

# Risk Assessment for Scenarios

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# Objective – Rank Scenarios for Planning and Resource Allocation

- ▶ Overall outcome is a ranked list of scenarios. This ranked listing is useful for planning for and prevention of threats. Threats are expressed as scenarios.
- ▶ A Scenario is:
  - Who, what, when, where, why, how

## Scenarios ranked by:

- Likelihood of successful occurrence
- Consequence of scenario
- Scenario Risk = function(likelihood, consequence)



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# IV. Outcome – Where to Focus Resources

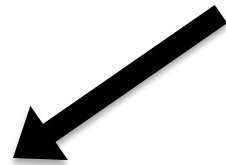
## ► Risk

Higher risk

- Scenario
- Scenario
- Scenario
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- Scenario

Lower risk

- Scenario
- Scenario
- ...



- Focus resources and attention on high risk scenarios
- Feed information back to contributing experts and stakeholders
  - Feedback provides diagnostic information on the overall process
  - Stakeholders use the information/process

Note: Risk calculations are **not absolutes**; they are **estimates** that include **uncertainty** and **error**.



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# What Will be Covered in this Presentation

- ▶ An Overall Approach and Methodology for Scenario Ranking
  - Four step process...
    1. Scenario generation
    2. Designed assessment
    3. Risk/likelihood calculations
    4. Rank (and feedback)
- ▶ Some Connections between methodology and Open Literature
  - Business Forecasting
  - Statistics
  - Expert Elicitation

