

RISK AND (UN)CERTAINTY – The Implications of the Relationship



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BACKGROUND

'God does not play dice' (Einestine)

- **Wind** speed and direction, air **density, temperature, pressure, humidity**, height thrown, angles of throw, **spinning** speed and angles, **landing surface** characteristics, **mass** and **volume** of the dice.
- Deterministic approach – **Always** produces the **same output** from a given starting condition.
- **Individual** as well as **Collective** behaviors of all known and unknown **parameters** is **not possible** to know.
- Therefore, particular **future state** of a system definitively/certainly **not establish able** – Hence **uncertainty**.
- Uncertainty gives rise to risk.

PROBLEMATIZATIIN AND KNOWLEDGE GAP

Risk and Uncertainty:

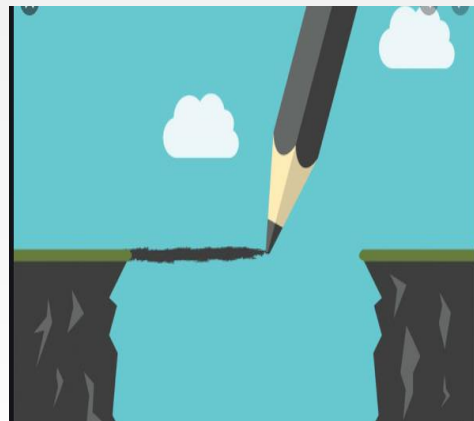
- **Multi-faceted** in their own **individual right**.
- Yet have **substantial connections** with each other.

Lack of documentation/literature on:

- How the **two terms**, rather concepts, are **related** with each other on **various fronts**.
- **How** can them both be used to **feed off** each other.

This constitutes:

- Risk misperception
- Risk miscommunication



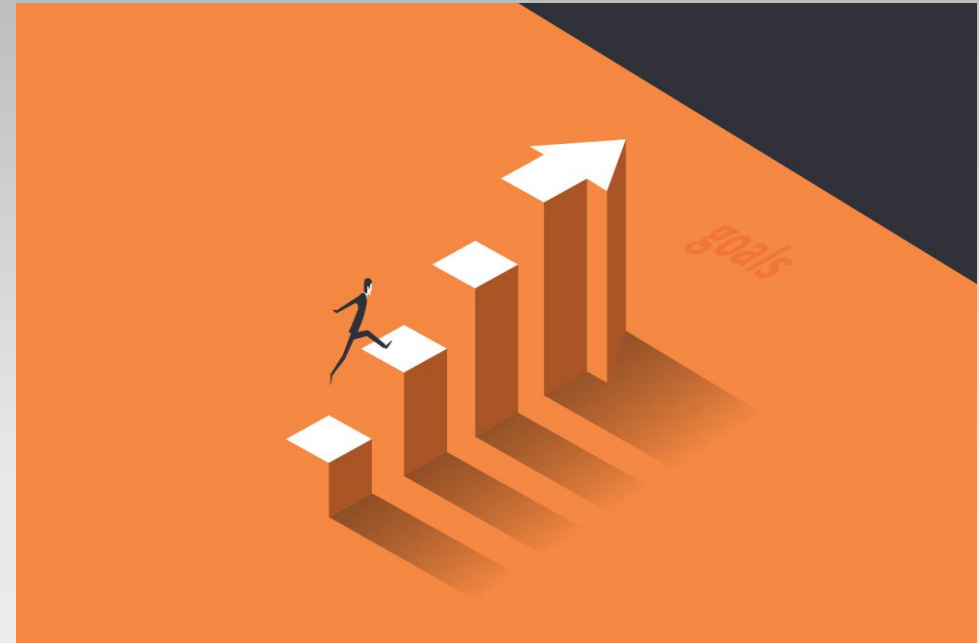
Aim

- Torch light on 'risk-uncertainty' relationship via the lens of certainty.
- Develop innovative conceptual models.
- Bring out New insights.



OBJECTIVES

- Create an **account of implications** of risk and uncertainty **individually**.
- **Map** the implications **on each other**.
- Establish how the two **link** with each other on **various fronts**.
- Employ illustrative **examples/case-study**.
- Design **conceptual schematics** to inform the development of **innovative models** of the relationship – Risk and Uncertainty.



