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

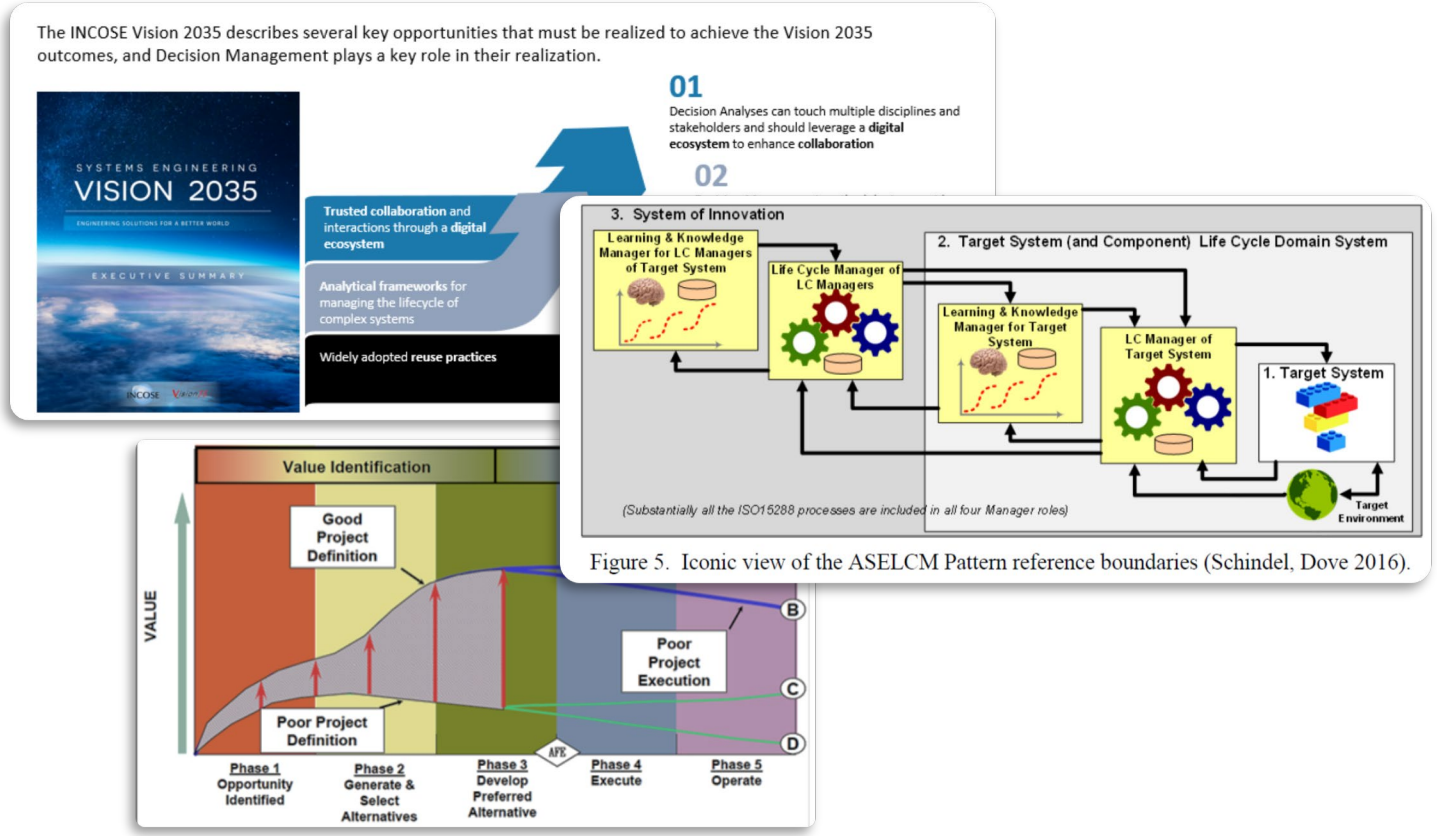


Figure 5. Iconic view of the ASELCM Pattern reference boundaries (Schindel, Dove 2016).