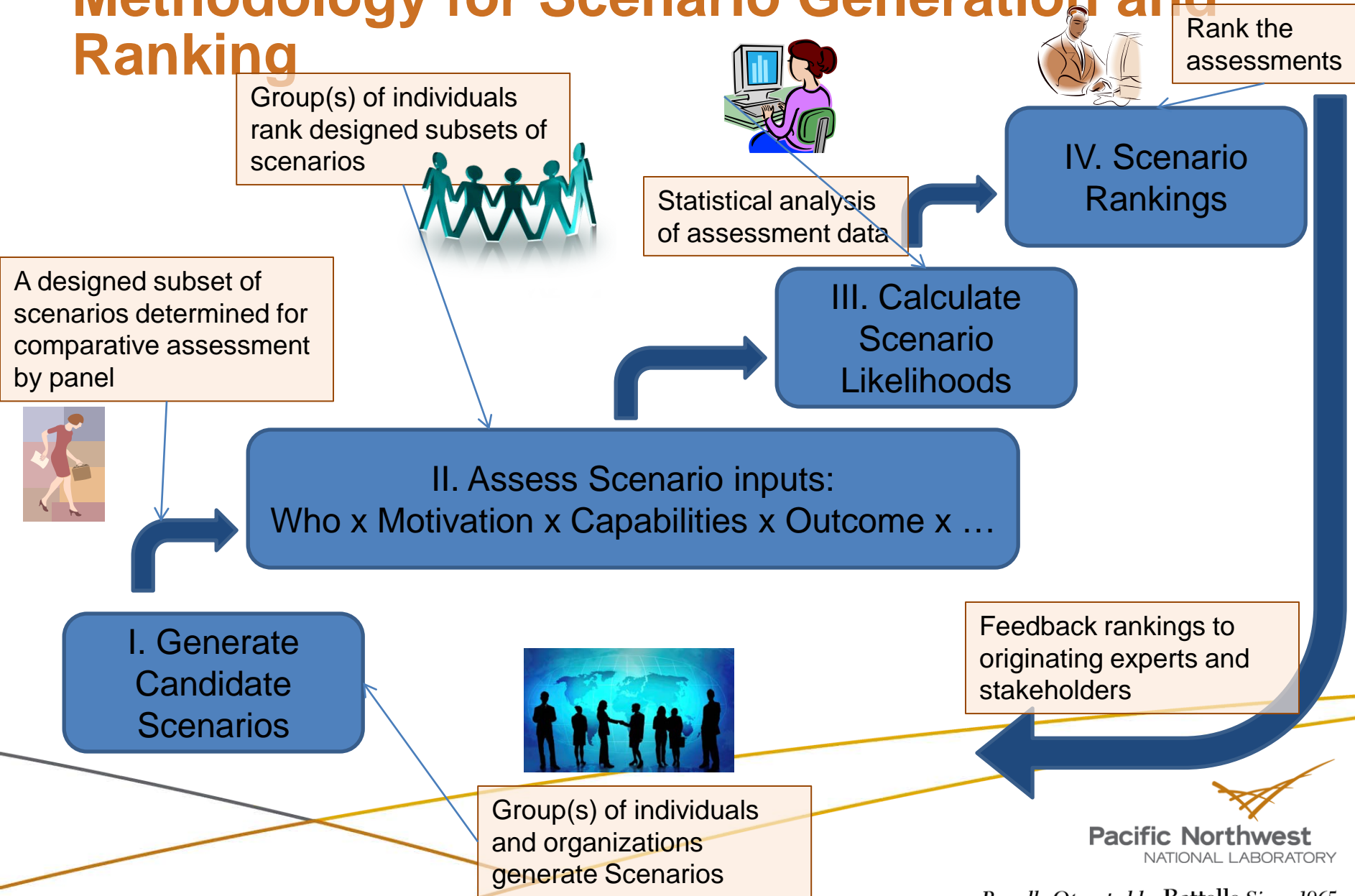


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# Methodology for Scenario Generation and Ranking



# I. Generate Candidate Scenarios

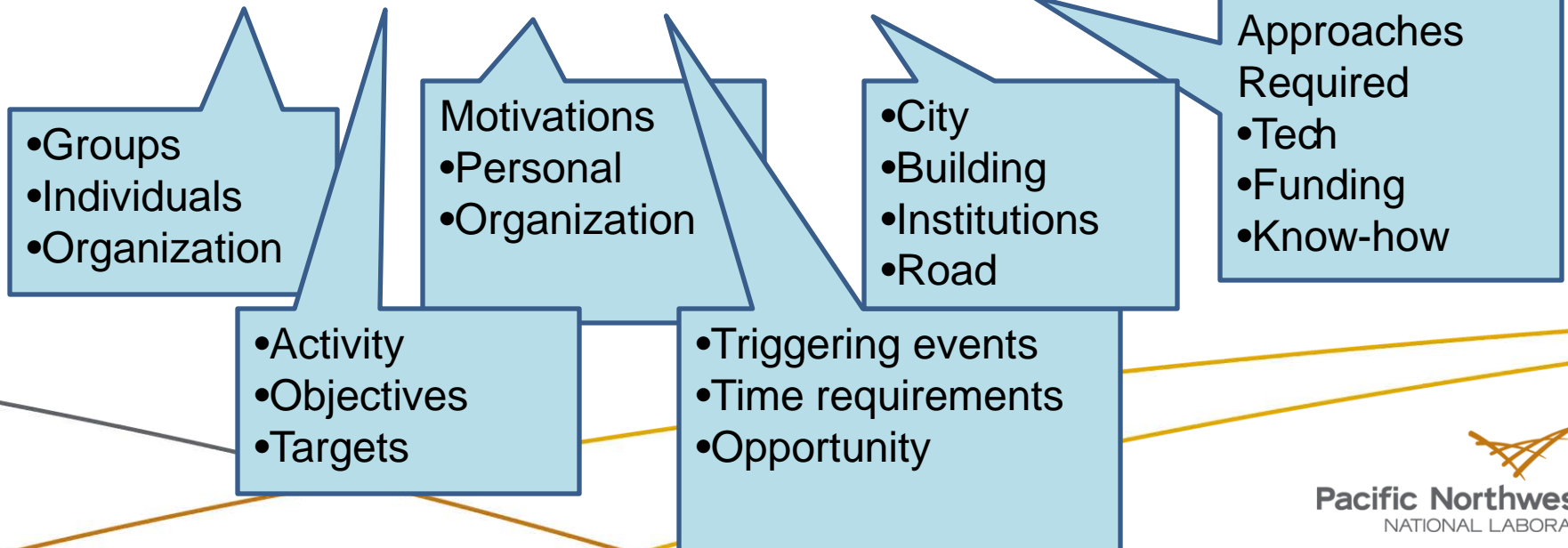
## ▶ Outcome:

- Extensive list of possible scenarios

## ▶ Approach:

- Panel elicitation/organized brainstorming
- Experts in each of:

Who, What, Why, When, Where, How



# Bio-Threat Scenario

A jihadist sleeper cell in New York City, seeking to attack an iconic symbol of U.S. imperialism and decadent Western culture, decides to poison a Coca-Cola bottling plant in the United States. The group receives authorization from al-Qa`ida central to proceed with the plan. Drawing on the expertise of a member who has a master's degree in microbiology, the group produces a liter of botulinum toxin by anaerobic fermentation over a period of two weeks. They then infiltrate an operative into a Coca-Cola bottling plant in northern New Jersey that supplies the New York City metropolitan area. The operative is hired as a worker on the bottling line and volunteers to work the night shift, when the intensity of surveillance is reduced. During the production of several batches, he injects the solution of toxin into the cola syrup before it is mixed with carbonated water on the assembly line. Cans and bottles containing the contaminated beverage are then widely distributed throughout the New York City area, causing dozens of fatalities. Within weeks, the FDA traces the outbreak to Coca-Cola, causing a dramatic drop in consumption of the beverage world-wide and the collapse of the company's stock price. The jihadist group later claims credit for the attack, claiming a symbolic victory over the "Great Satan."



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# IED Scenarios

**Group X** has the **objective** of repelling and limiting the efficiency of a well-armored occupying force in order to preserve the sanctity of their way of life from the corrupting influences of the occupying force. This group has access to a wide **variety of demolitions and explosives** as well as **experts** in employing them, having had many of their members trained in military service and universities across the world. To send a message to the occupying forces, a **low-level recruit** places an IED in a **roadside mailbox** – well aligned to target a passing vehicle, on a route **frequently** traveled by the occupiers. After placing the device, an **observer** remains nearby to set off the charge at the appropriate time when a target vehicle passes the mailbox (detonation in this case done by command wire) and to also record the attack for effects analysis and future training, motivational, propaganda, and recruitment purposes.



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## II. Design/Assess Scenario Inputs

- ▶ This step: relative likelihood information obtained to support calculation
- ▶ Approach: Relative likelihood of aspects of the scenario:
  - Compare Who X What for scenario entities
  - Compare Where X When for scenario entities
  - ...
- ▶ Scenario Consequence
  - Consequence is a function of multiple and often, context-dependent factors (e.g., deaths, money, political costs, social disruption)
  - Consequence statements are contingent on what is being risked (lives, money), and the nature of a location (impact of flu outbreak in New York City much different than in rural Nebraska)



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# Design/Assess Scenario Inputs

Scenarios Decomposed

Consensus Scores

Who	What	When	Where	Why	How	Score*
Group X	Activity 1	Time 1	Indiana	...	...	I
Group X	Activity 1	Time 1	Wyoming	...	...	0
Group Y	Activity 1	Time 1	Indiana	...	...	C
Group Y	Activity 1	Time 1	Wyoming	...	...	CC
Group X	Activity 1	Time 1	Indiana	...	...	C
Group X	Activity 2	Time 2	Indiana	...	...	I
...	...	...	...	...	...	...

**Design Option**

Score*	Interpretation
CC	Strongly Consistent - Likely
C	Consistent – somewhat likely
0	Neutral
I	Inconsistent – somewhat unlikely
II	Strongly inconsistent – very unlikely

# Design/Assess Scenario Inputs

Scenarios Decomposed

Consensus Scores

Who	What	When	Where	Why	How	Score*
Group 1	Activity 1	Time 1	Place 1	...	...	I
Group 2	Activity 1	Time 1	Place 1	...	...	0
Group 3	Activity 1	Time 1	Place 1	...	...	C
Group 4	Activity 1	Time 1	Place 1	...	...	CC
Group 1	Activity 2	Time 2	Place 2	...	...	C
Group 2	Activity 2	Time 2	Place 2	...	...	I
...	...	...	...	...	...	...

**Design Option –  
focuses on  
contrasting ‘Who’**

Score*	Interpretation
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# Design/Assess Scenario Inputs

Scenarios Decomposed

Consensus Scores Decomposed

Who	What	When	Where	Why	How	Motivation and Intent	Target suitability	Group Capability
Group 1	Activity 1	Time 1	Place 1	...	...	I	0	C
Group 2	Activity 1	Time 1	Place 1	...	...	0	C	I
Group 3	Activity 1	Time 1	Place 1	...	...	C	CC	I
Group 4	Activity 1	Time 1	Place 1	...	...	CC	I	0
Group 1	Activity 2	Time 2	Place 2	...	...	C	C	0
Group 2	Activity 2	Time 2	Place 2	...	...	I	C	0
...	...	...	...	...	...	...		