RISK – HISTORICAL PERSPECTIVE

- ***“Source of harm”***: Blount’s “Glossographia” (1661)
- ***“Chance of harm”***: Johnson’s “Dictionary of the English Language” (1755)
- ***“Statistically expected loss”***: The probability of an event X its magnitude (the US Nuclear Regulatory Commission 1975)
- ***“Likelihood and severity of events”*** (Kaplan et al, 1981).
- The “triplet” definition of risk as **“scenarios, probabilities and consequences”** (Kaplan et al, 1981).

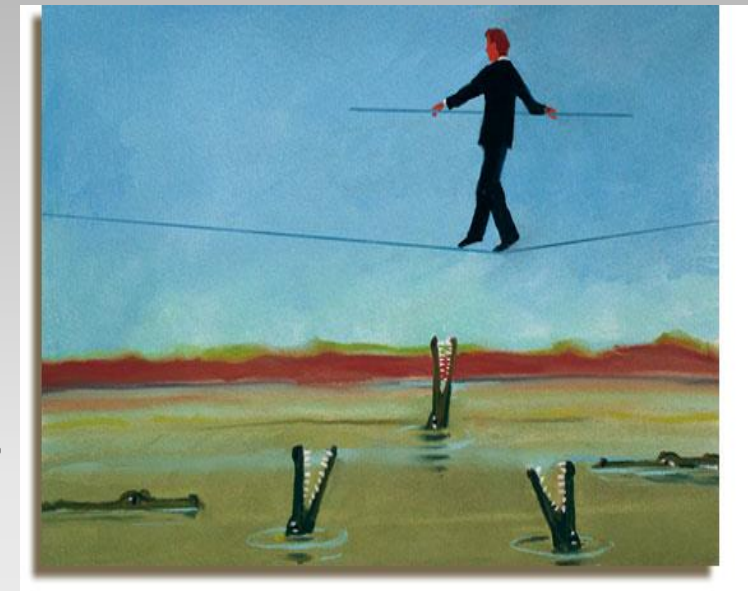


RISK

- Risk = **f (hazard, exposure and vulnerability).**
- **Probability of events 'Z' (positive or negative) occurring X Total losses or gain per event 'Z' occurring (impact) = Risk of 'Z'.**

However, risk is seen in negative context unless specified.

- Risk = **(Probability of an undesired event) X (Severity of the Impact of the event / harm).**
- Risk = **(Likelihood of a hazard to cause harms) x (Harms)**
- In summary, risk is **“how much X how bad”**.



RISK APPLICATIONS

Environmental context

- Contaminated land (e.g. landfills)
- Food Industry
- Ecology
- Epidemiology
- Radiation
- Flooding
- Fire
- Landslides
- Health & Safety
- Oil industry – environ. issues

Non-environmental context

- Construction management
- Building contract selection
- Economics
- Insurance
- Finance
- Earthquakes
- Ship Navigation
- Reliability engineering
- Health & Safety
- Oil Industry – e.g. trace oil reserves

UNCERTAINTY

Refers to the situations involving **imperfect or unknown information**.

Formal definition of uncertainty: **“Not knowing if a statement (or event), is true or false”**.

If we know a statement to be true, or false, we are certain (sure).
If we don't, we are uncertain (unsure).

Uncertainty exists in:

Partially observable and/or random situations – Due to ignorance, indolence, or both.



