



# **27th Annual Systems and Mission Engineering Conference:**

**Digital Transformation across the lifecycle for Mission Success**

## **Review of the INCOSE Decision Analysis Data Model (DADM)**

**Frank Salvatore, SAIC**  
**Devon Clark, Deloitte**

# Overview

The INCOSE Decision Analysis Working Group (DAWG) is developing a Decision Analysis Data Model (DADM) to help realize INCOSE Vision 2035 objectives for analytical frameworks, data standardization, and model re-use by doing the following:

# 1

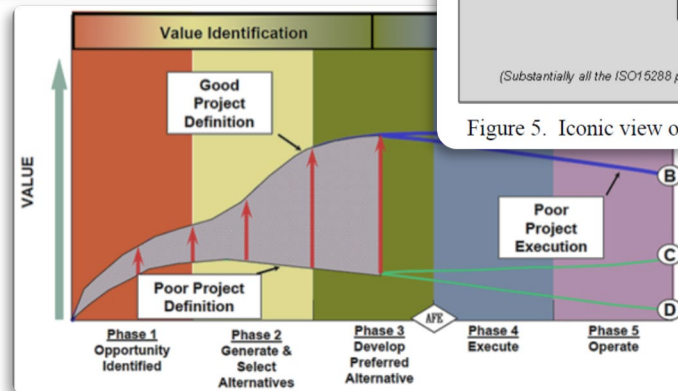
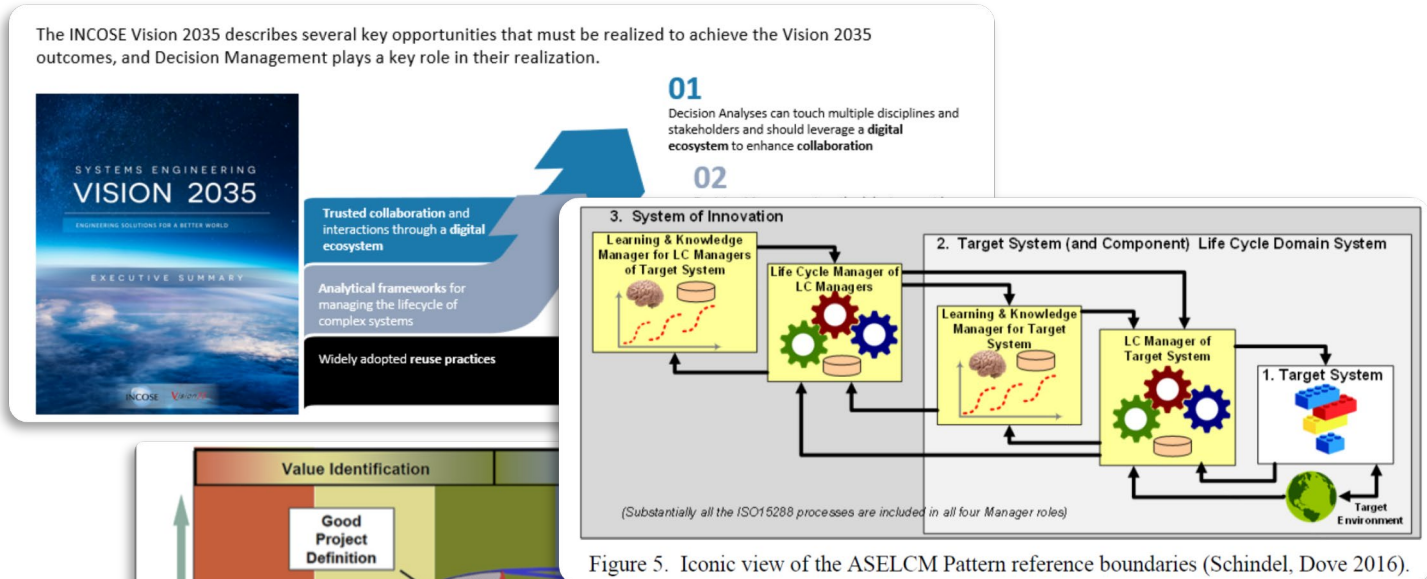
Support the SE Vision 2035

# 2

Integrate Decision Management Life Cycle Process

# 3

Enhance Data Driven Decision Making



Chevron "Eagle Beak" Chart

# DADM core Team



Name	Company	WG Role
Frank Salvatore	SAIC	Chair
Dr. Gregory Parnell	University of Arkansas	Co-Chair
Dr. Robert Kenley	Purdue University	Co-Chair
Devon Clark	Deloitte Consulting	Co-Chair
Jared Smith	Deloitte Consulting	Co-Chair
Drake Nwobodo	Deloitte Consulting	Co-Chair
Jeremy Doerr	GTRI	Member
William Fischer	MITRE	Member
Bill Schindel	ICTT	Member
James Martin	Aerospace	Member
Eric Specking	Infinity Labs	Member

Join the DAWG!

[decision-analysis@incose.net](mailto:decision-analysis@incose.net)



<https://www.incose.org/communities/working-groups-initiatives/decision-analysis>

Attend our meetings at  
INCOSE IW and IS

# Supports SE Vision 2035

## Develop a reusable Decision Analysis Data Model to support SE Vision 2035

The INCOSE Vision 2035 describes several key opportunities that must be realized to achieve the Vision 2035 outcomes, and Decision Management plays a key role in their realization.



Trusted collaboration and interactions through a **digital ecosystem**

Analytical frameworks for managing the lifecycle of complex systems

Widely adopted **reuse practices**

### 01

Decision Analyses can touch multiple disciplines and stakeholders and should leverage a **digital ecosystem** to enhance **collaboration**