Score*	Interpretation
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# Input Data From Assessment/Likelihood Panel

Ndde/ACH scores	1C	1B	1A	2C	2B	3B	4C	4B	5A	2A
M&I	I,I,CC,CC	nr	CC,CC	CC,CC	nr	CC	CC,CC	CC,CC	CC,CC	CC, CC
Target fits goals	I,I	nr	NA	NA	nr	CC	CC	CC	CC	C
Perception of Vulnerabil	NA	nr	NA	NA	nr	NA	NA	NA	NA	NA
Material	NA	nr	C	N	nr	C	NA	N	C	C
Operations	CC	nr	CC	CC	nr	CC	CC	CC	CC	CC
Equipment	C,N	nr	C	CC	nr	CC	NA	C	C	C

The ~12-14 indicators for which information on the 10 scenarios was solicited fit into the leaf nodes for the Bayes network – see below.

Input values for scenarios 1B and 2B were obtained based on discussions with the group facilitator.

# Design/Assess Scenario Inputs

**Scenario Generation**

- Who
- What
- When
- Where
- Why
- How

Primary Scenarios and Variations

**Comparisons Design**

- Who1, Who2, Who3,...
- What
- When
- Where
- Why
- How

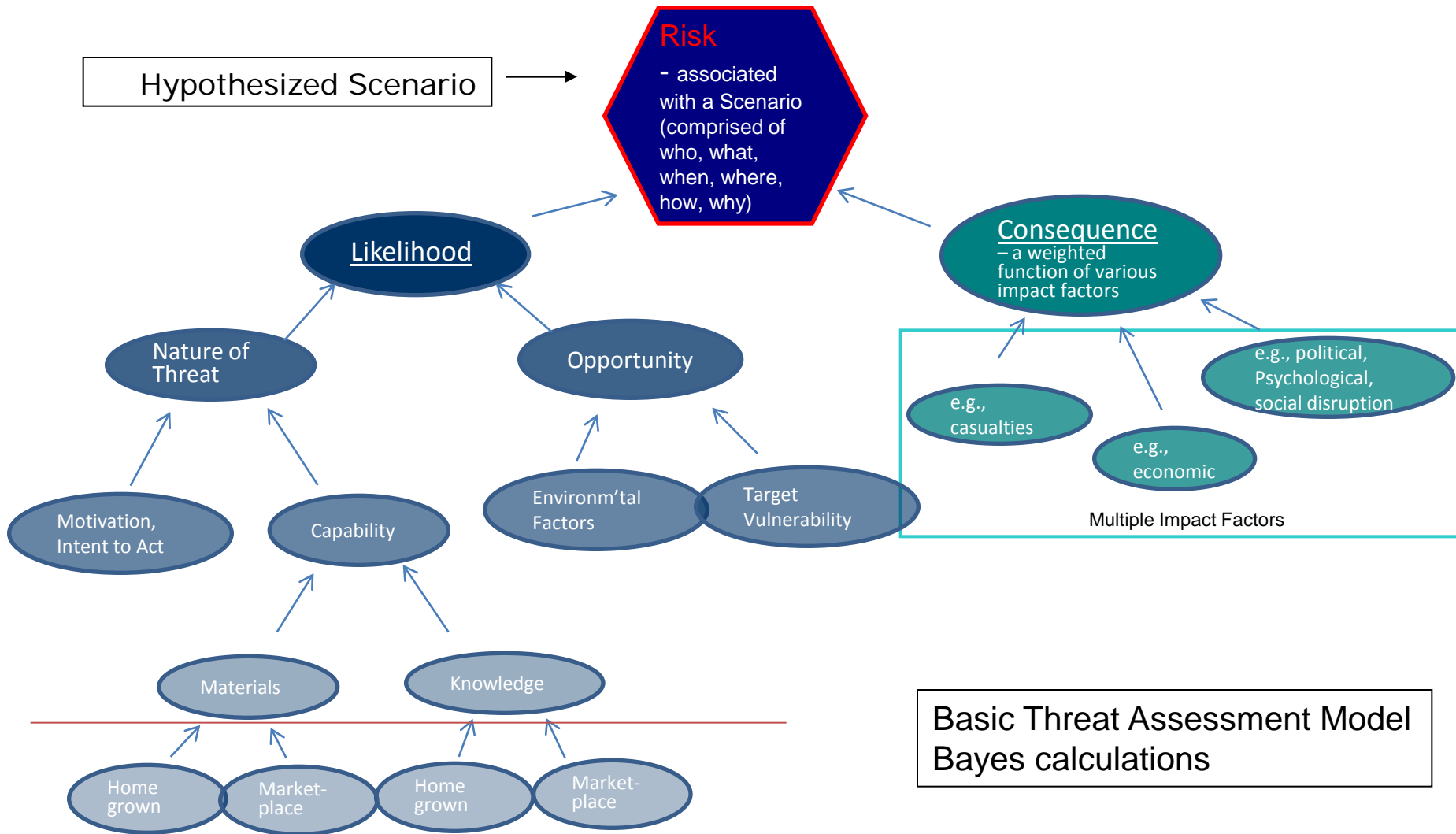
Distinct Scenarios Compared

**Comparisons Elicited for Indicators in these Categories:**

- Motivation and Intent
- Target Characteristics Relative to Group
- Group Capability

