Risk Analysis in the Context of Health, Food, and Agriculture Resilience

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2024 Annual Meeting of the University Consortium for Health, Food, and Agriculture Resilience

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Session Objectives

1. Review basic terms and fundamentals of risk analysis.

2. Review themes from discussions on risk at the first University Consortium meeting (October 2022).

3. Describe recent risk assessment developments related to *National Security Memorandum on Strengthening the Security and Resilience of United States Food and Agriculture.*

4. Present current work towards a risk register concept and associated considerations and challenges.

5. Introduce optional individual reflection activity.

What is "Risk?"

Risk is defined as "potential for an unwanted outcome resulting from an incident, event, or occurrence, as determined by its **likelihood** and the associated **consequences**" (DHS Risk Lexicon)

- Likelihood is defined as an estimate of the potential of an incident or event's occurrence; and is itself a function of a combination of **threat** and **vulnerability**

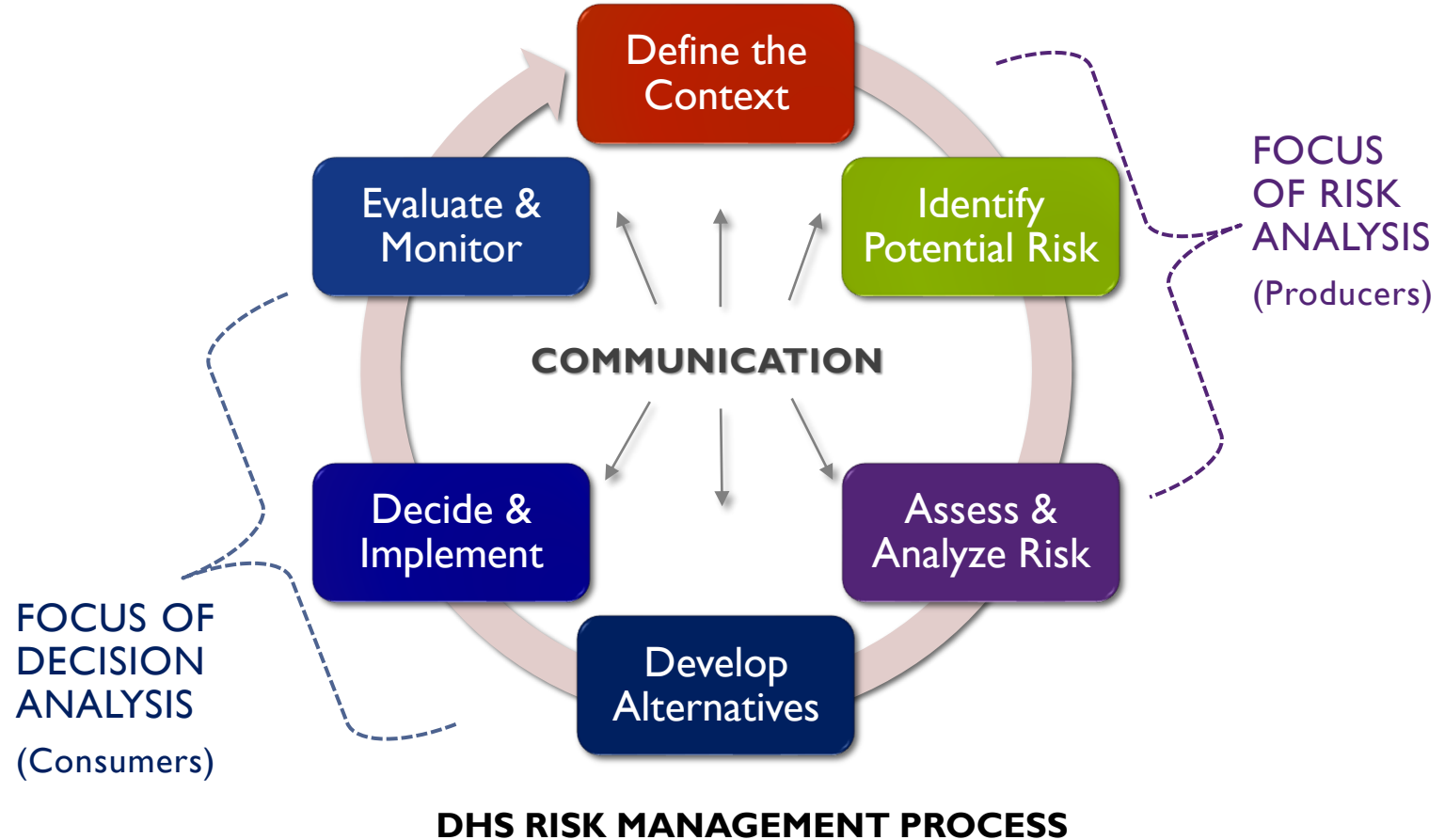Therefore **risk** can be expressed as a function of:

- Threats
- Vulnerabilities
- Consequences

Risk Steering Committee

DHS Risk Lexicon

2010 Edition

September 2010

Homeland Security
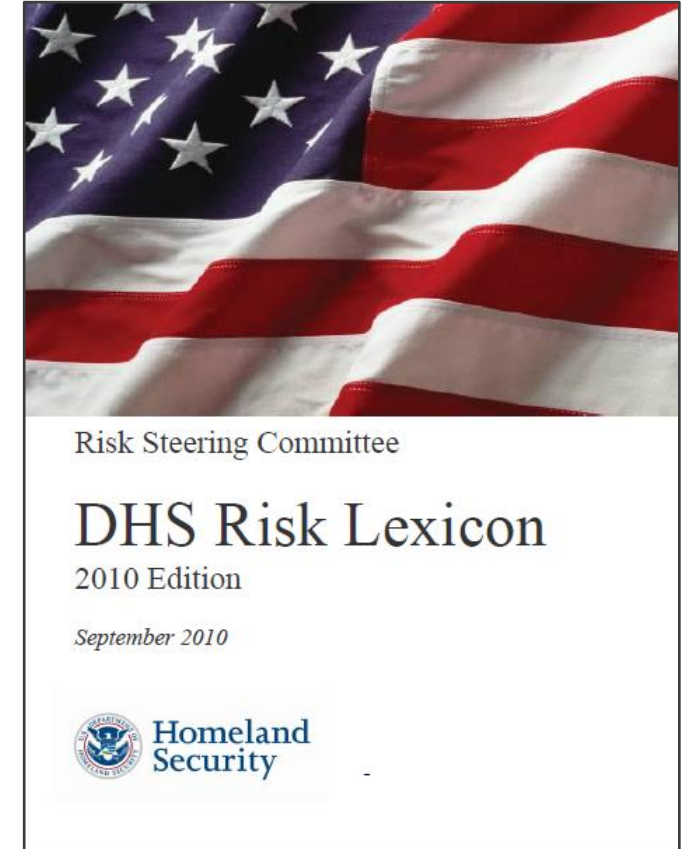
Risk Analysis & Decision Analysis

- Risk analysis as an iterative process:
  - Identifies and assesses risks
  - **Decision support** with risk information - informs decisions among alternative courses of action
  - Develops, prioritizes, and implements options
  - Monitors and manages the results
- A coordinated approach to health, food and agriculture sector risk assessments will support a holistic understanding of catastrophic risks and vulnerabilities to the sector and enable effective mitigations.

FOCUS OF RISK ANALYSIS (Producers)

FOCUS OF DECISION ANALYSIS (Consumers)

Define the Context

Identify Potential Risk

Evaluate & Monitor

COMMUNICATION

Decide & Implement

Assess & Analyze Risk

Develop Alternatives

DHS RISK MANAGEMENT PROCESS

Source: DHS Risk Management Fundamentals (2011)

Recap of Risk Assessment Themes: October 2022 University Consortium Meeting

- **Need for coordinated, systematic approaches to measure and evaluate risk within the health, food, and agriculture domain effectively and comprehensively.**
  - Multidisciplinary, systems approach to problem solving may provide an increased awareness of dynamics, intra- and inter-dependencies across various systems

- **A whole-of-community approach: Disciplines and areas of research that connect to the topic of risk assessment need to have input**
  - For example: invasive species, ecology, natural resources, social sciences
  - Greater inclusion across the academic spectrum will enable not only more informed technology development, but also technology maturation, integration, and deployment

- **Scoping of systems and risk assessments**
  - Need to address spatial and temporal variability; for example, network dynamics to characterize spatial, temporal, and other heterogeneous facets of a system-of-systems

- **Potential future steps/modalities for University Consortium & partner engagement**
  - Application of scenarios, for example to support network characterization
  - Belief elicitation around risk
  - Workforce development considerations

National Security Memorandum on Strengthening the Security and Resilience of United States Food and Agriculture

Released November 2022; referred to as "NSM-16"

Excerpts from NSM-16:

- The food and agriculture sector is extensive, interconnected, diverse, and complex.