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

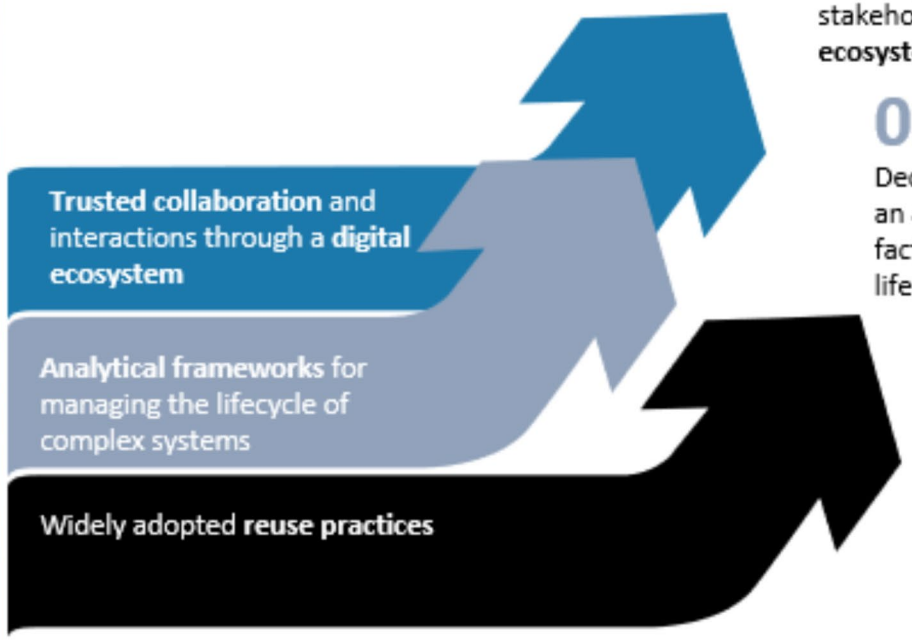
https://www.incose.org/communities/working-groups-initiatives/decision-analysis

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.



01

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

02

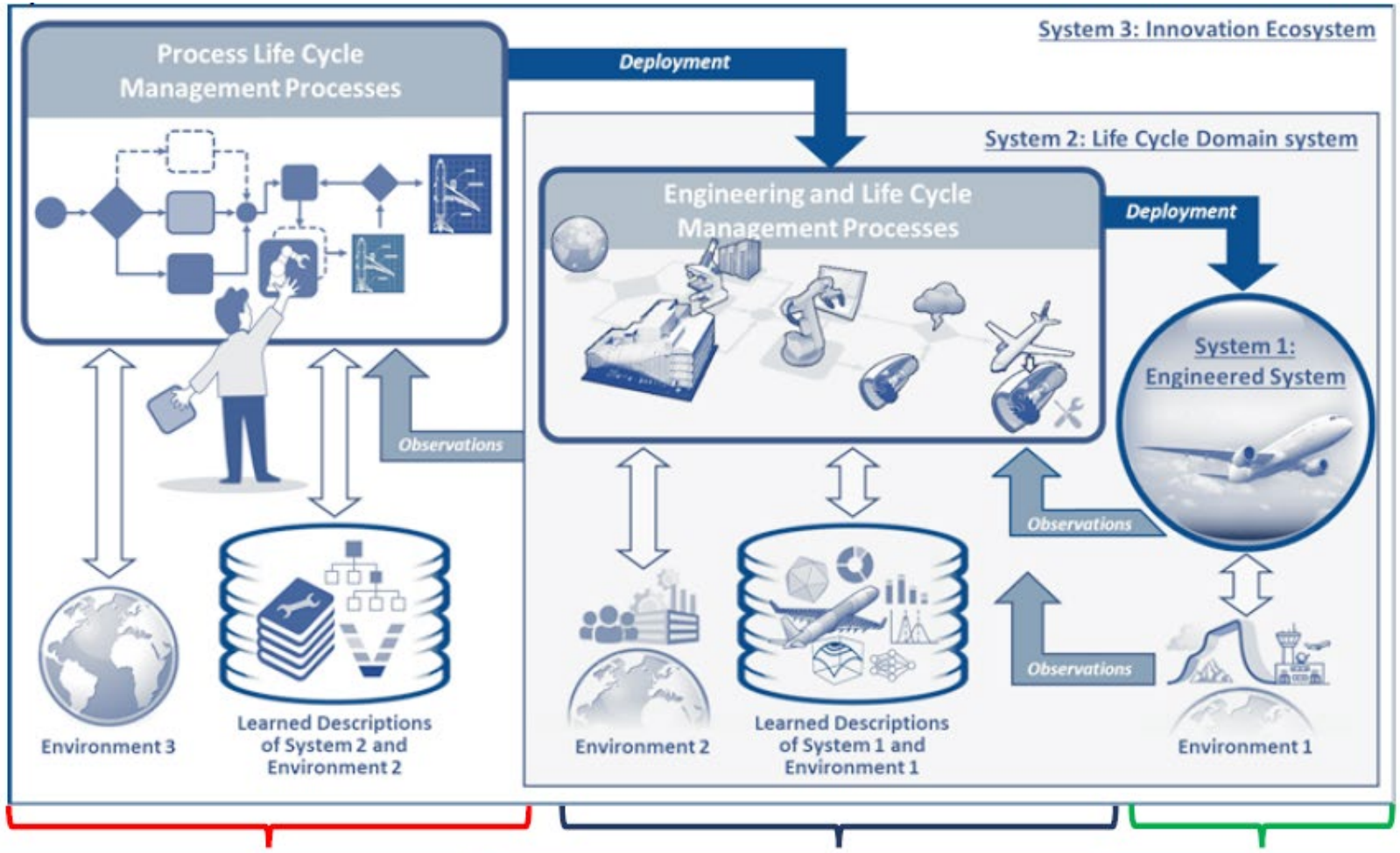
Decision Management methodologies provide an **analytical structure** for approaching multi-factor decision making throughout the system lifecycle