Scenario Scores Elicited

# III. Calculation Approach





# Generic Threat Model

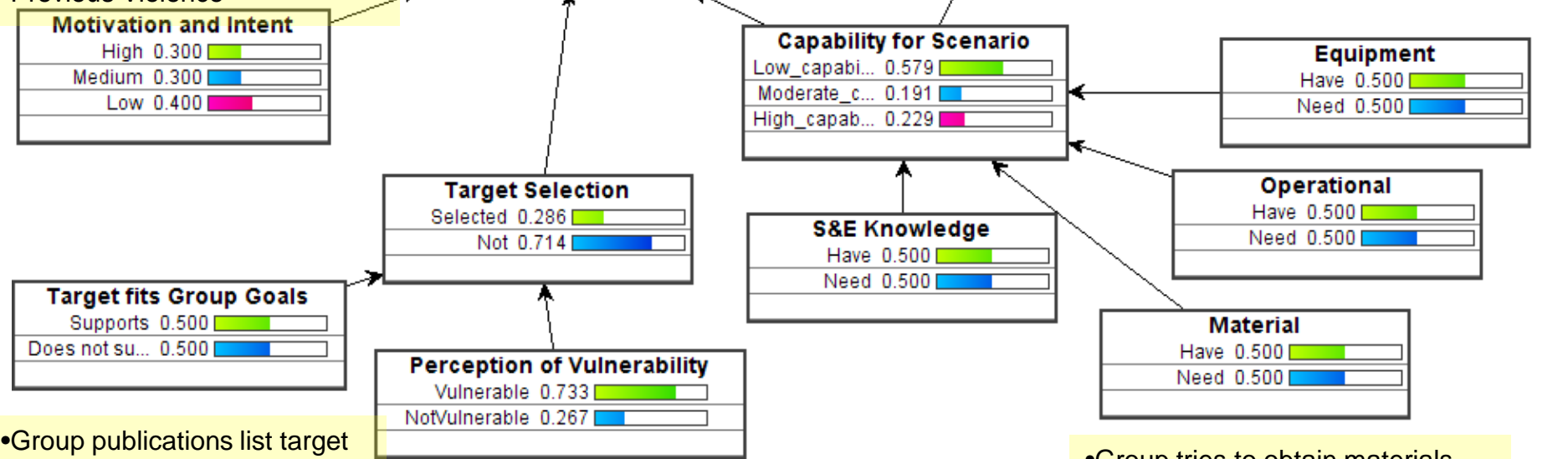
Processes Inputs

Produces Relative Likelihood and Risks

As represented in the BACH software

Couple with consequences to estimate risk

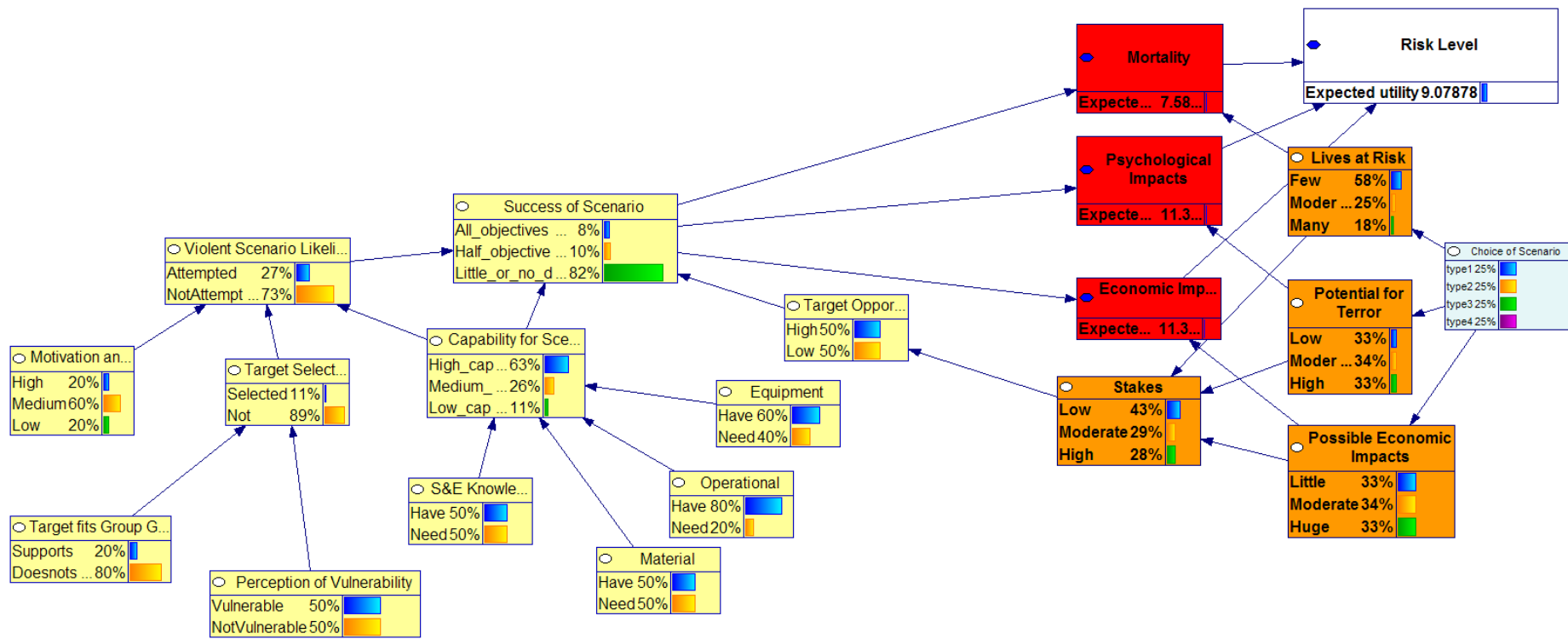
- Government ineffectiveness
- Criminal and Black Market Activity
- Controls territory
- High Alliance Connections
