

SAFETY ANALYSIS & SAFETY CASE: IMPORTANCE OF UNCERTAINTY (& OF ITS MANAGEMENT)

September 14, 2020 • F. Lemy (Bel V - UMAN WP Leader)



The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 847593.

WHAT DOES « UNCERTAINTY » MEAN ?



“A situation in which something is not known, or something that is not known or certain”

Source: <https://dictionary.cambridge.org>

« UNCERTAINTY » VS. « RISK »

- **Uncertainty \neq Risk !**
- **Risk**
 - related to a scenario or sequence of events
 - = Probability x Consequences
 - can be interpreted as the measure of significance of an uncertainty
- **The significance of uncertainties needs to be assessed**



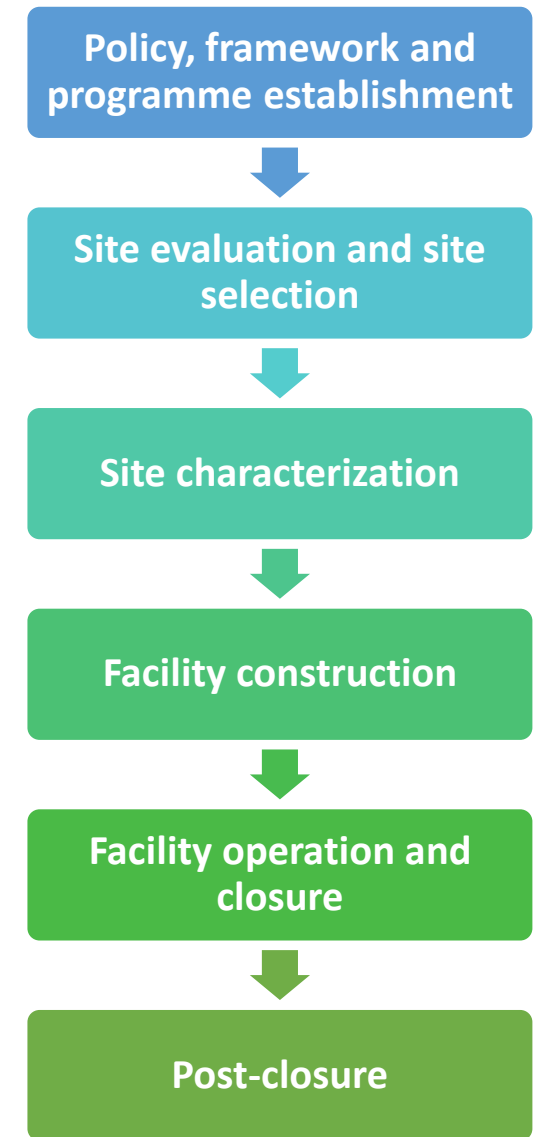
« EPISTEMIC » VS. « ALEATORY » UNCERTAINTIES

An uncertainty can be:

- « **epistemic** »
 - i.e. relating to knowledge or to the degree of its validation
 - e.g. lack of knowledge about site characteristics
 - *can be reduced*
- « **aleatory** »
 - i.e. related to random variability
 - e.g. uncertainty over the time of occurrence or magnitude of rare events
 - *cannot be reduced*

UNCERTAINTY & DECISION-MAKING PROCESS

- Disposal programme = “**Stepwise decision-making process**”
- Decisions are made:
 - in presence of **irreducible and reducible uncertainties**
 - considering that some uncertainties will **decrease as new information will become available** e.g. “as-built” properties, monitoring data, R&D results,...
- **Choices** made on the basis of limited information in early phases **may have to be confirmed** during subsequent phases
- **Information about uncertainties and perspectives on how they can be managed** form an important input for the decisions to be taken at each phase





ROLES OF THE SAFETY CASE

- The safety case provides the **basis for demonstration of safety and for licensing**
- They **assist and guide decisions made at each programme phase**
- The safety case will also be the main basis on which:
 - **dialogue** with interested parties will be conducted
 - **confidence in the safety** of the disposal facility will be developed