UNCERTAINTY APPLICATIONS

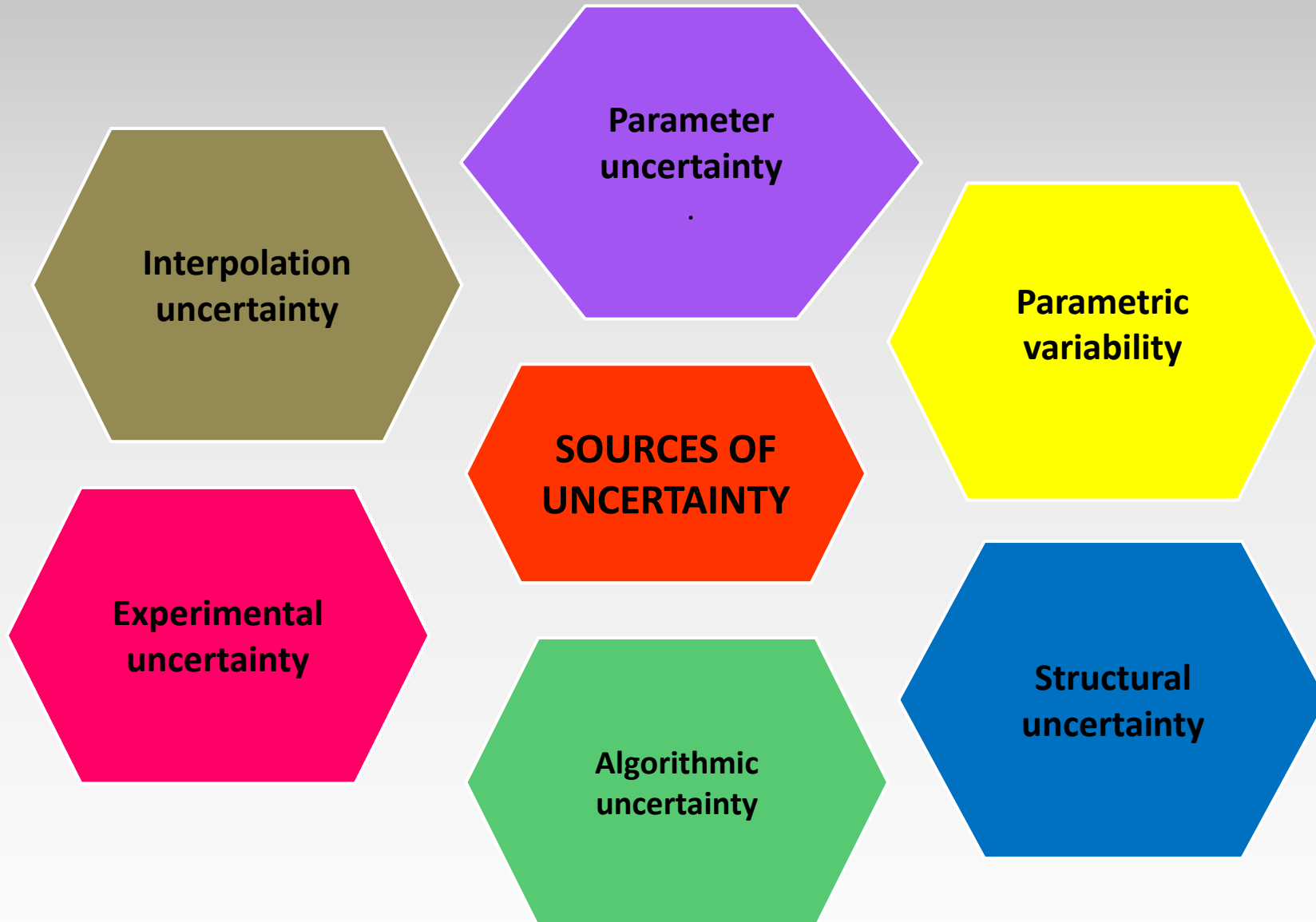
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Where there is Uncertainty, there is a Risk.