03

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

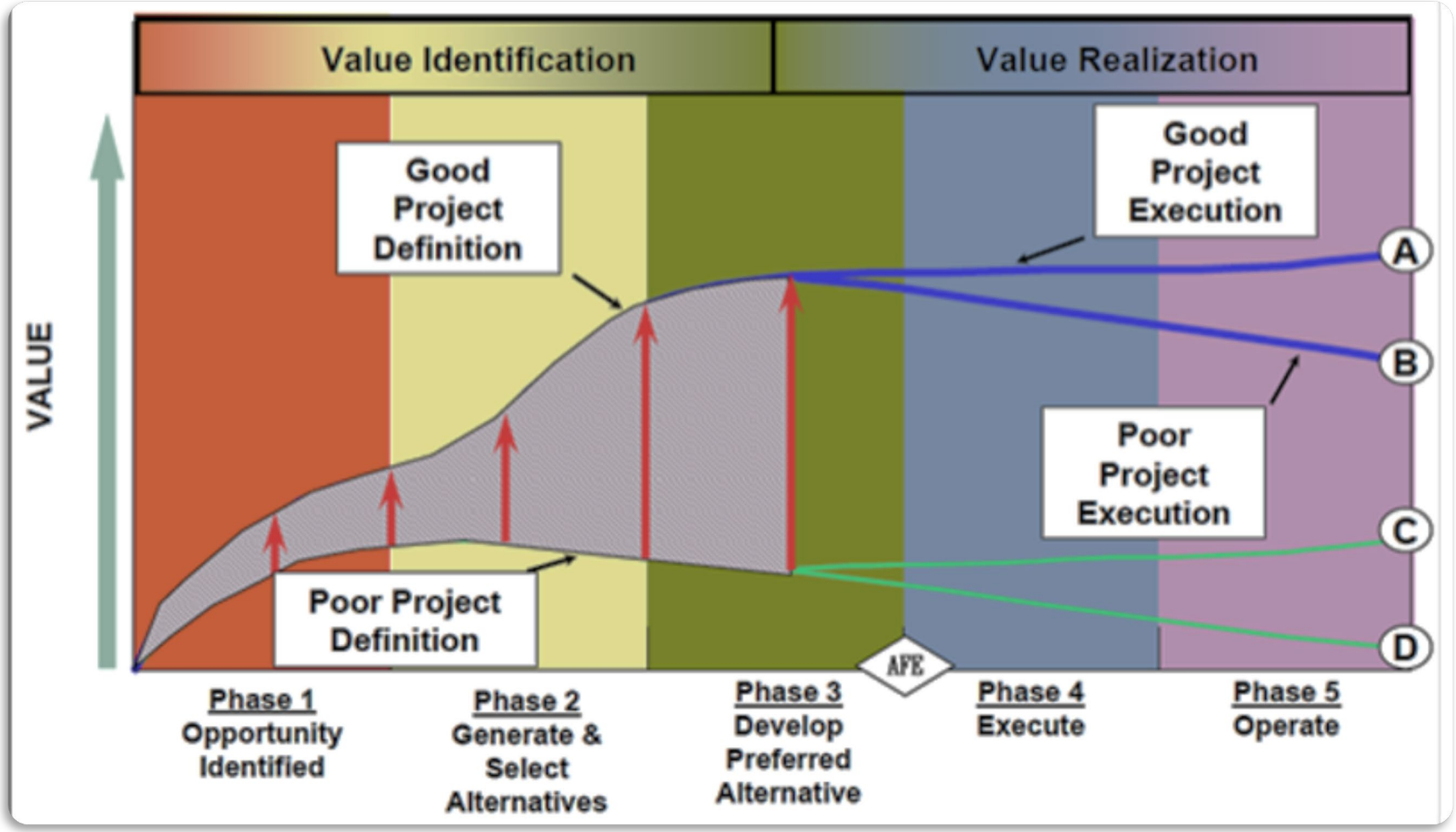
Integrates Decision Management into the Process Life Cycle Processes