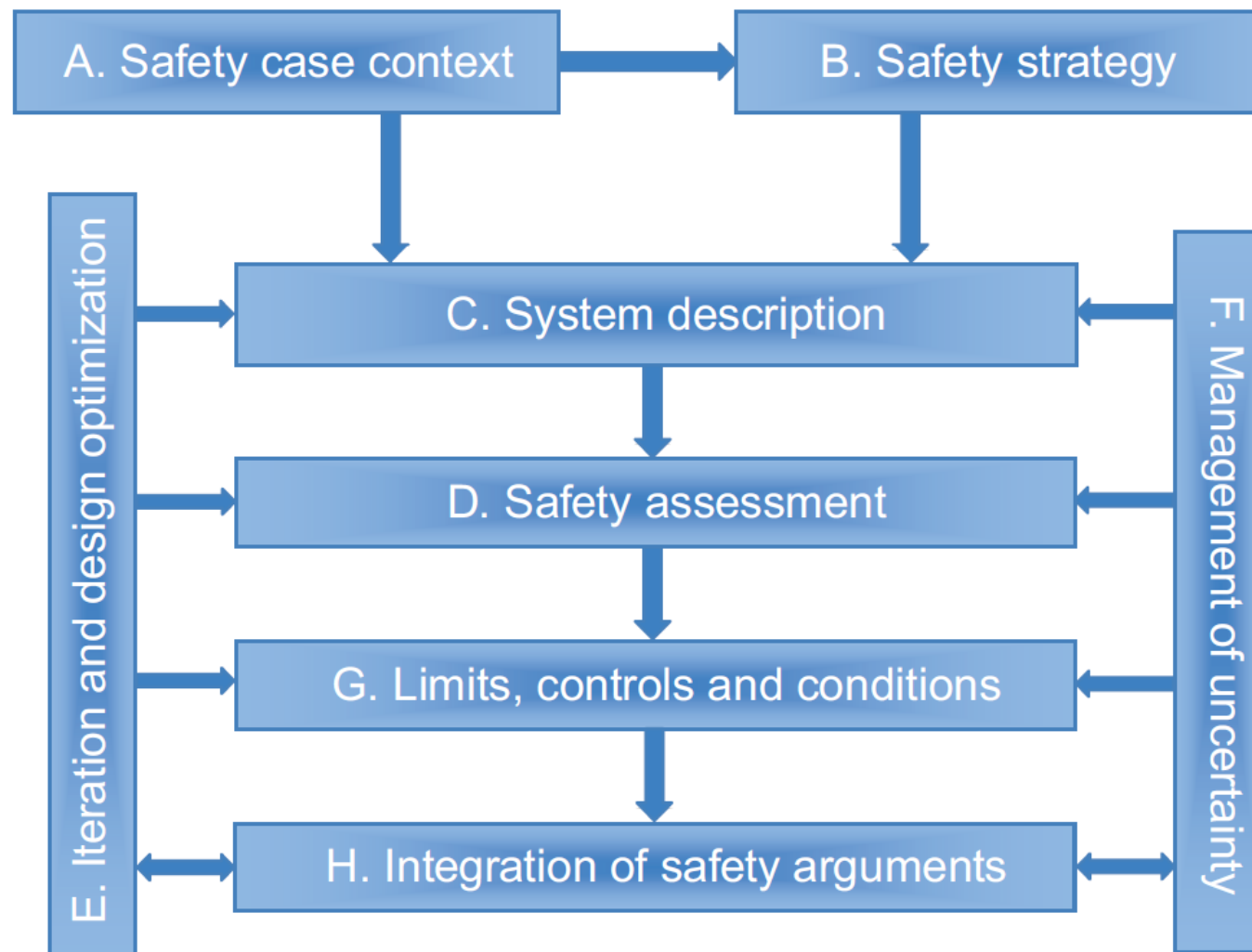
UNCERTAINTY & THE SAFETY CASE

=> The safety case needs to:

- describe the **approach to managing uncertainties**
- acknowledge and **identify significant uncertainties**
- **assess the impact** of uncertainties
- show that **existing levels of uncertainty are acceptable** given the decision(s) to be taken
- show **how significant uncertainties will be managed** in subsequent phases
- be **regularly updated** so that it remains an adequate basis for making decisions