- Previous Violence



- Group publications list target
- Group has attacked similar targets

- Group tries to obtain materials
- Group known to possess materials

# Example Risk Calculation



# IV. Outcome – Where to Focus Resources

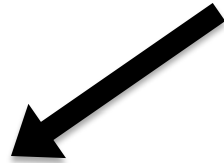
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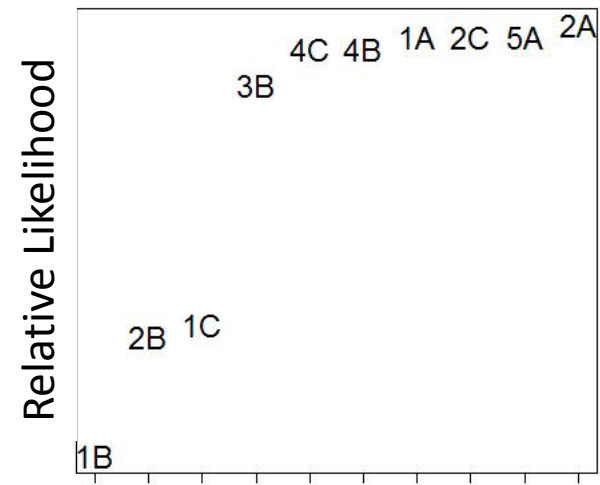
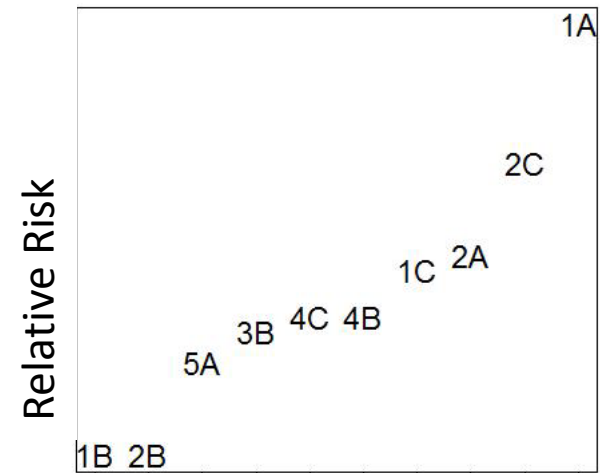


