	20	1
Well Control	15	2
Blowout	12	3

- 17% of the reviewed papers we reviewed use descending scores, whilst 83% use ascending scores.

WHAT OTHER BEST PRACTICES PRODUCE DIFFERENT RECOMMENDATIONS SIMPLY BY CHANGING THE SCALE OR THE UNITS?

Small changes in the size of the categories changes the prioritization of risks.



Risk Rankings

WC = 1, BO = 2, SL = 3

WC = 3, BO = 1, SL = 2

WC = 2, BO = 3, SL = 1

WC = Well Control BO = Blowout SL = Severe Losses

Small changes in category ranges lead to major changes in risk ranking.

THERE IS NO SCIENTIFIC BASIS FOR HOW TO CHOOSE THE RANGES, NOR DOES ISO, API, OR NORSOK PROVIDE ANY GUIDELINES.

ChatGPT 4o – Issues with the risk matrix

1. Inconsistent Risk Ranking:
2. Rank Reversal and Misleading Prioritization:
3. Loss of Detail in Risk Categorization:
   - risks that are low probability but high impact may be overlooked
   - decisions could be made based on an incorrect prioritization,
4. Overconfidence Due to Perceived Clarity:
   - give decision-makers a false sense of confidence.
   - tendency to assume that the tool accurately reflects reality
5. Inadequate for Managing Complex, Interdependent Risks:
   - leading to an underestimation of potential compound risks
6. Lack of Empirical Validation for Decision-Making Quality:
   - no validated link to decision quality

ChatGPT 4o – Does it work?

Can you point me to a single example demonstrating that risk matrices work?

Answer

The search results do not provide a specific study that empirically demonstrates the effectiveness of risk matrices in real-world applications.

Discussion and Conclusion

- The RMs are intuitive, visually appealing and supposedly easy to understand, which is believed to improve communication.
- They even might appear authoritative and intellectually rigorous.
- However, as illustrated, RMs inherent flaws tend to create an *illusion of communication* rather than real communication.
- As shown, the rankings, decisions, and risk-management actions produced by RMs depend upon *arbitrary choices* regarding their design.
- The flaws in RMs are *inherent to their design* and use and cannot be corrected.

A TOOL THAT PRODUCES ARBITRARY RECOMMENDATIONS IN AN AREA AS IMPORTANT AS RISK MANAGEMENT *SHOULD NOT BE CONSIDERED A "BEST PRACTICE"*

Discussion and Conclusion

- Some professionals recognize the flaws in risk matrices and take steps to mitigate the risks, as much as possible.
  - However, we believe this does not apply to most professionals who develop or use risk matrices.
- Some argue that risk matrices are only used at very early stages, so their flaws have minimal impact.
  - But if the initial risk assessment is based on poor measures, risk management decisions will likely target the wrong issues.
  - At best, this wastes time and money.
  - At worst, it leads to serious health, safety, and environmental (HSE) risks.

Risk Matrices are Worse than Useless

- A risk management process or tool can fall into one of three categories:
  - Useful -> improves our risk management decisions
  - Useless -> does not impact our risk management decisions
  - Worse than useless -> leads to arbitrary and suboptimal risk management decisions

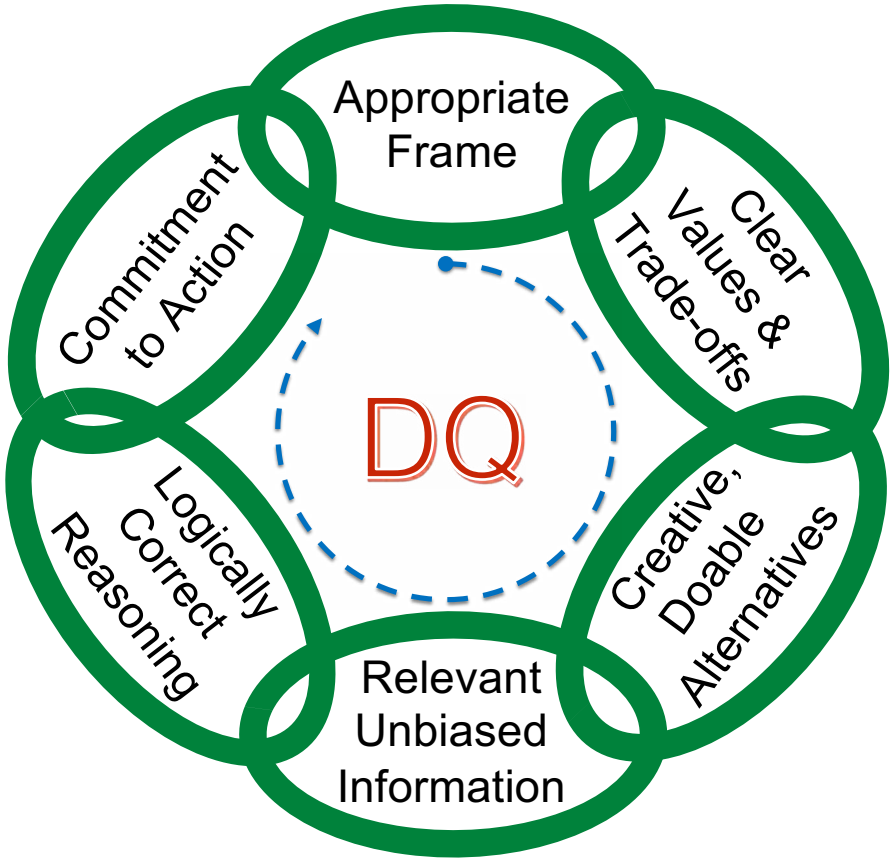
RISK MATRICES FALL INTO THE LAST CATEGORY AND SHOULD BE ABANDONED.