### 02

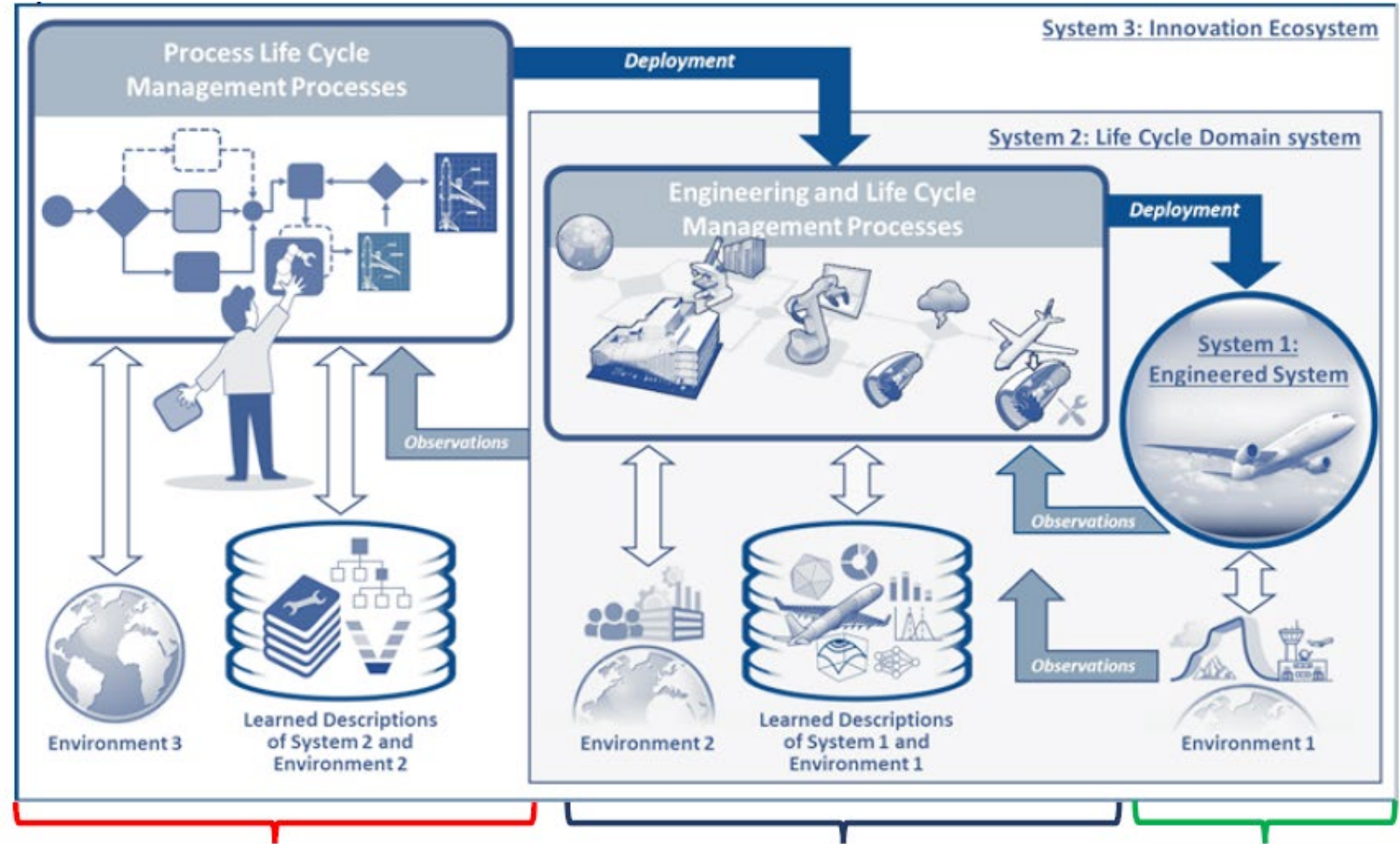
Decision Management methodologies provide an **analytical structure** for approaching multi-factor decision making throughout the system lifecycle

### 03

By creating a **reusable** Decision Analysis Data Model, practitioners are aided in quickly deploying decision management strategy for traditional or model-based projects

# Integrates Decision Management into the Process Life Cycle Processes

The DADM, is designed as a System 3 pattern from the Innovation Ecosystem and deployed as a generic model for configuration and used as a System 2 Lifecycle Domain system to support making and managing System 1 decisions



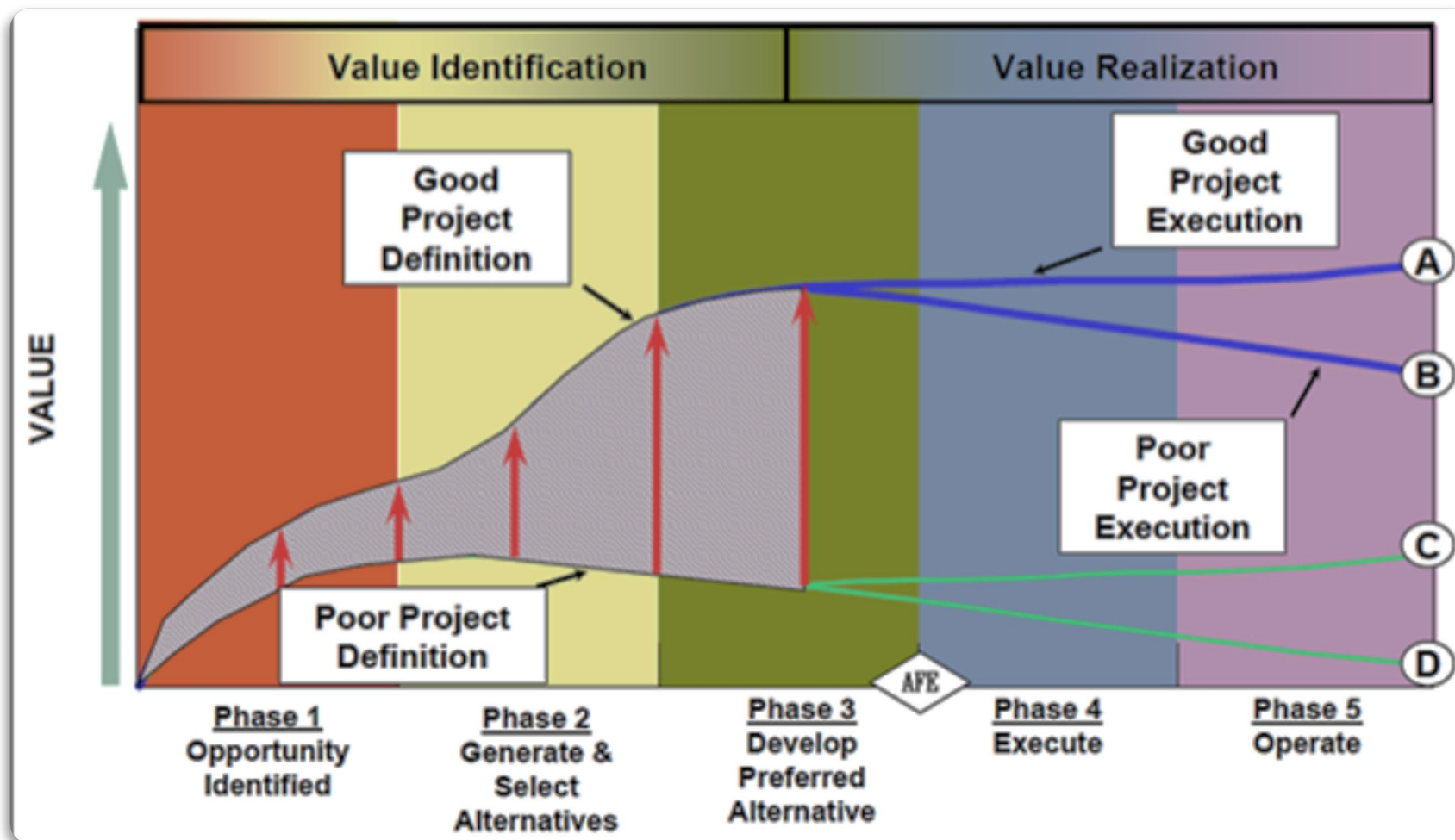
**System 3: Life Cycle Manager of System 2**