- Designated as critical infrastructure and primarily owned and operated by private sector and non-Federal entities, food and agriculture systems and supply chains are vulnerable to disruption and damage from domestic and global threats.

- It is the policy of the United States to ensure that our Nation's food and agriculture sector is secure and resilient in response to the possibility of **high-consequence and catastrophic incidents**.

NSM-16 & Risk Assessment

- NSM-16 seeks to "Identify and assess threats, vulnerabilities, and impacts from…high-consequence and catastrophic incidents, including but not limited to those presented by CBRN, [pandemics,] climate change, and cybersecurity, and **prioritize resources to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk**."

- NSM-16 requires the development of a comprehensive risk assessment that will undergo review on an annual basis
  - Threat assessment
  - Vulnerability Assessment

- NSM-16 also required the development of an "Interim Risk Review"

What are the greatest risks to the US food and agriculture sector?
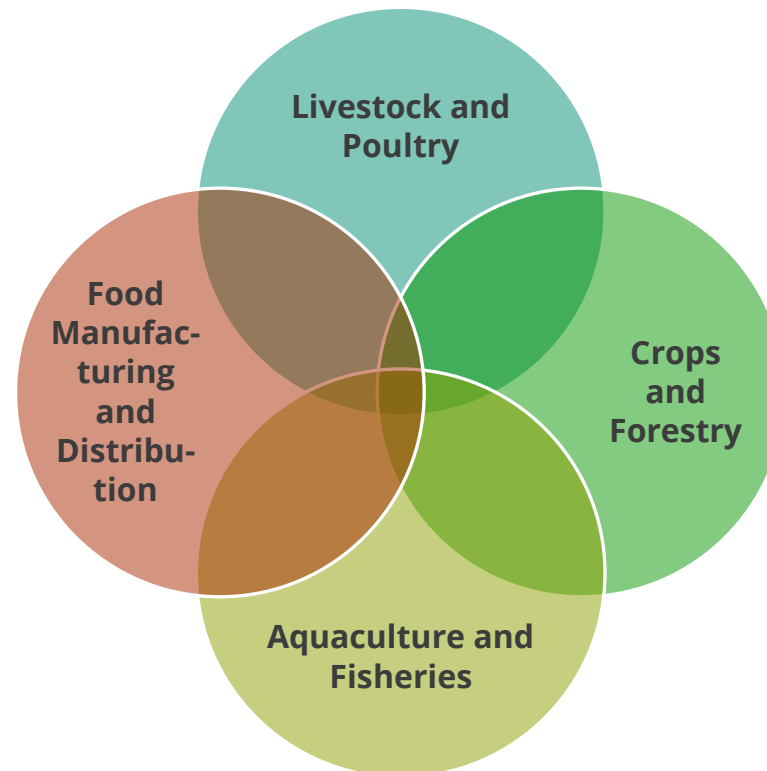
120-Day Food and Agriculture Interim Risk Review (March 2023)

Publicly released July 2023

Purpose: "an interim review of critical and emergent risks to the food and agriculture sector"

Four "domains"

120-Day Food and Agriculture Interim Risk Review: https://www.fda.gov/food/cfsan-constituent-updates/strengthening-security-and-resilience-us-food-and-agriculture120-day-interim-risk-review

Hazards, Threats, and Potential Risk Factors

The Interim Risk Review focused on three categories of hazards & threats; and included discussion on current federal efforts to mitigate risks:

- Chemical, Biological, Radiological, and Nuclear (CBRN), including naturally-occurring biological hazards:
  - Crop and Seedborne Pests & Pathogens
  - Transboundary Animal Diseases & Pests
  - Human Diseases / Pandemics

- Cyber Threats

- Climate Change:
  - Natural Disasters & Extreme Weather Events
  - Drought and Water Security
  - Pollinator and Pollinator Service Loss
  - Increased Exposure Potential
  - Human-Animal Interface
  - Agriculture-Nature Interface

- Potential Risk Factors

120-Day Food and Agriculture Interim Risk Review: https://www.fda.gov/food/cfsan-constituent-updates/strengthening-security-and-resilience-us-food-and-agriculture120-day-interim-risk-review