But … what should we then use?

- Pointing out the flaws of risk matrices does not oblige us to propose an alternative.
- Just as one doesn't need to propose a new medical treatment to challenge the outdated practice of bloodletting.
- Highlighting the inadequacies of risk matrices stands on its own merit.
- The arbitrariness of RMs is not conditional on whether or not other alternatives exist.

- Nevertheless, the question is bound to be raised, and thus ...

We should use the DA/DQ framework which is based on a solid scientific foundation



- DA/DQ removes arbitrariness in decision-making and uncertainty management.
- There is strong scientific and empirical support for its effectiveness.

Instead of risk matrices, we should apply DA/DQ procedures that rest on 300 years of scientific development and understanding.

References that discuss the limitations and criticisms of risk matrices:

- Cox, L. A. (2008). What's Wrong with Risk Matrices?
  - **Risk Analysis,** DOI: 10.1111/j.1539-6924.2008.01030.x. Highlights several issues with risk matrices, such as poor resolution, errors in risk rating, suboptimal resource allocation, and ambiguous inputs and outputs.
- Hubbard, D. W. (2020). **The Failure of Risk Management: Why It's Broken and How to Fix It**.
  - The book discusses the lack of scientific basis and objectivity in risk matrices, arguing they are often based on subjective judgments and can lead to incorrect risk prioritization.
- Thomas, P., Bratvold, R. B., & Bickel, J. E. (2013). The Risk of Using Risk Matrices. **SPE Economics & Management**.
  - This article argues that risk matrices are conceptually flawed and do not improve risk management decisions, citing issues like ranking reversal and instability.
- Reluctant.io (2022). Why the Risk Matrix is Broken – and What to Use Instead.
  - This article criticizes the use of risk matrices in information security for providing an illusion of control without truly understanding or managing risks.
- Safesmart (n.d.). The Problem with Risk Scores and a Risk Matrix.
  - Discusses how risk matrices can obscure certain hazards due to their numeric focus and highlight issues like inconsistency in scoring.

References Decision Analysis/Decision Quality:

- *Decision Quality: Value Creation from Better Business Decisions* by Carl Spetzler, Hannah Winter, and Jennifer Meyer. This book provides frameworks for making high-quality decisions in business contexts.
- *Foundations of Decision Analysis* by Ronald A. Howard and Ali E. Abbas. A comprehensive exploration of decision-making processes and methodologies.
- *Making Good Decisions* by Reidar B. Bratvold and Steve Begg. Published by the Society of Petroleum Engineers in 2010, this book focuses on strategic decision-making in the oil and gas industry, covering topics such as decision-tree analysis and Monte Carlo simulation.
- *Making Hard Decisions with DecisionTools Suite* by Robert T. Clemen and Terence Reilly. This book combines decision analysis theory with practical applications using software tools.
- *Smart Choices: A Practical Guide to Making Better Decisions* by John S. Hammond, Ralph L. Keeney, and Howard Raiffa (1999). This book offers a systematic approach to decision-making, emphasizing a clear process for evaluating options and making informed choices.
- *Thinking, Fast and Slow by Daniel Kahneman (2011).* This influential book explores the dual systems of thought that drive the way we think and make decisions, providing insights into cognitive biases and decision-making processes.
- *Value-Driven Design* by Ralph L. Keeney. This book emphasizes focusing on values rather than alternatives in decision-making, highlighting the importance of generating alternatives to achieve desired values.