**System 2: Life Cycle Manager of System 1**

**System 1: Engineered System**

# Why Manage Decisions?

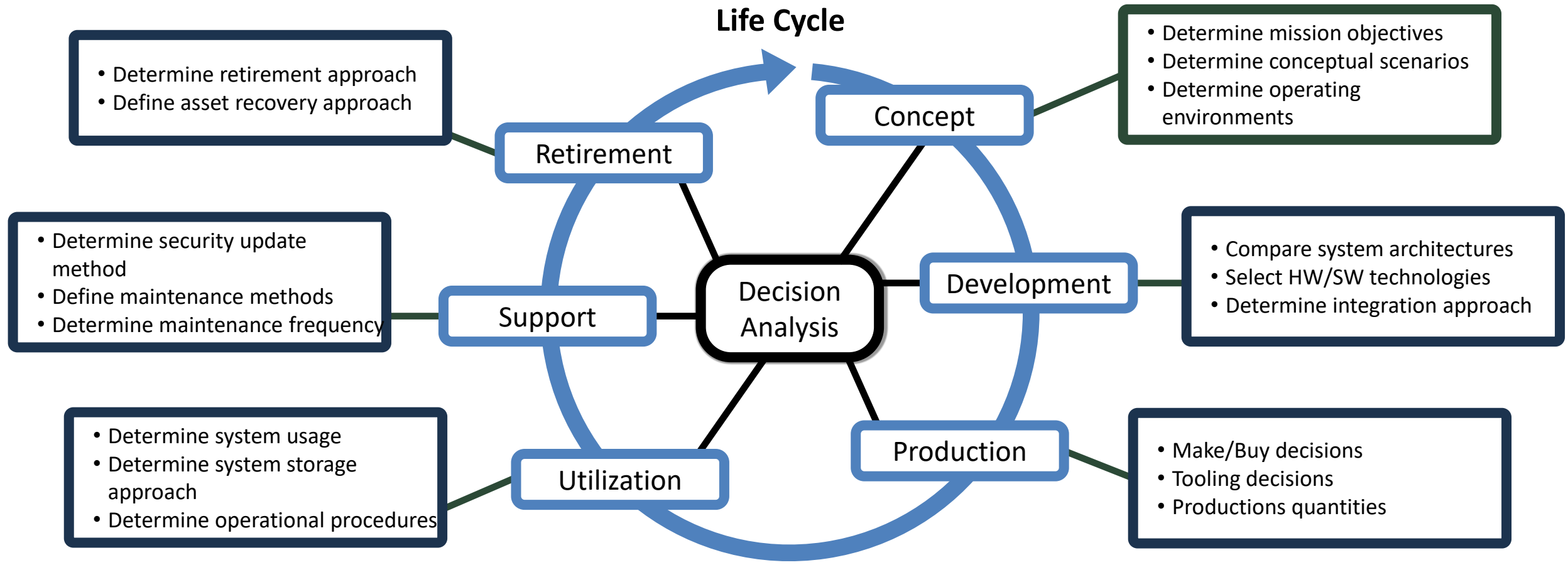
## Good decisions drive better outcomes



- Proper decision framing leads to **better project definition**
- Proper decision analysis leads to **better alternatives** and **maximizes opportunity**
- Better alternatives result in **smoother development efforts**
- Proper decision management **reduces risk, simplifies execution, and improves operational outcomes**

Chevron "Eagle Beak Chart, Section 1.3, page 5, Trade-off Analytics, Creating and Exploring the System Tradespace

# Decisions Occur in all Lifecycle Stages



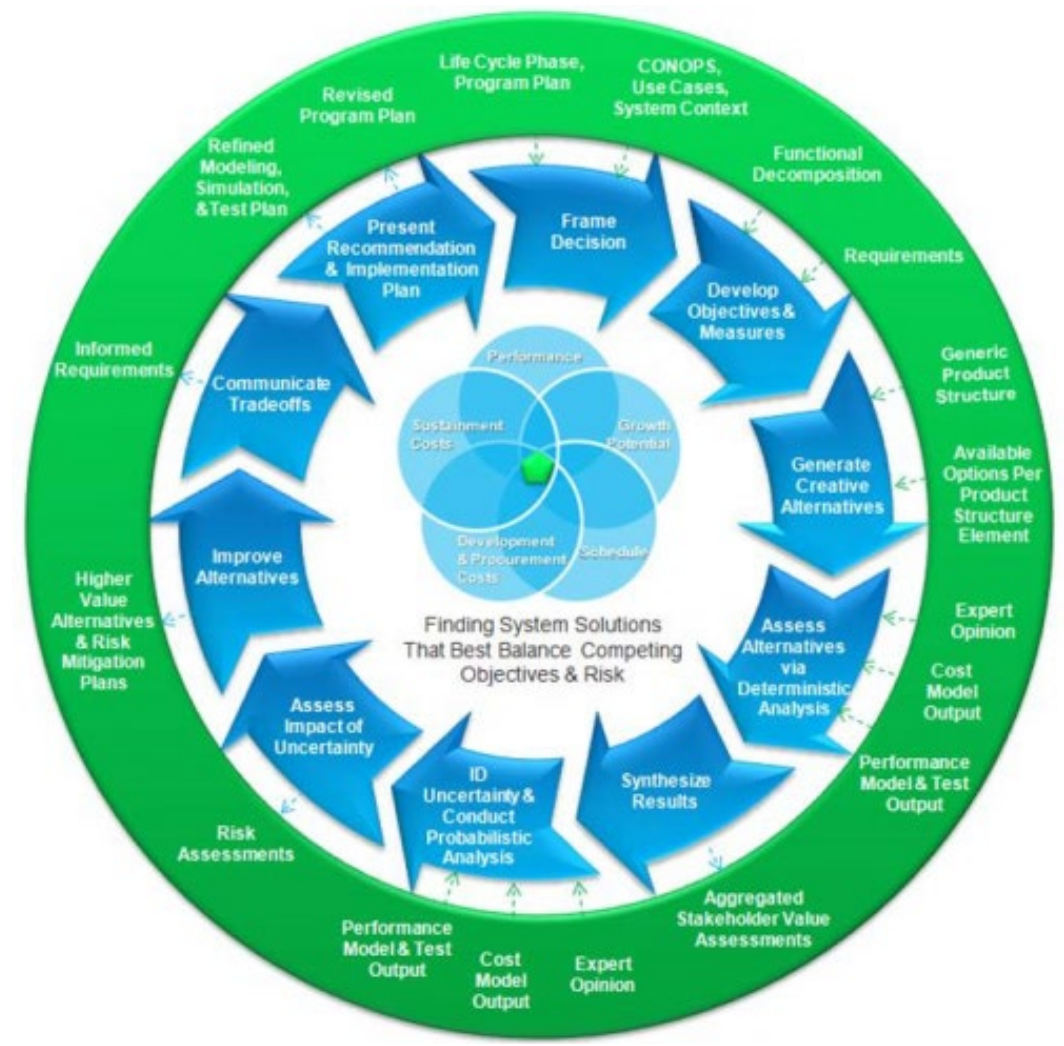
# Decision Management – Process (Conceptual)