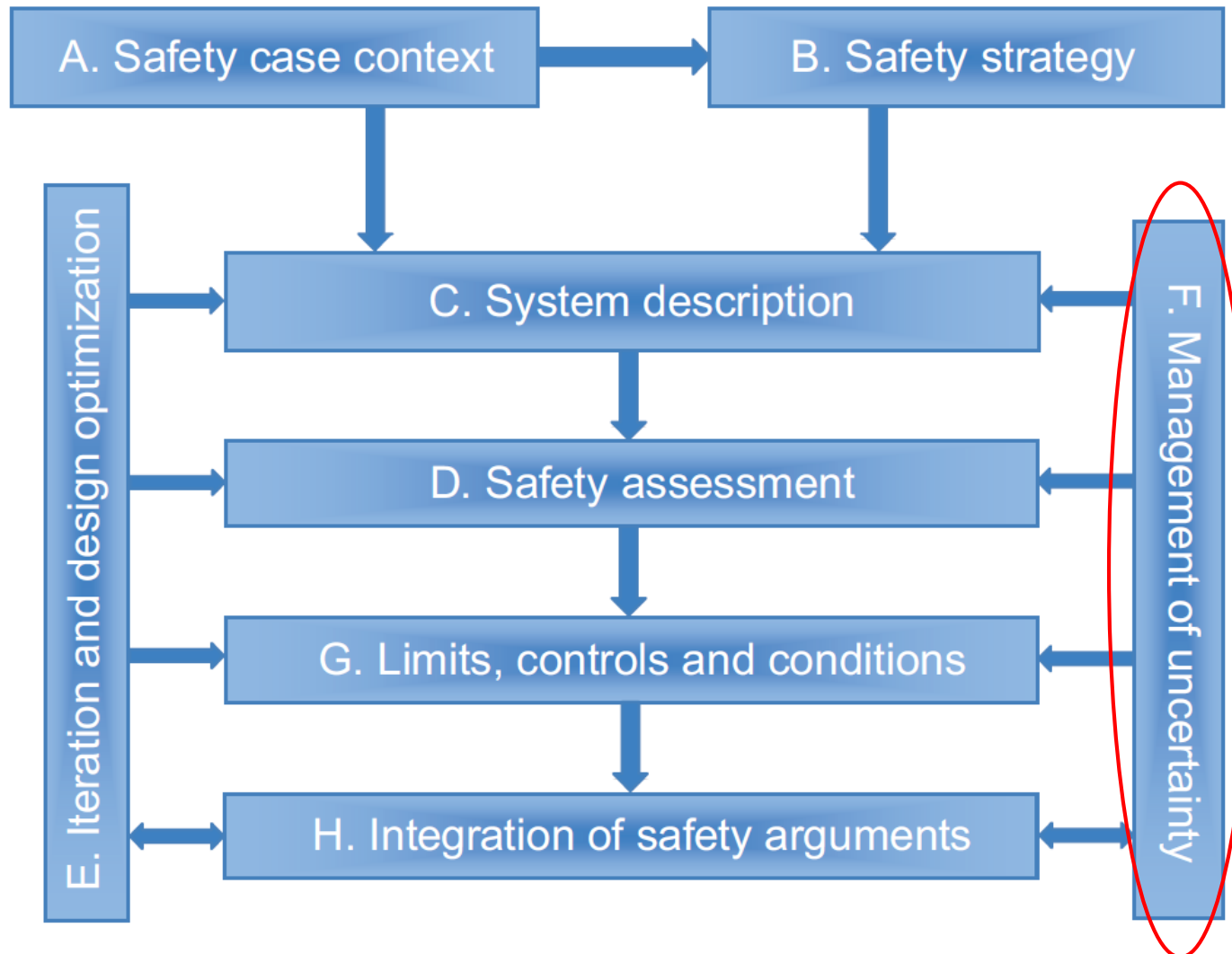


COMPONENTS OF THE SAFETY CASE



Source:
IAEA Safety Guide SSG-23

MANAGEMENT OF UNCERTAINTY



- Uncertainty management is a **cross-cutting element of the safety case**

TYPES OF UNCERTAINTIES THAT MAY HAVE TO BE MANAGED IN A DISPOSAL PROGRAMME

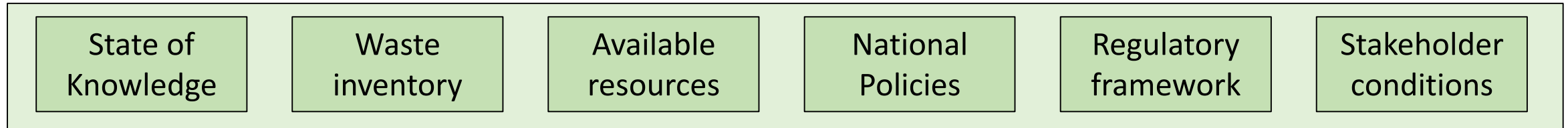
- **Programme uncertainties**, i.e. uncertainties associated with the national radioactive waste management programme and other prevailing circumstances (e.g. uncertainties relating to the types and volume of waste to be disposed of, stakeholder conditions, the regulatory framework, disposal concepts and schedule, available resources,...)
- Uncertainties associated with the **initial characteristics** of the waste, site and engineered components
- Uncertainties in the **evolution of the disposal system and its environment**, including those that may affect the initial characteristics of the disposal facility
- Uncertainties associated with the **data, tools and methods** used in the safety case
- Uncertainties associated with the **completeness of the Features, Events & Processes (FEPs)** considered in the safety case



ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

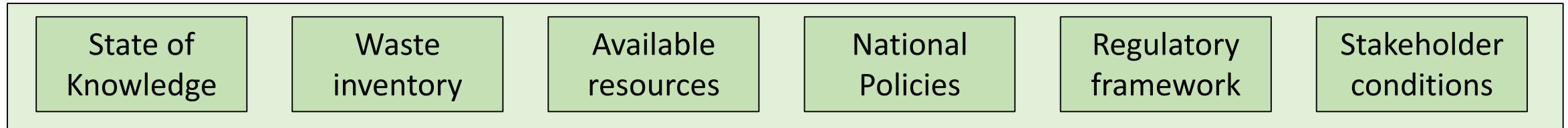
ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