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



Why Manage Decisions?

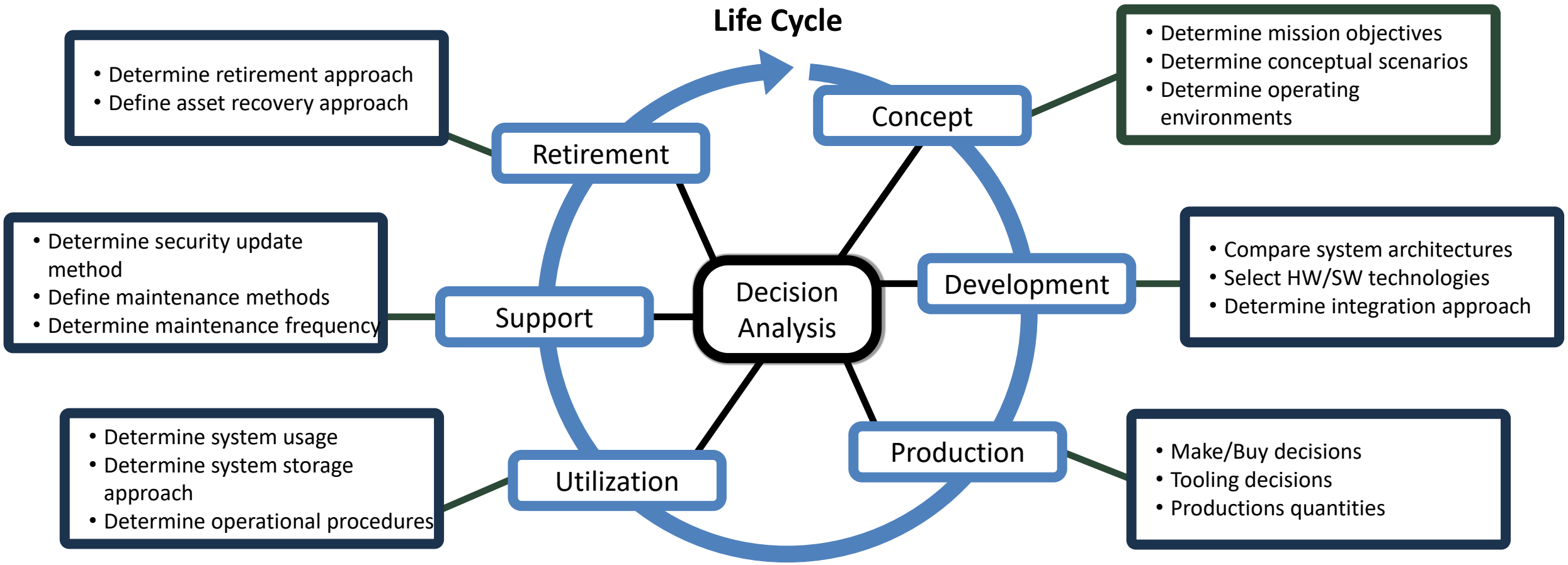
Good decisions drive better outcomes