The purpose of the decision management process is “...to provide a structured, analytical framework for objectively identifying, characterizing and evaluating a set of alternatives for a decision at any point in the life cycle and select the most beneficial course of action.” ([ISO/IEC/IEEE 15288](https://www.iso.org/standard/54548.html))

DADM uses the Decision Management Process in the SEBoK. This process was developed to align with ISO/IEC/IEEE 15288 and the INCOSE SE Handbook)

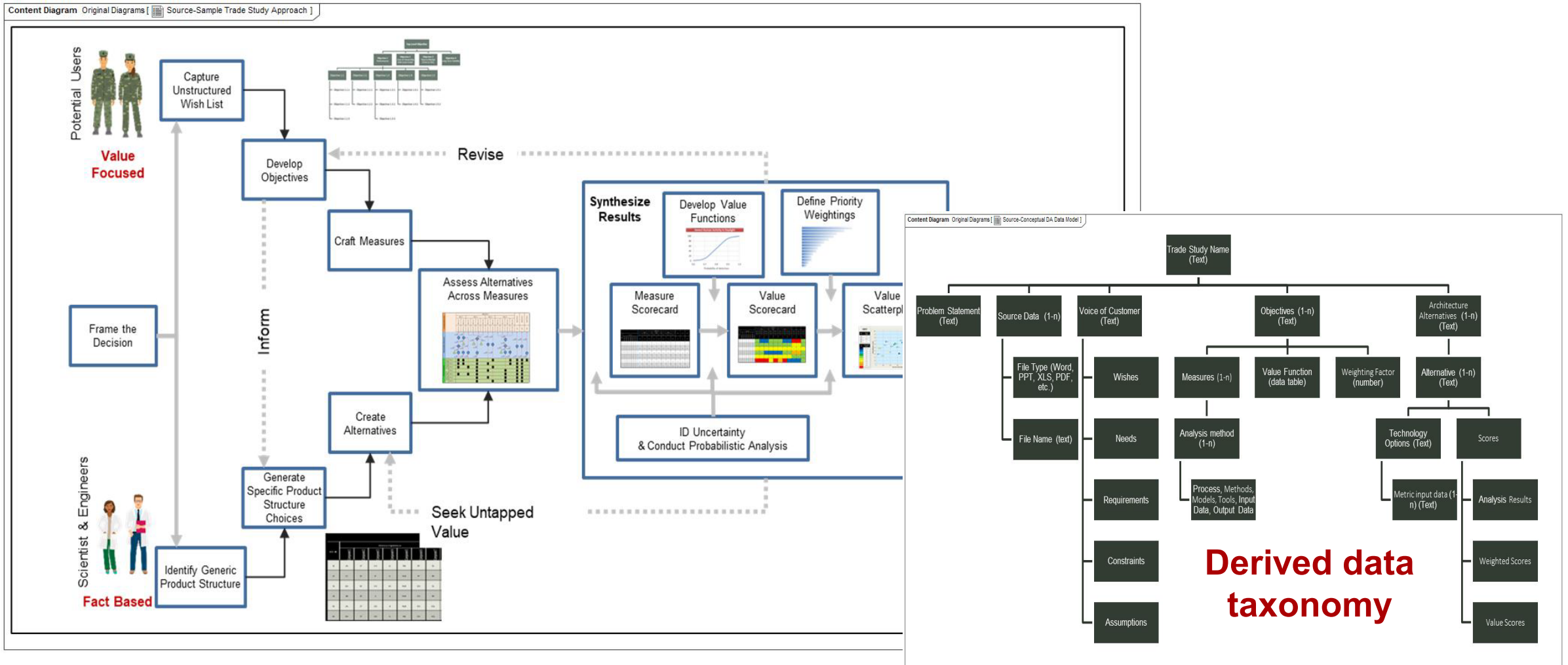


[https://sebokwiki.org/wiki/Decision\\_Management](https://sebokwiki.org/wiki/Decision_Management)





# Started from a Sample Trade Study Approach



**Too Vague! Requires a model-based approach for more precision.**

# What is a Data Model?

A model that aligns data definitions to the information and concepts necessary to support the organization's mission and operations, driving consistency and interoperability across disparate developers and teams.

## Conceptual Data Model

A high-level representation of the most critical concepts that apply to a given problem

## Logical Data Model

Elaborates on the conceptual model to identify information needs (entities, relationships, key attributes, and non-key attributes) without being tied to any specific implementation

## Physical Data Model

A complete representation of the data structure, business rules, and specific database for an information system, including all management system (DBMS) parameters and relationships needed to create a database

- Simple
  - Strategic
  - Foundation for design
- 
- Detailed
  - Technology-Agnostic
  - Foundation for Integration & Development
- 
- Structured
  - Technology-Specific
  - Foundation for Implementation

**Decision Analysis Data Model (DADM)**

**What is the DADM?**  
The DADM is a reusable model that provides an analytical framework for integrated data-driven decision making. It is an aid for practitioners to accelerate trade-off analyses and integrate performance, cost, and schedule data, increasing consistency and enabling digital collaboration across all phases of a system's life cycle.