Risk assessment across the Health, Food, and Agriculture domain space is a complicated and challenging process

Community/ Partner Diversity

In addition to governmental, academic, and non-governmental entities, the roles of private industry and consortiums are critical within the health, food, and agriculture domain

Domain Diversity

While there are clear connection points across the space there are also unique aspects within specific sectors

Time Course & Implementation

After the initial assessment is complete it can be difficult to update the assessment over time and share the results to all relevant parties

Multiple Scales of Risk Assessment

Health, Food, Agriculture Sector Risk Assessments

Global

Regional (e.g., North America)

National

Sub-National (e.g., State, Tribal, Territorial)

Local

Entity

Summary of SME Input – Relative Risk Assessment

We consulted a group of subject matter experts to elicit specific hazards and threats that should be considered as part of future risk assessments in HFAR domains. Selected inputs included:

- Resistance (antimicrobial, herbicide/pesticide, anthelmintic)

- Plant pathogens (e.g., wheat blast, rice bacterial blight, Old World Bollworm)

- Animal pathogens (e.g., ASF, FMD)

- Zoonotic pathogens (e.g., Nipah Virus)

- Attacks on critical infrastructure required by US agriculture

- Cyber attacks

- Natural disasters (earthquake, winter storm, extreme rain/flooding)

Current Work – Relative Risk Assessment

- Framing a risk assessment method to develop repeatable, comparable approaches to assessing catastrophic risks to the health, food, and agriculture systems.

- Based on work to date, currently working to establish primary scenario classes to be applied in risk assessment process

- Will lead to risk prioritization (risk register)

  - A repository of identified (known) risks and their associated assessments of likelihood and consequence

Target Outcome: A "risk register" describing relative risk assessment across health, food, and agriculture resilience space

What is a risk register? Example – UK Risk Register

UK National Risk Register (NRR) is the public-facing version of the National Security Risk Assessment (NSRA)

- Risks are thematically grouped for the risk assessment process

The UK NRR focused on highest risks over next 2 years

Considerations:

- Timeframe

- Audience for the risk register

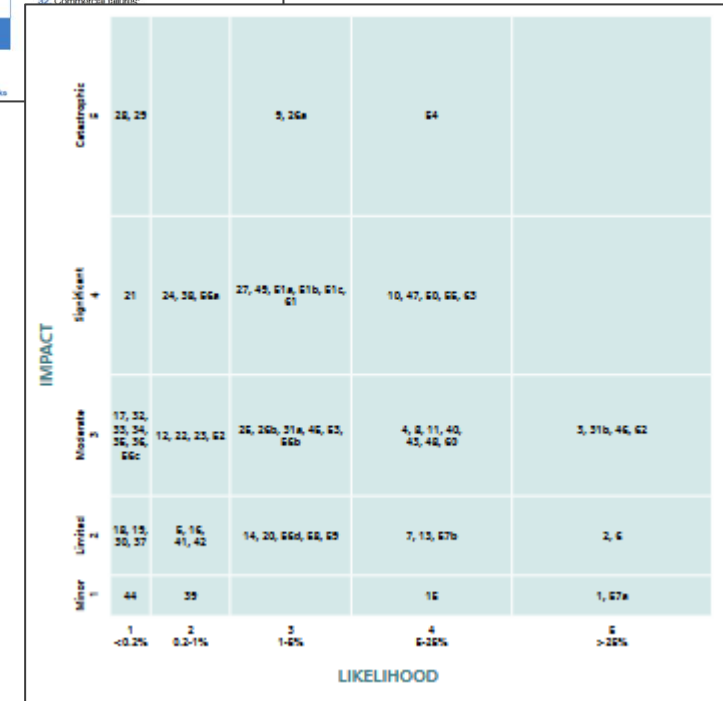**UK NRR is periodically updated (latest version: 2023)**
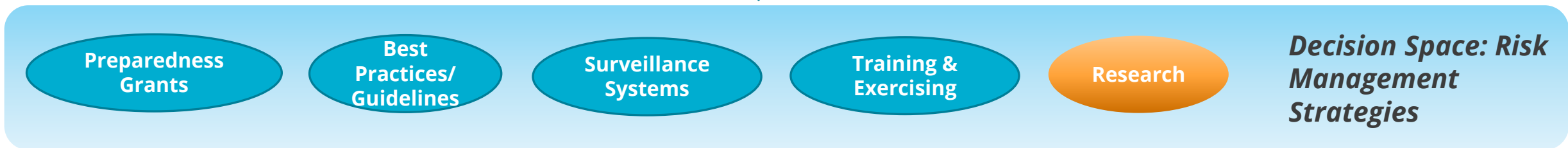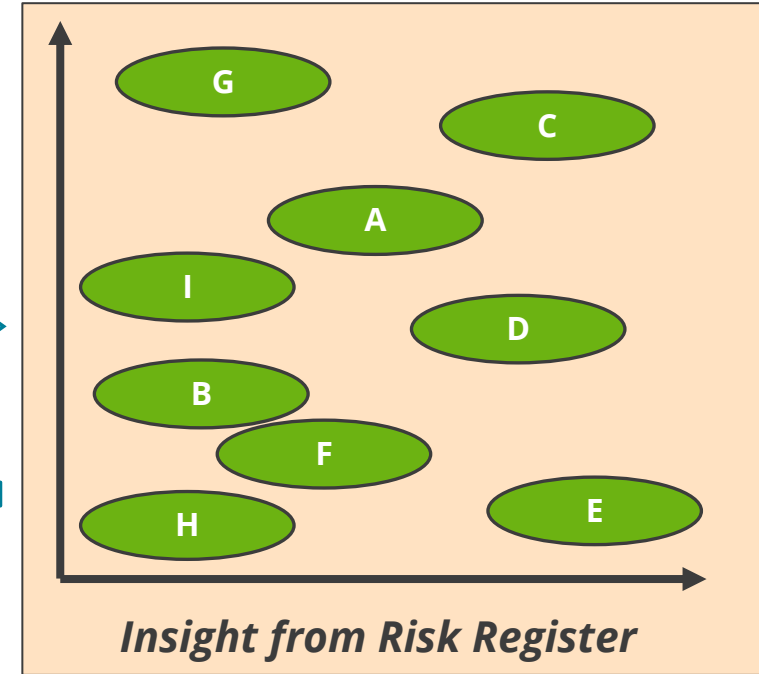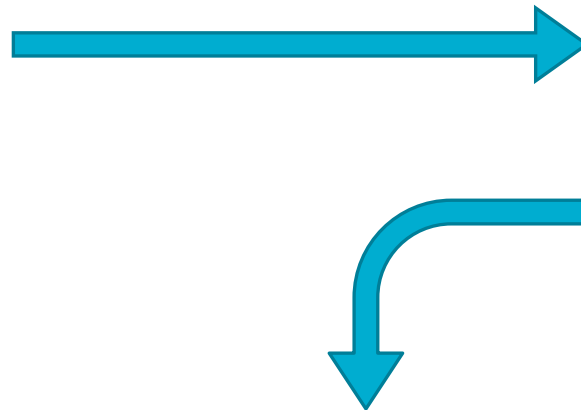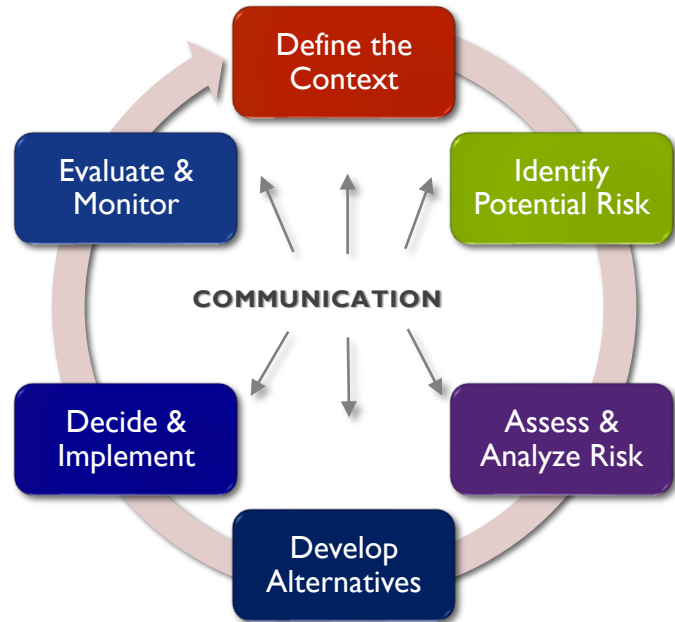