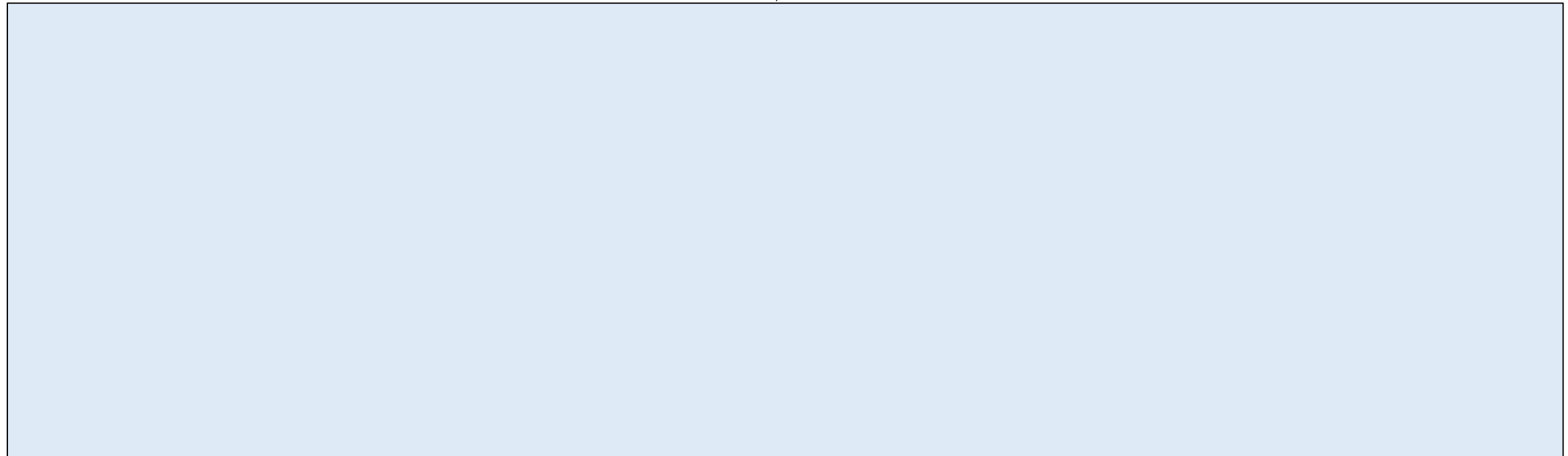


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

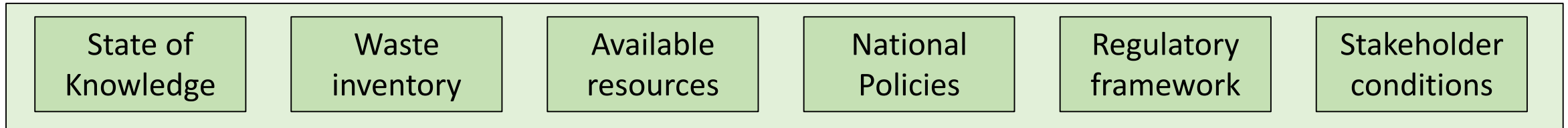


Programmatic activities



ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances



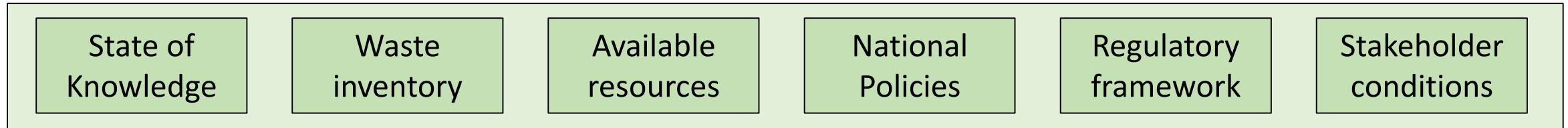
Programmatic activities



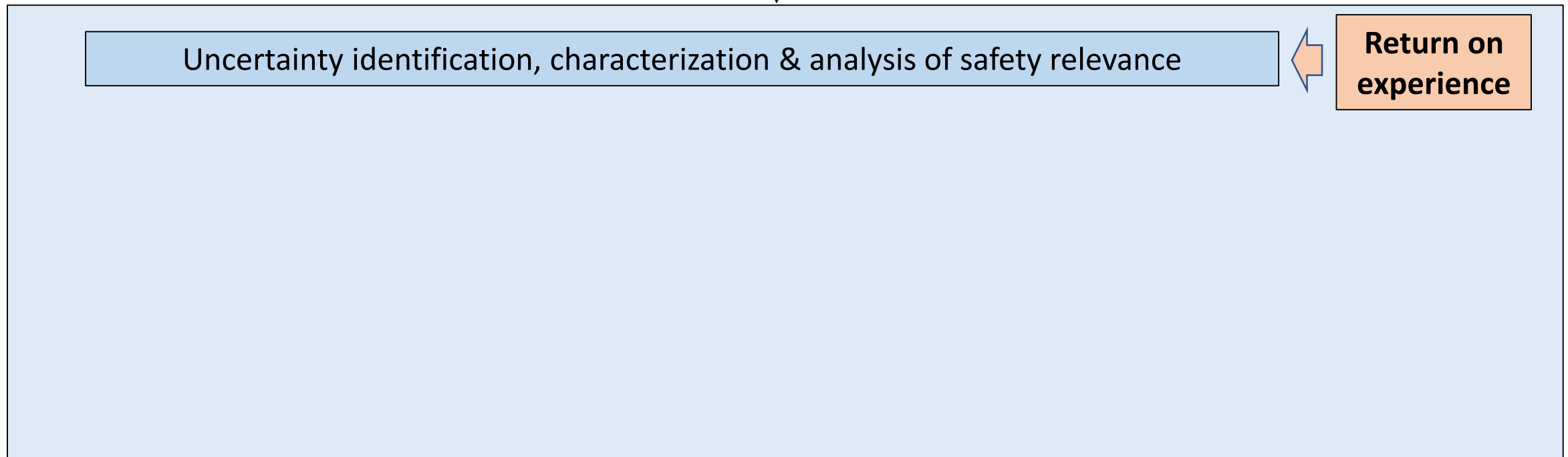
Uncertainty identification, characterization & analysis of safety relevance

ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

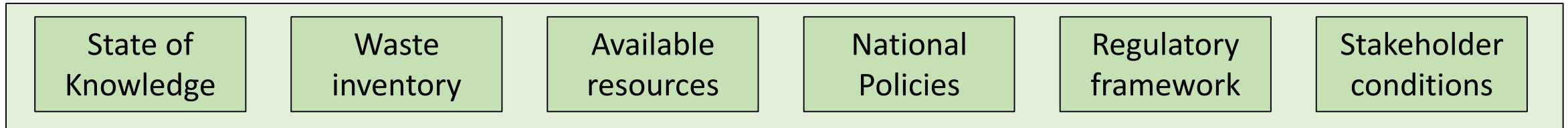


Programmatic activities

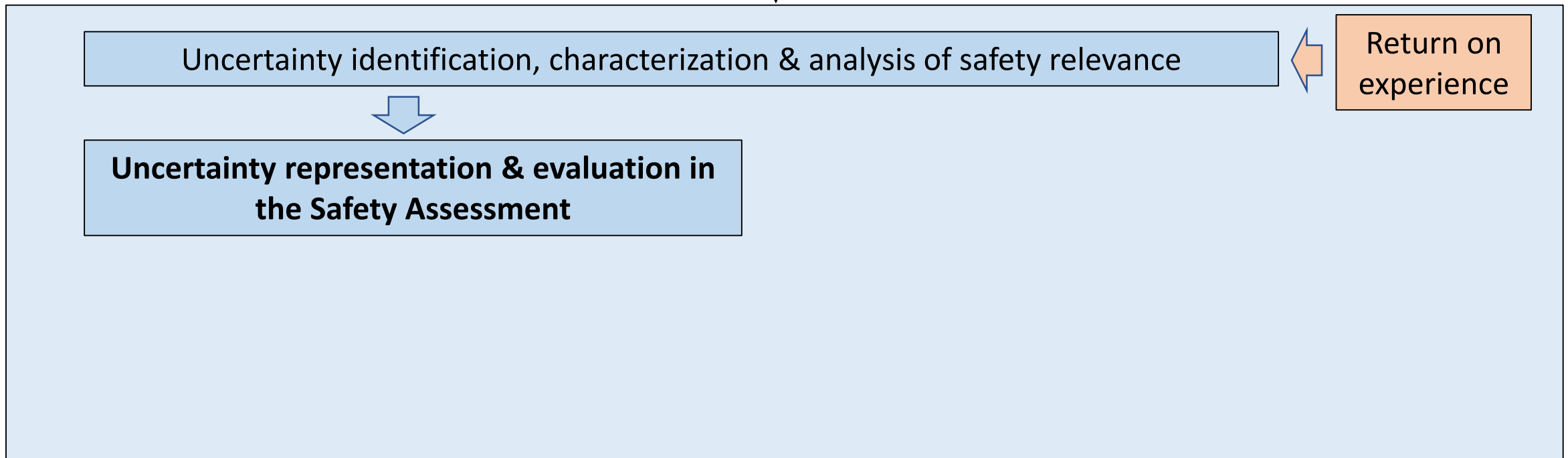


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

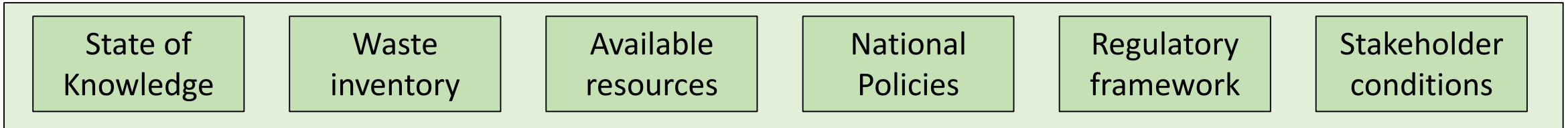


Programmatic activities

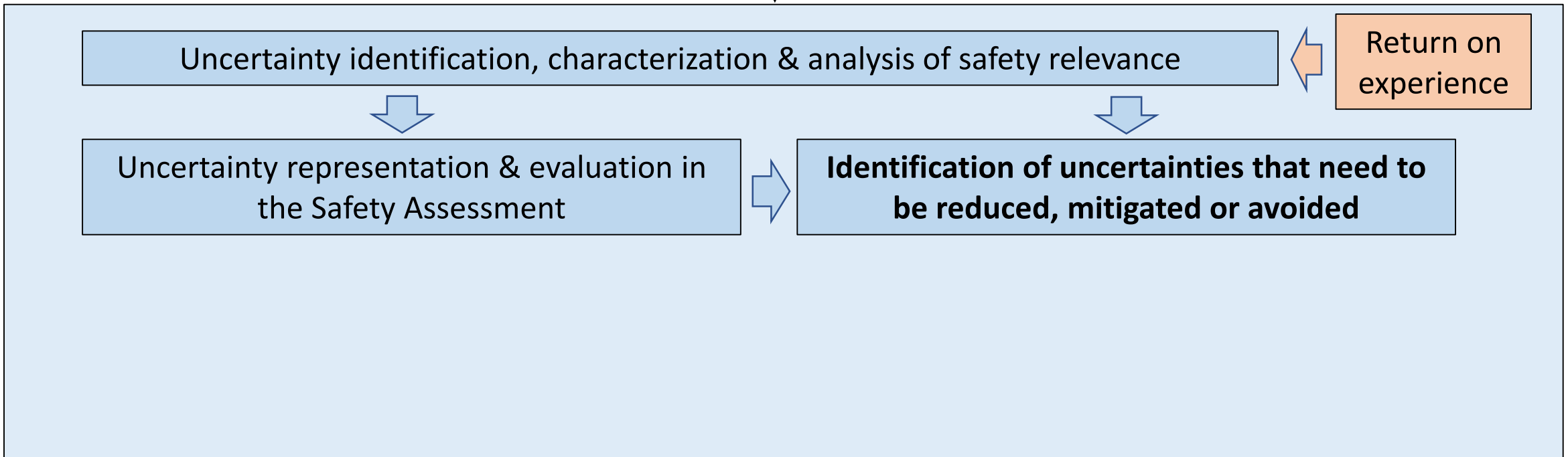


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

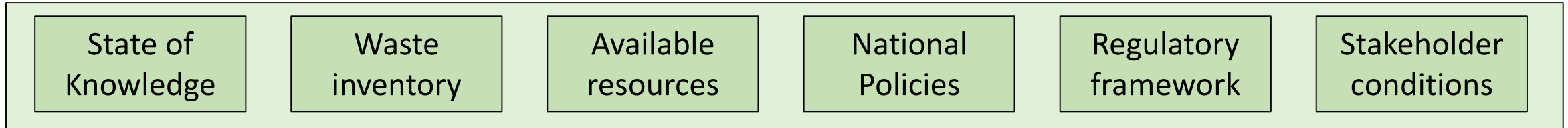


Programmatic activities

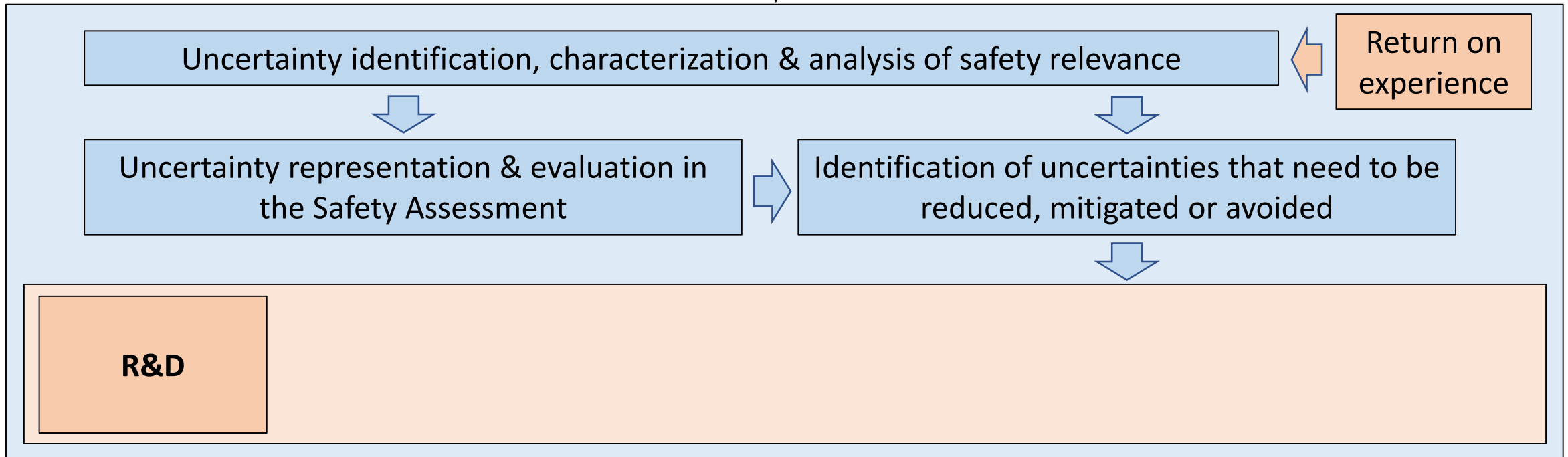


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