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# Likelihood and Risk Rankings

- Bio-threat scenarios elicited
- Scenario Comparisons made – based on SME knowledge
- Comparisons processed through threat model
- Relative likelihood and risks of scenarios calculated

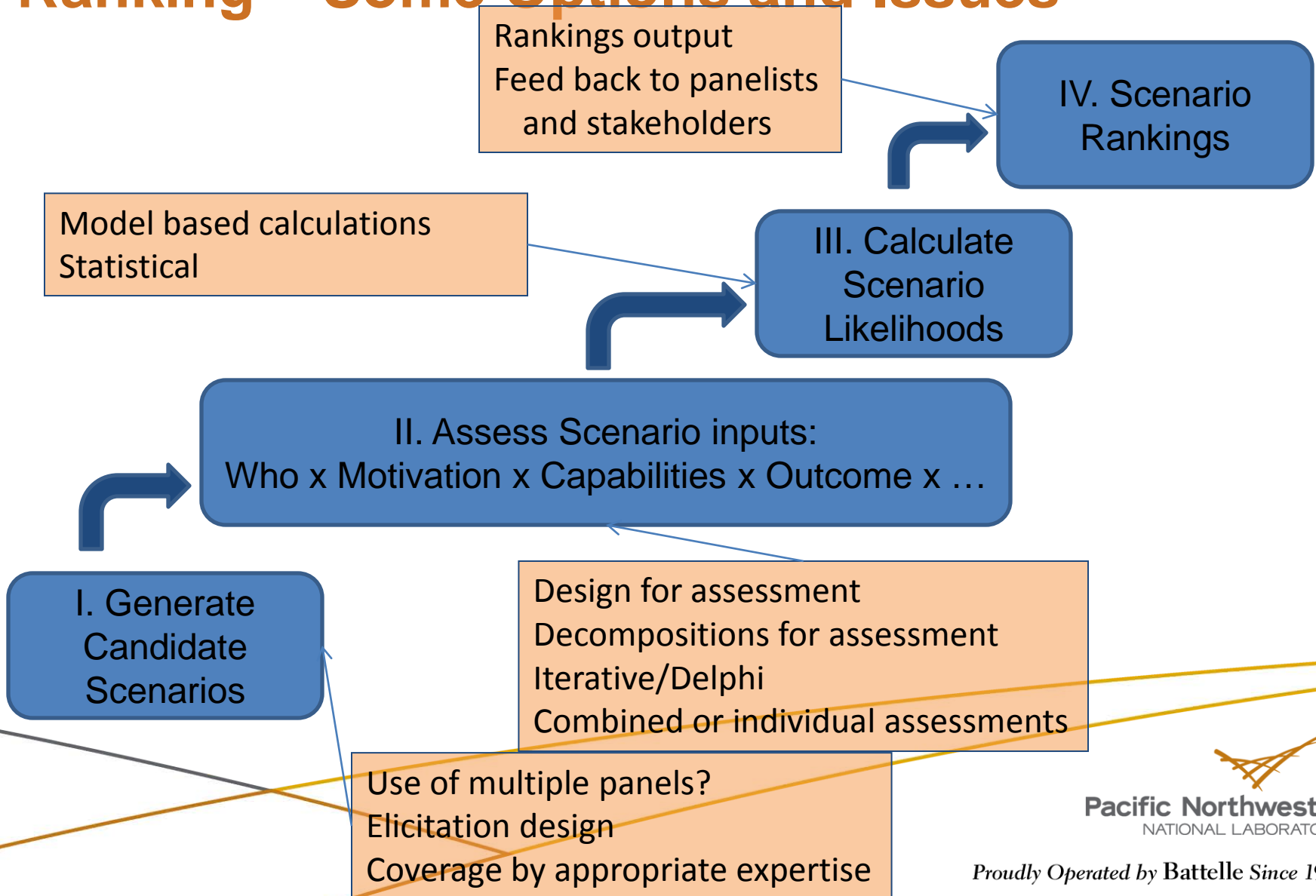


Rank

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# Methodology for Scenario Generation and Ranking – Some Options and Issues



# Thanks!