**What's the Purpose?**  
To support practitioners in quickly deploying decision management strategi for traditional and model-based projects.

The DADM is organized into two categories: Data Models and Processes.

**Data Models** The Data Models captures the types of data needed to successfully inform a decision and the attributes, relationships, and constraints of that data.

**Processes** The Processes tie those data types to the actions and processes typical to a decision analysis.

**Resources**

**Examples** **Glossary** **Acronyms**

**Version History**

#	Version	Documentation
1	v.0.8	This version realigns the DADM to the original SEBoK and SE Handbook content. Also adds definitions and sources for terms and additional process logic.
2	v.0.7	This version includes layout and package structure updates to simplify model navigation and usability, as well as consistency fixes across architecture updates.
3	v.0.6	This version includes significant updates to the logical data model to support instantiation.
4	v.0.5	This version includes initial conceptual and logical data models for the generic and engineering lifecycle contexts. It also includes the initial generic process flow for the decision analysis process.

**Contact Us**  
The DADM is a product of the Decision Analysis Working Group (DAWG). For

A data and process model for world-class decision analyses

# DADM includes the Processes and the Data

## Process

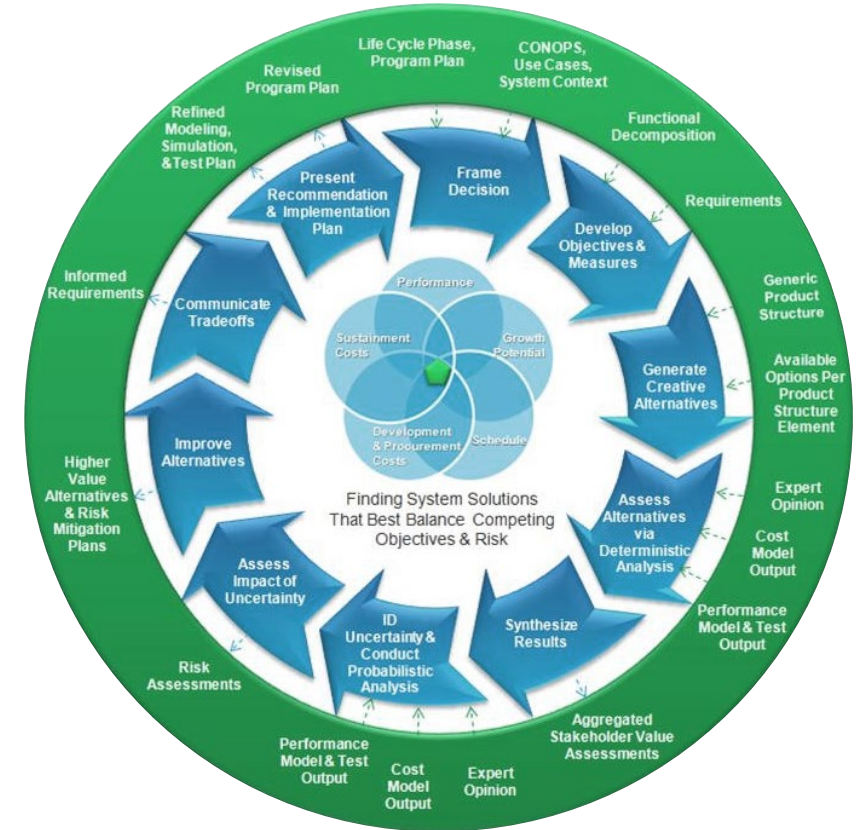
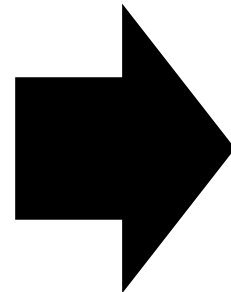
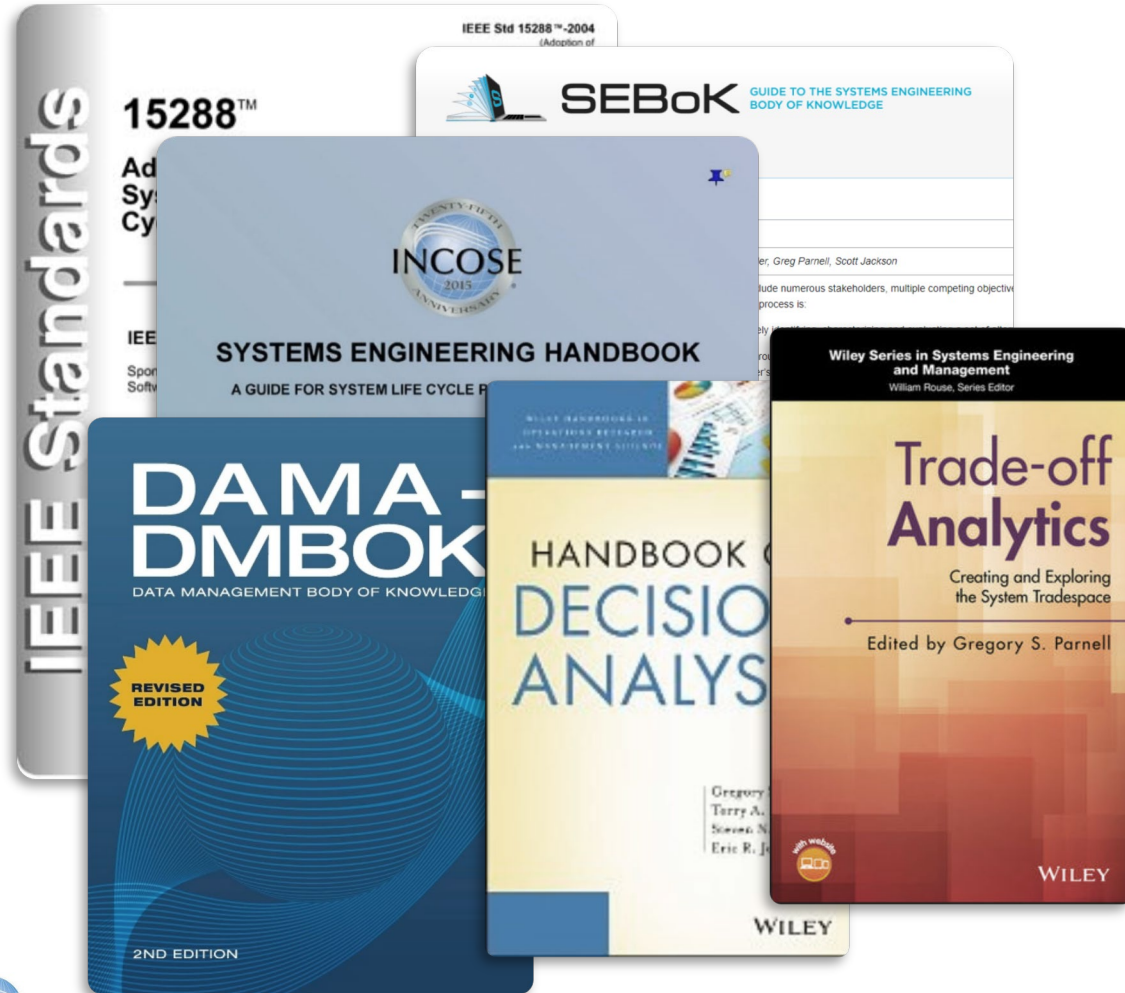
- Leverages decades of expert experience to **definitively capture the decision analysis process**
- **Validates the data model** by describing the data exchanged between all activities
- **Aids users in performing consistent decision analyses** and serves as the **foundation for decision automation**