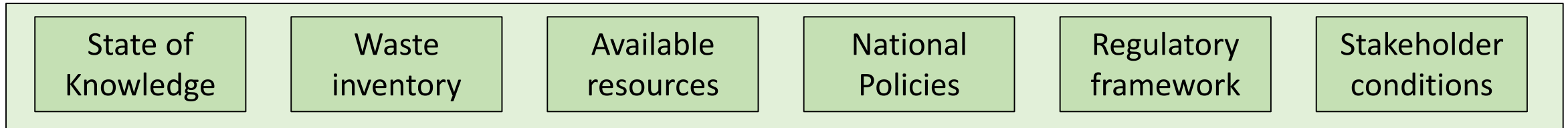


Programmatic activities

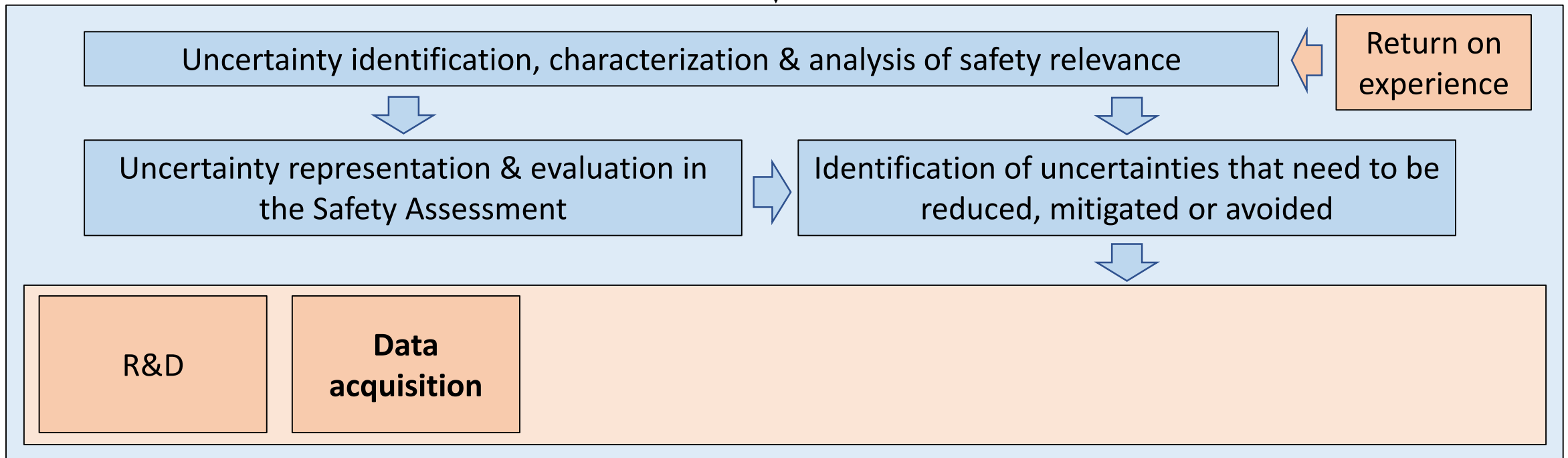


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

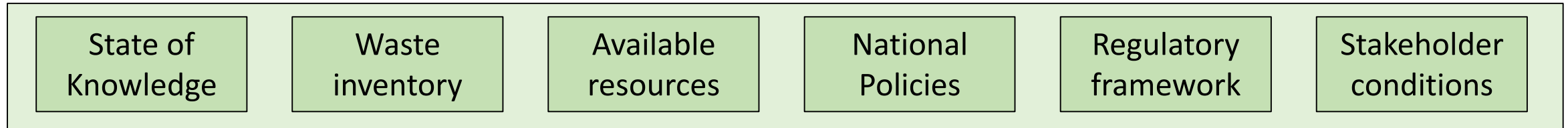


Programmatic activities

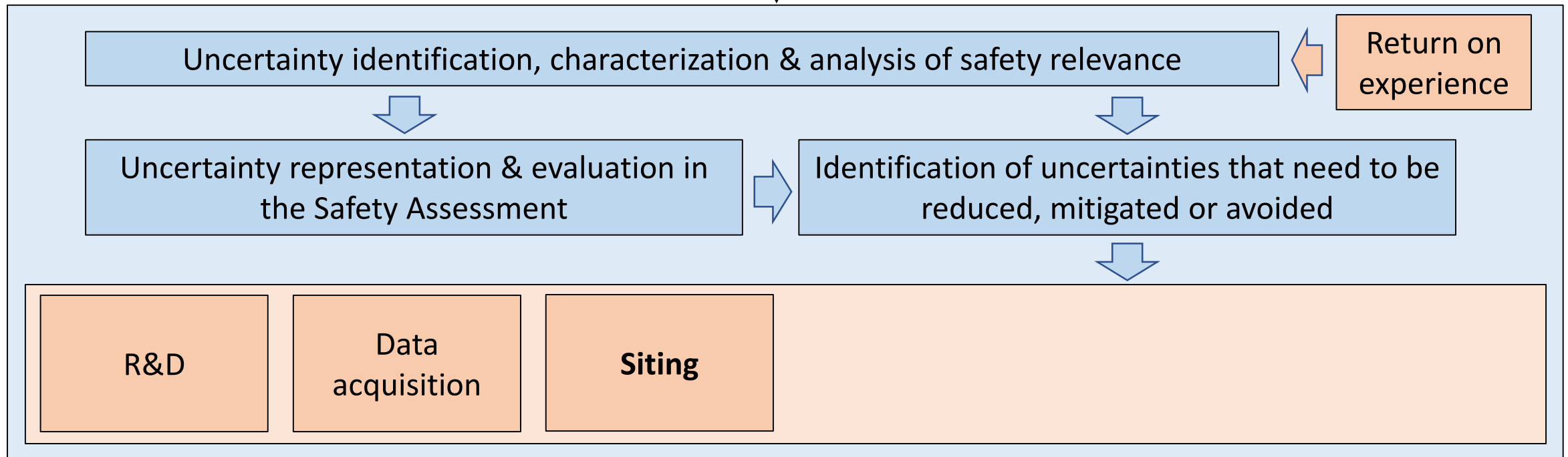


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

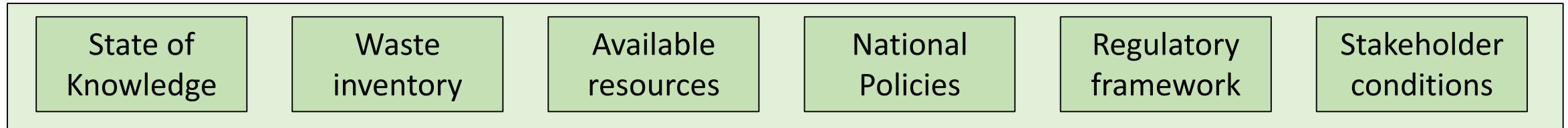


Programmatic activities

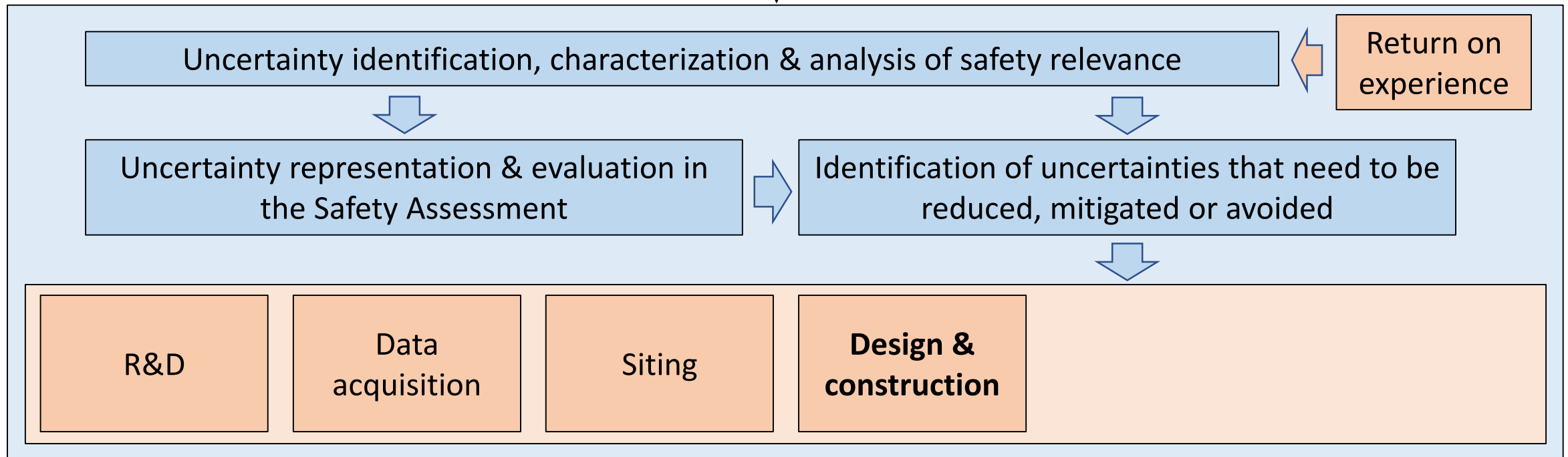


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

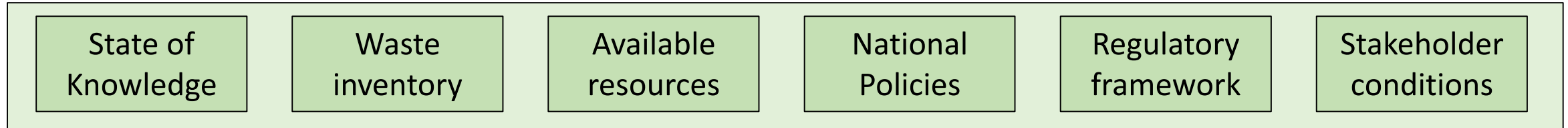