**Interpolation
uncertainty**

**Parameter
uncertainty**

**Parametric
variability**

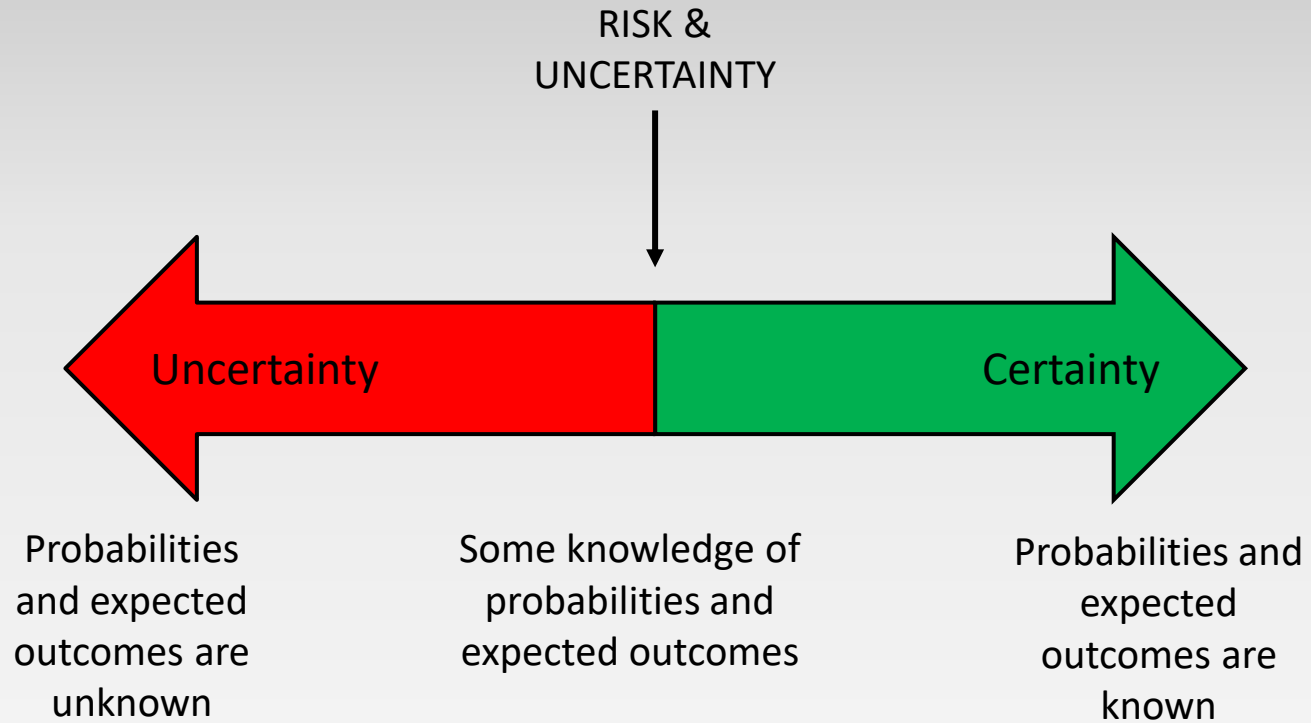
**SOURCES OF
UNCERTAINTY**

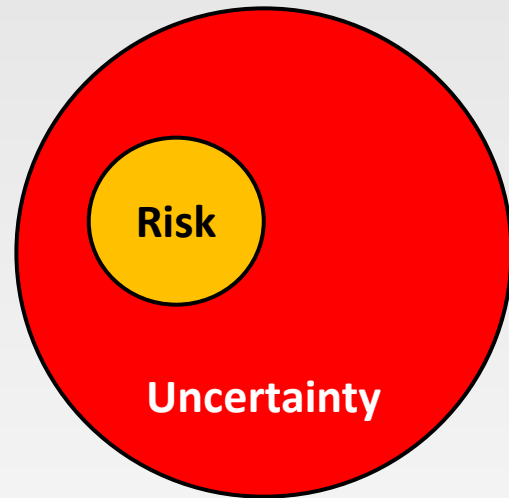
**Experimental
uncertainty**