## Data

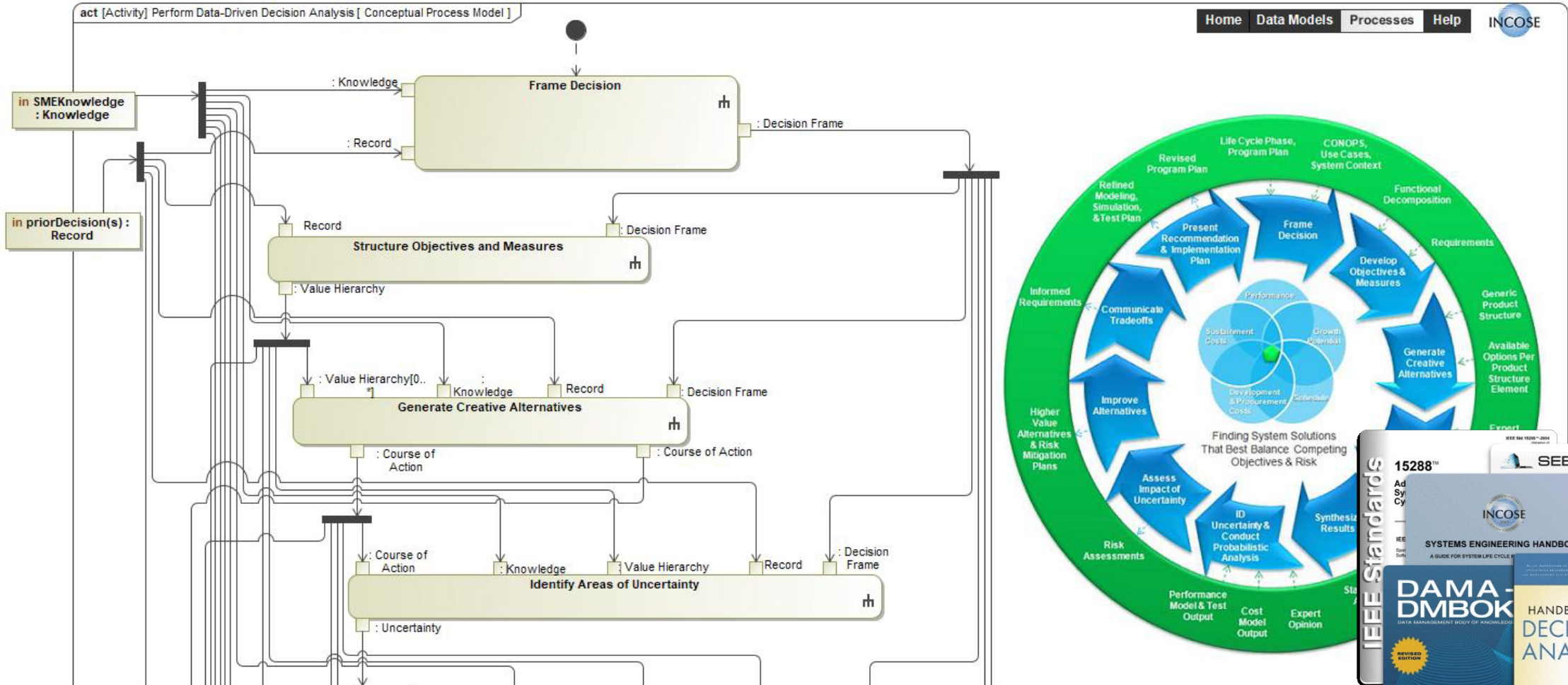
- **Explicitly define the data** needed for a quality decision
- This definition **enables consistency** across decisions
- This consistency **enables the reuse of past decisions** in future decisions
- This chain of decisions **enables real analytics on decision quality and program outcomes** for an organization

# Decision Mgmt Fundamentals

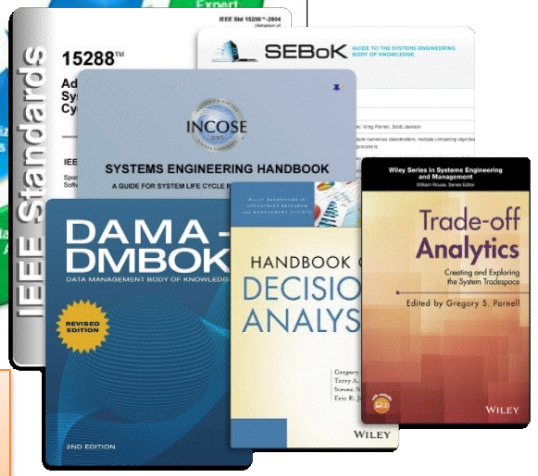
## The DADM is rooted in industry standards and best practices