Source: UK National Risk Register – 2020 Edition

2020 UK Risk Register

Source: UK National Risk Register – 2023 Edition

Why a Risk Register? Risk Analysis to Decisions

Define the Context

Identify Potential Risk

Evaluate & Monitor

COMMUNICATION

Decide & Implement

Assess & Analyze Risk

Develop Alternatives

G   C   A   I   D   B   F   H   E

Insight from Risk Register

Preparedness Grants

Best Practices/ Guidelines

Surveillance Systems

Training & Exercising

Research

Decision Space: Risk Management Strategies

Prevention & Preparedness

Protection & Detection

Mitigation

Response

Recovery

Outcome: Resilient Architecture

Future Work: Addressing Challenges and Considerations

- Scoping
  - Which scenario classes to include? Which to exclude?
  - Wide range of threats, vulnerabilities, and consequences
  - Emerging and unknown threats

- Addressing Range of Scales
  - Local to global, acute to persistent

- Comparability of risk analysis across scenario classes

- Identification and access to appropriate subject matter expertise

- Data availability and data sharing

- Identification of future research needs based on risk register

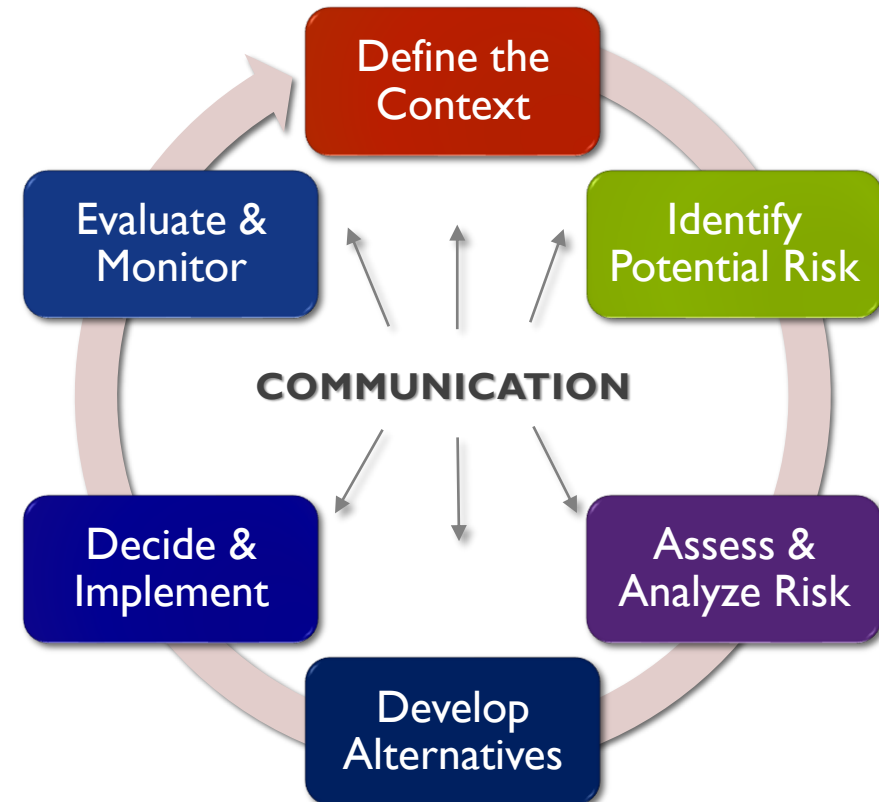- Audience and mode of communication

Thank you for your attention!

Questions?

(Optional) Individual Reflection Activity

Instructions:

1. This is a voluntary individual reflection activity.
2. Please take a few minutes to consider this morning's discussions and the individual reflection questions.
3. Consider sharing your thoughts with your colleagues!

Individual Reflection Activity – Candidate Questions

1. What hazard(s)/threat(s) to health, food and agriculture do you consider to be most important to prepare for? Why?

2. What role(s) do universities play in health, food, and agriculture risk and decision analysis? In what ways does academia contribute to stakeholder understanding of risk (including the public)? What role(s) could universities play in the future?

3. Where could there be greater communication and collaboration across domains (e.g., livestock & poultry, crops & forestry, public health) and partners (e.g., academia, industry, levels of government) to conduct and utilize risk analysis?
   1. Have you observed approaches that have been effective in other contexts?

4. What gaps exist in current research that, if addressed, could inform future understanding of risk?