**Algorithmic
uncertainty**

**Structural
uncertainty**

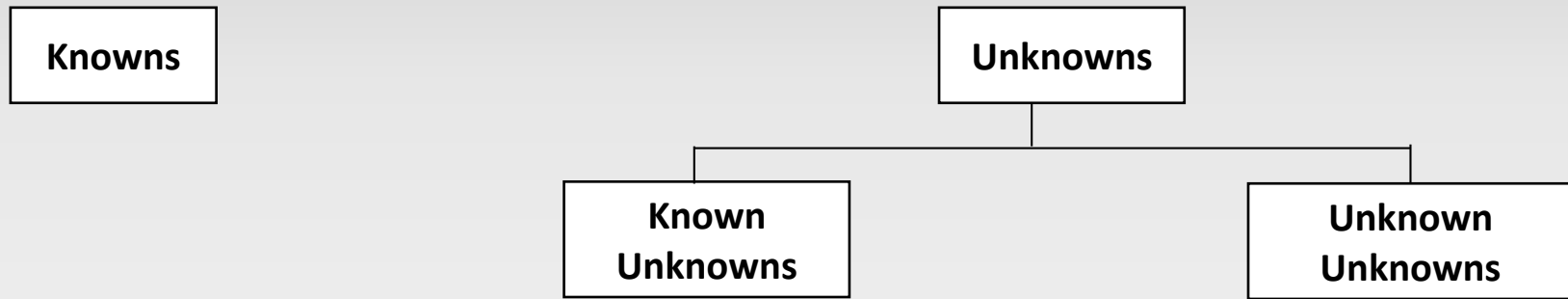
RISK vs UNCERTAINTY





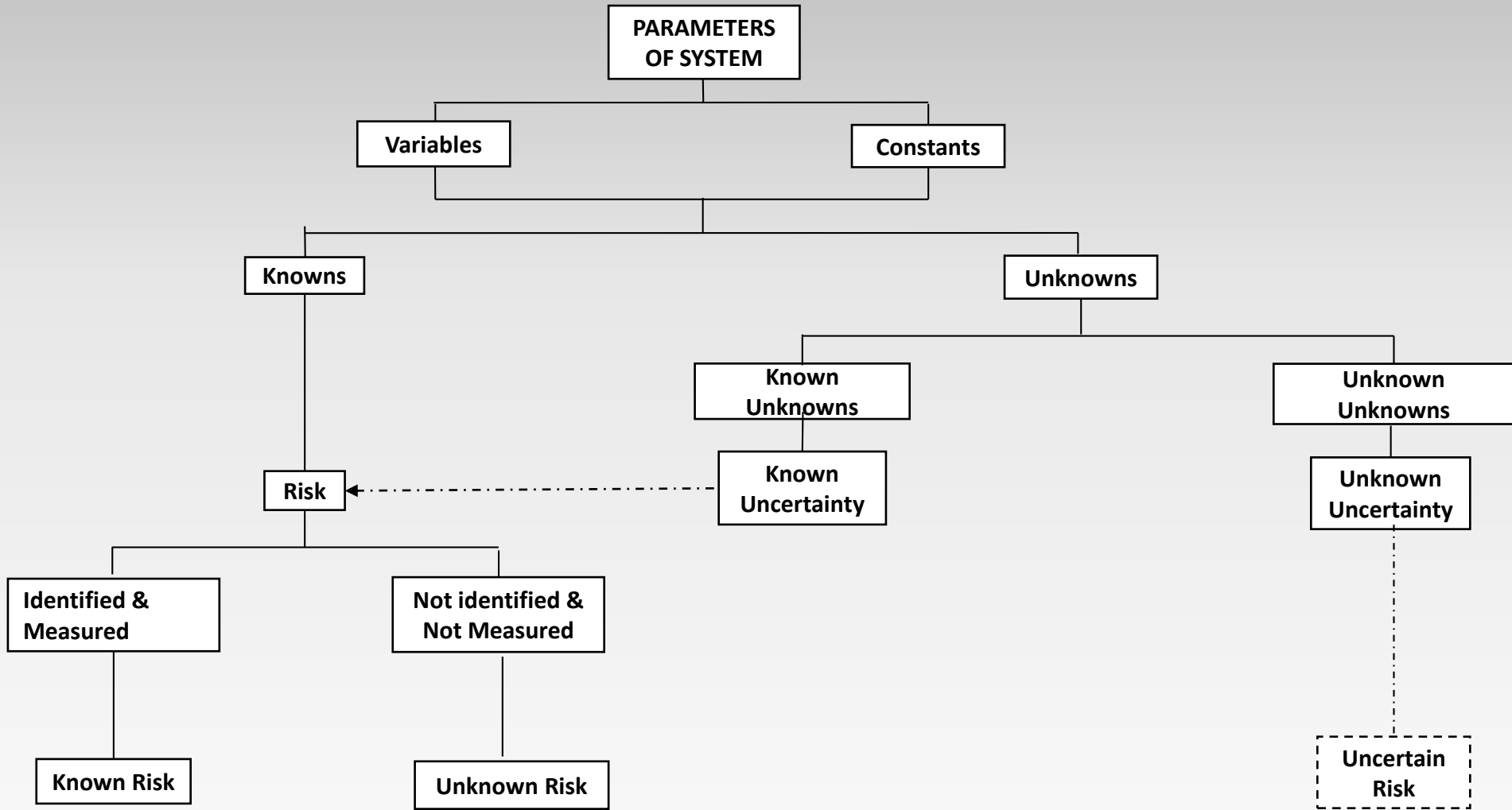
**Every Risk is Uncertainty
But not every Uncertainty is a Risk**