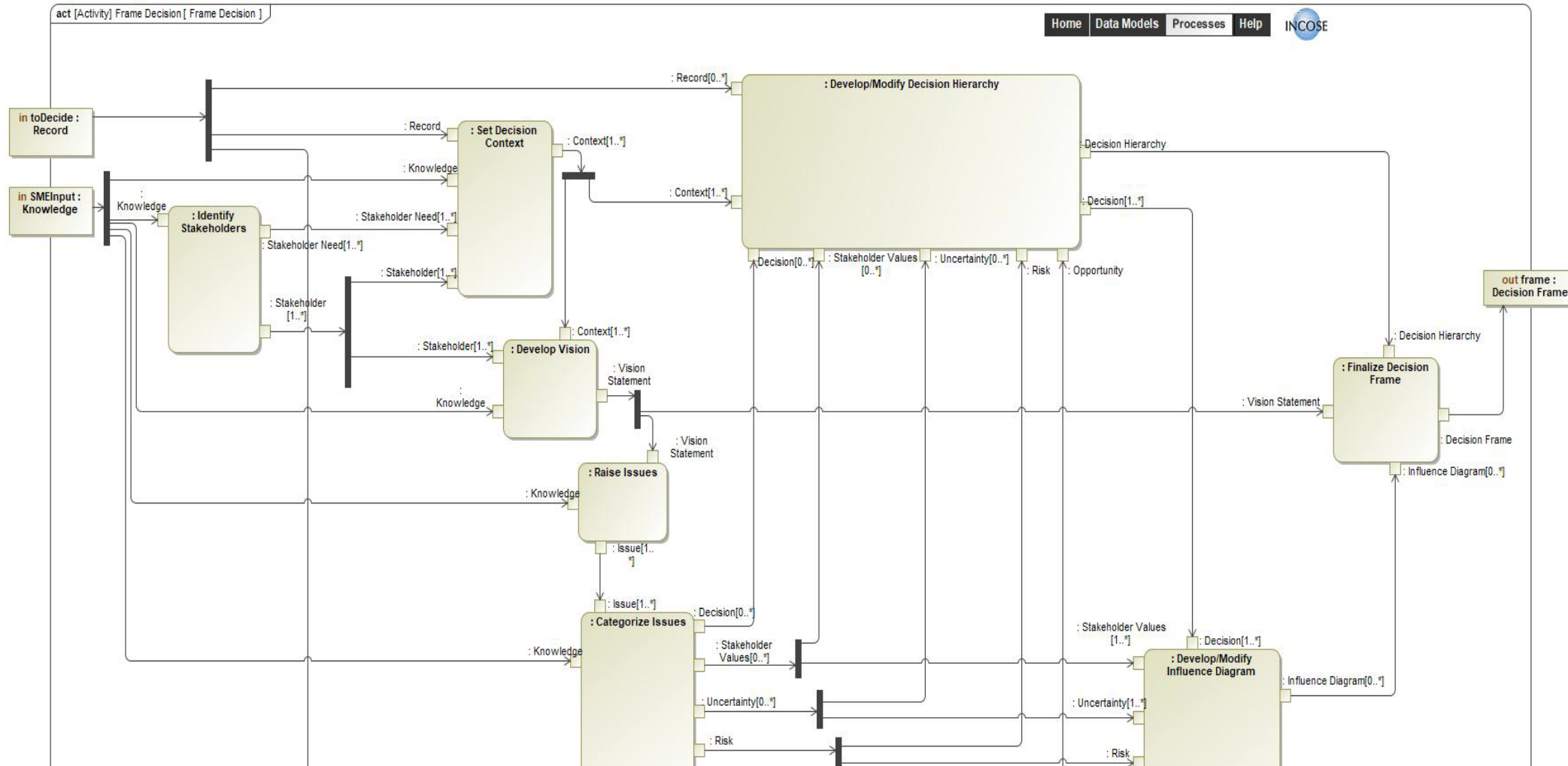
# Conceptual Process Model



The SEBoK Decision Management conceptual diagram (expanded in the Trade-Analytics Textbook) provided the foundation for the more complex logical model but more information was required to complete the model.