Programmatic activities

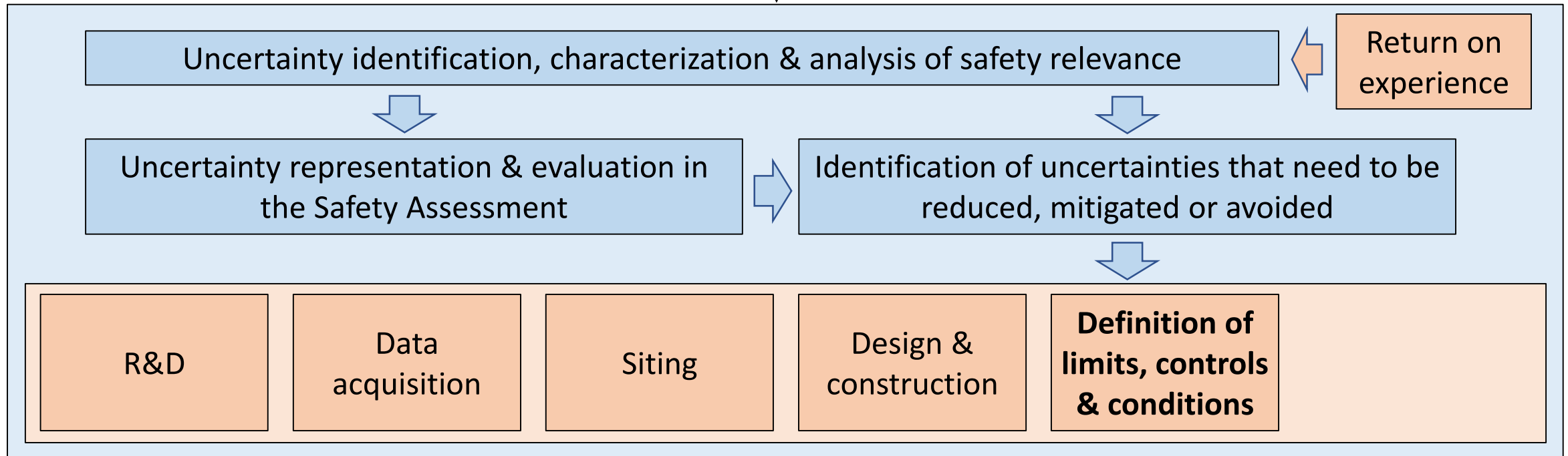


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

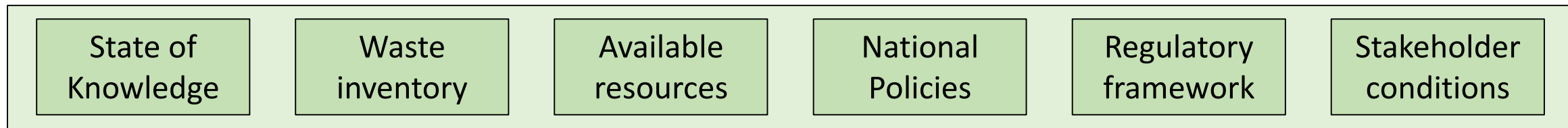


Programmatic activities

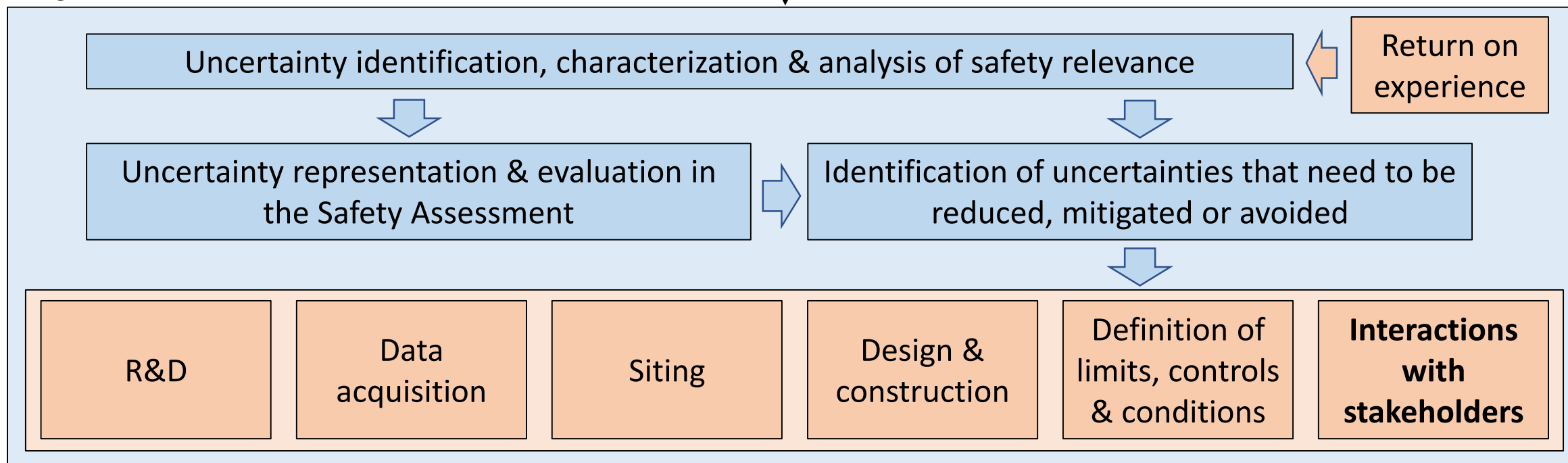


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances

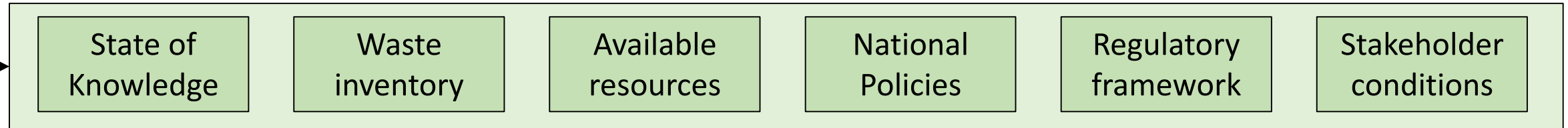


Programmatic activities

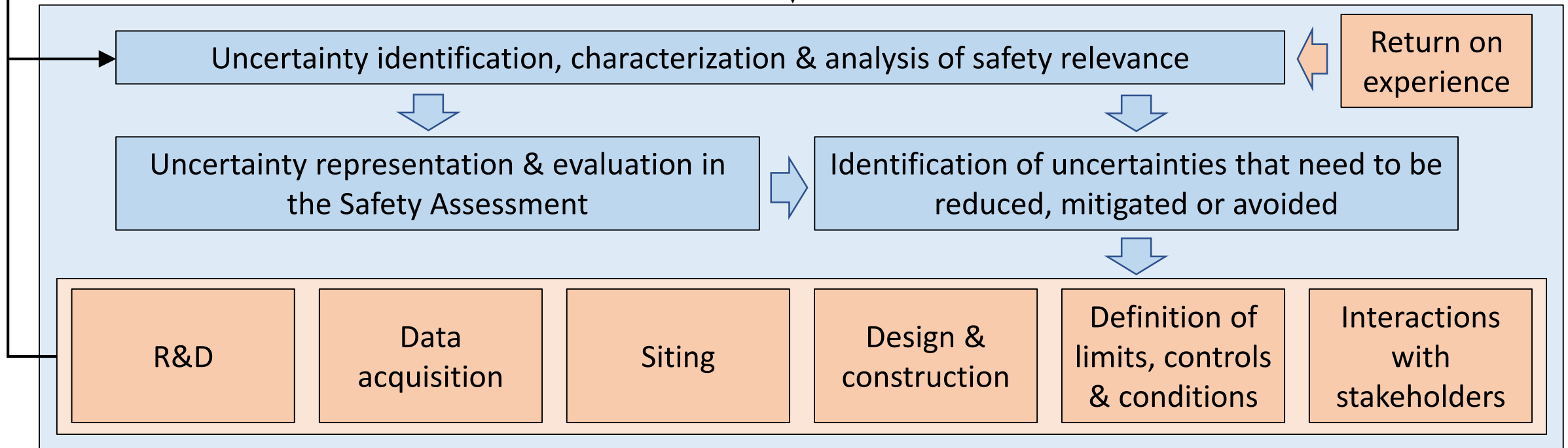


ELEMENTS OF AN UNCERTAINTY MANAGEMENT STRATEGY

Prevailing circumstances



Programmatic activities





KEY MESSAGES

- *“Uncertainty is the only certainty there is, and knowing how to live with insecurity is the only security”*
(John Allen Paulos)
- Uncertainty \neq Risk
- Managing uncertainties is key when developing a disposal system and assessing its safety
- Various types of uncertainties need to be managed in a disposal programme
- Several options might be available to reduce, avoid or mitigate these uncertainties
- Uncertainty management is an iterative process associated with the stepwise implementation of the disposal programme



THANK YOU FOR YOUR ATTENTION !