SCHEMATIC MODEL OF KNOWN AND UNKNOWN LANGUAGE

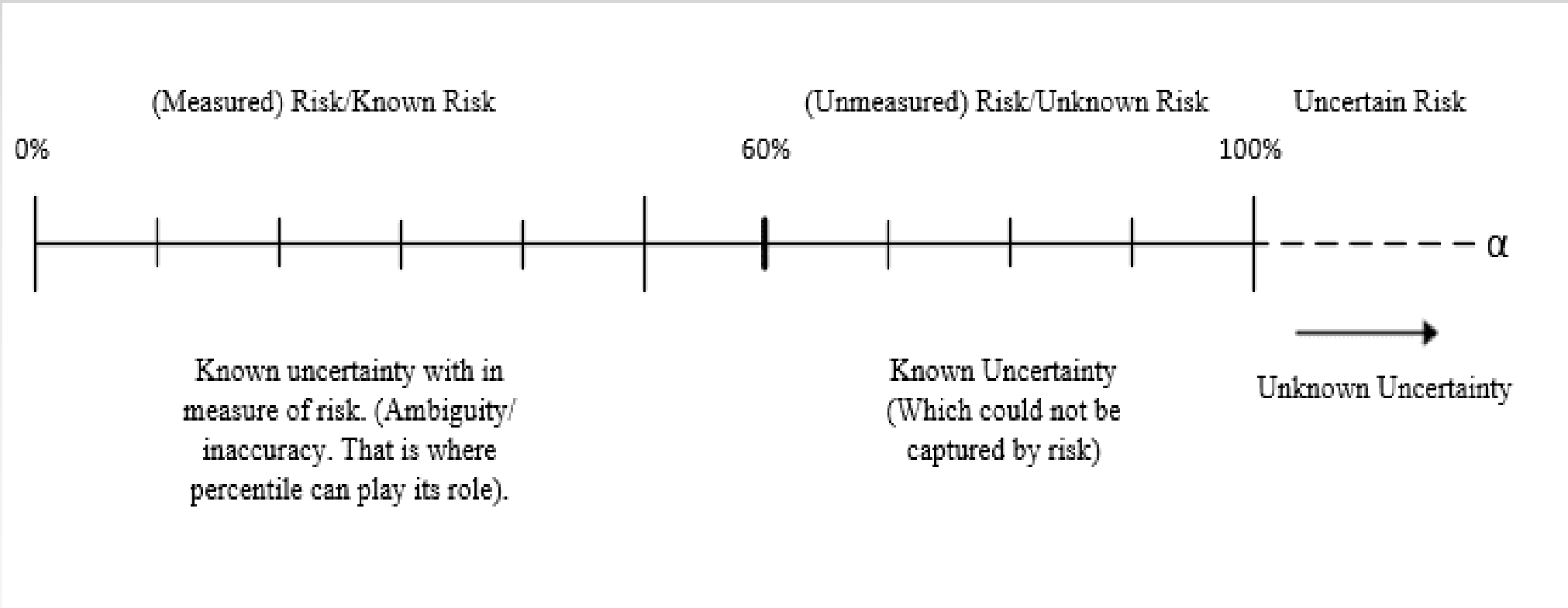


Regardless of known and unknown this is fundamental language which this research has used to develop conceptual models of implications of Risk-Uncertainty relationship.

BREAK DOWN MODEL – IMPLICATIONS OF RISK-UNCERTAINTY RELATIONSHIP



SPECTRUM MODEL – IMPLICATIONS OF RISK-UNCERTAINTY RELATIONSHIP



Note: Text above the linear conceptual model of the relationship is in the language of Risk and the text below the line is in the language of (Un)certainty.

RISK

- A state of **uncertainty** where some **possible** outcomes have an undesired effect or significant loss.
- Risk has the **background** information.
- A risk may result in either a **gain or a loss** because the probable outcomes are **known**.
- In risk, there is a **specific probability** assigned to each outcome (as when flipping a fair coin).
- Risk is present when future events occur with **measurable probability**.
- Risk is **simpler and easier to manage**, especially if proper measures are observed.
- Risk **can be measured**, so can be controlled/managed.

UNCERTAINTY

- Uncertainty is the lack of **certainty**, a state of limited knowledge where it is **impossible** to exactly describe the existing state, a future outcome, or more than one possible outcome.
- Uncertainty is **without background** information.
- Uncertainty comes with **unknown probabilities** i.e. **gain or loss are not known**.
- Uncertainty is indefinite, “**indeterminate**” and “**not known** beyond a doubt”.
- Uncertainty is present when the probability of future events is indefinite or **incalculable**.
- Uncertainty is **complex** and is **about ambiguity**.
- Uncertainty **cannot be measured**, so cannot be controlled/managed.

ありがとう!



**Any
questions**