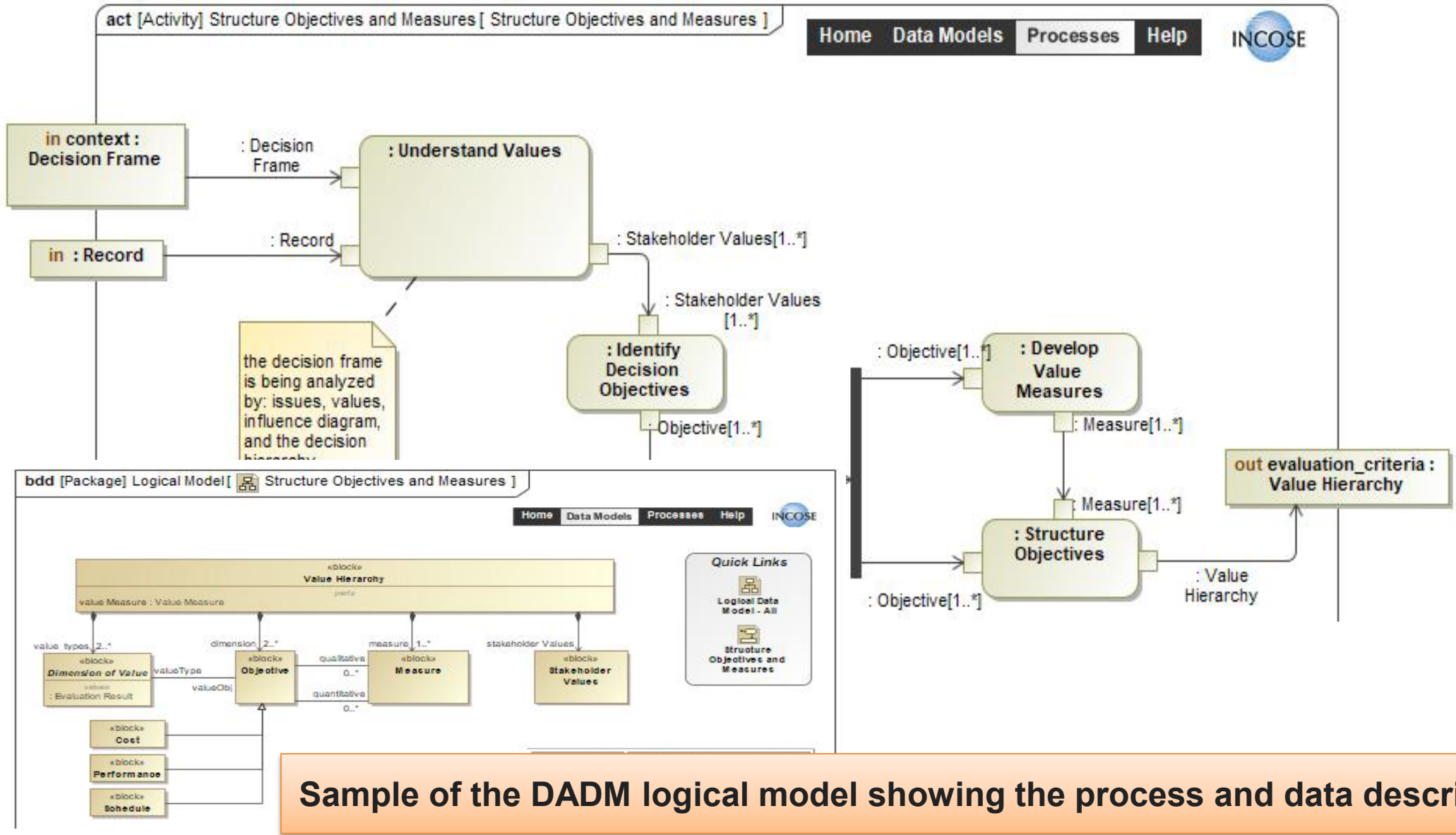


# Frame Decision



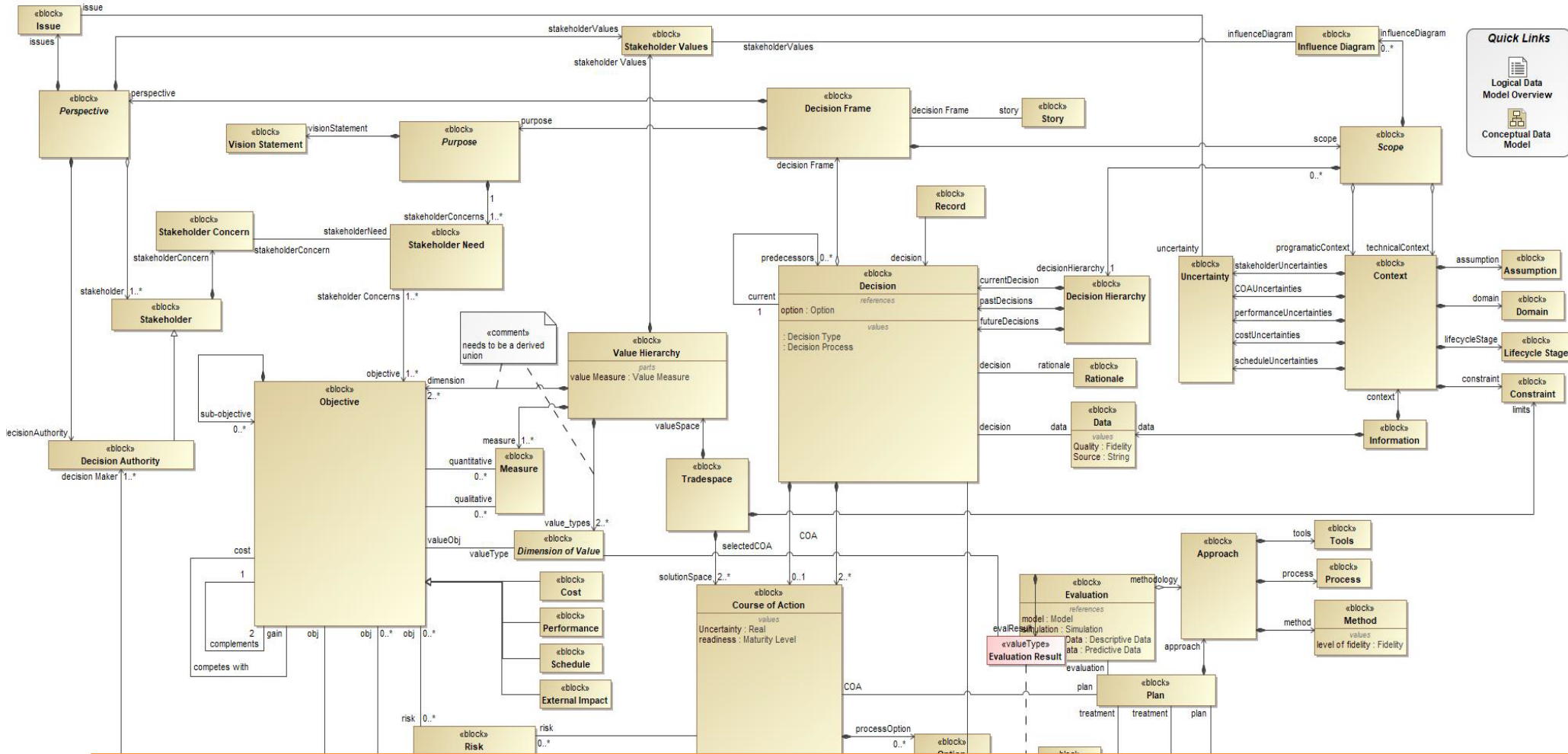
The logic level modeling required SME conversations helping to improve understanding and will result in changes to the SEBOK, the INCOSE Handbook, and other sources.

# Structure Objectives and Measures



Sample of the DADM logical model showing the process and data description.

# Logical Data Model



**Quick Links**

- Logical Data Model Overview
- Conceptual Data Model

The logical data model represents a comprehensive Decision Analysis process and data definition that supports decision management.



# Next Steps

## 2024

- Release the model (4<sup>th</sup> Quarter 2024)
- Identify pilot participants and early adopters
- Submit abstract for INCOSE IS
- Deploy to SE Lab and INCOSE Store

## 2025

- User Testing at INCOSE International Workshop 25
- Present DADM at International Symposium 25
- DADM v2
  - Pursue Standard designation
  - BPMN translation
  - SysML v2 integration
  - Example implementation

International Workshop 25 in Seville, Spain



International Symposium 25 in Ottawa, Canada



# How can you participate?

Join the DAWG! [decision-analysis@incose.net](mailto:decision-analysis@incose.net)



<https://www.incose.org/communities/working-groups-initiatives/decision-analysis>

**We need  
your help to  
validate  
DADM!**



Attend our meetings at INCOSE IW and IS.