- 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



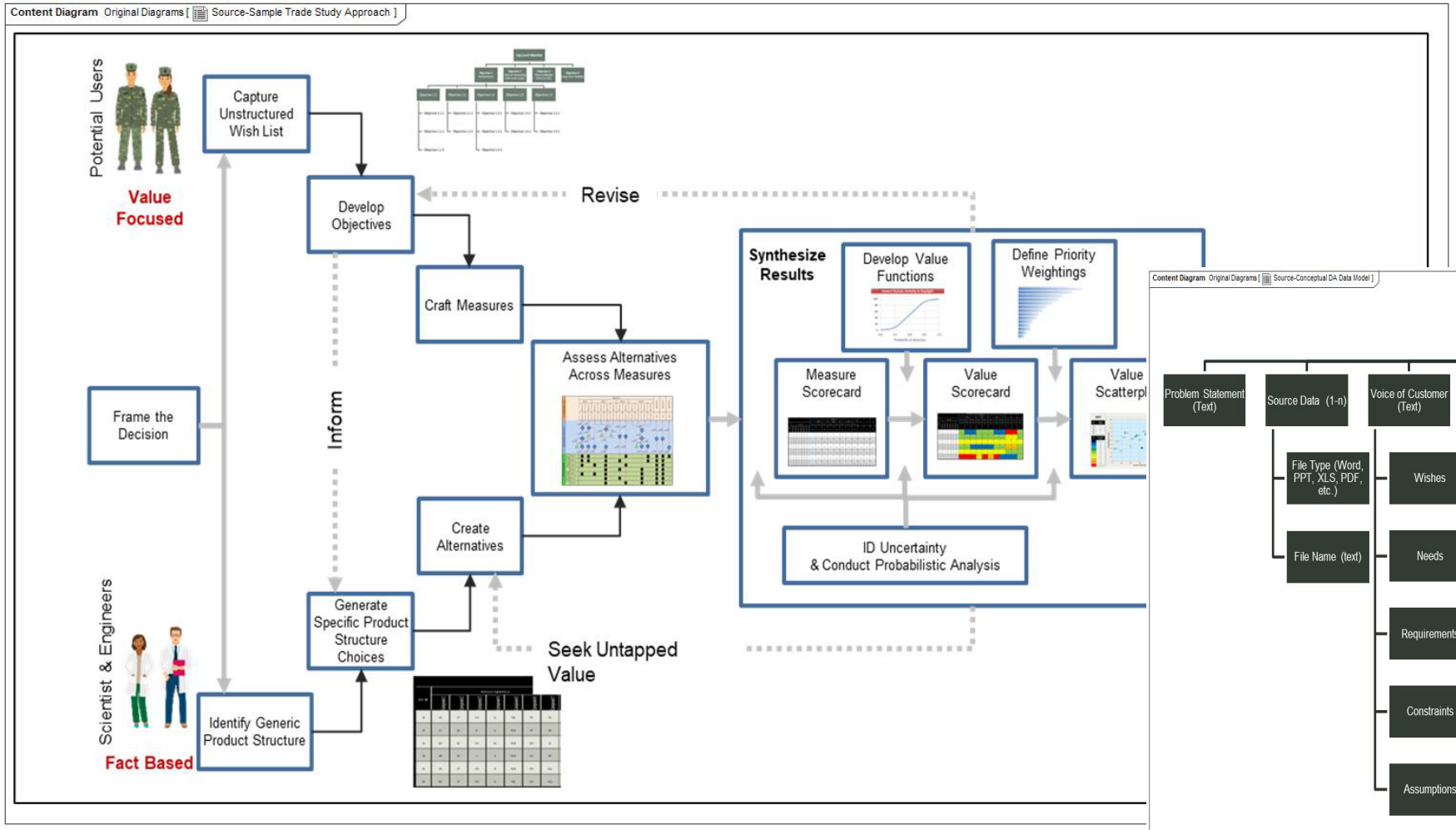
Decision Management – Process (Conceptual)

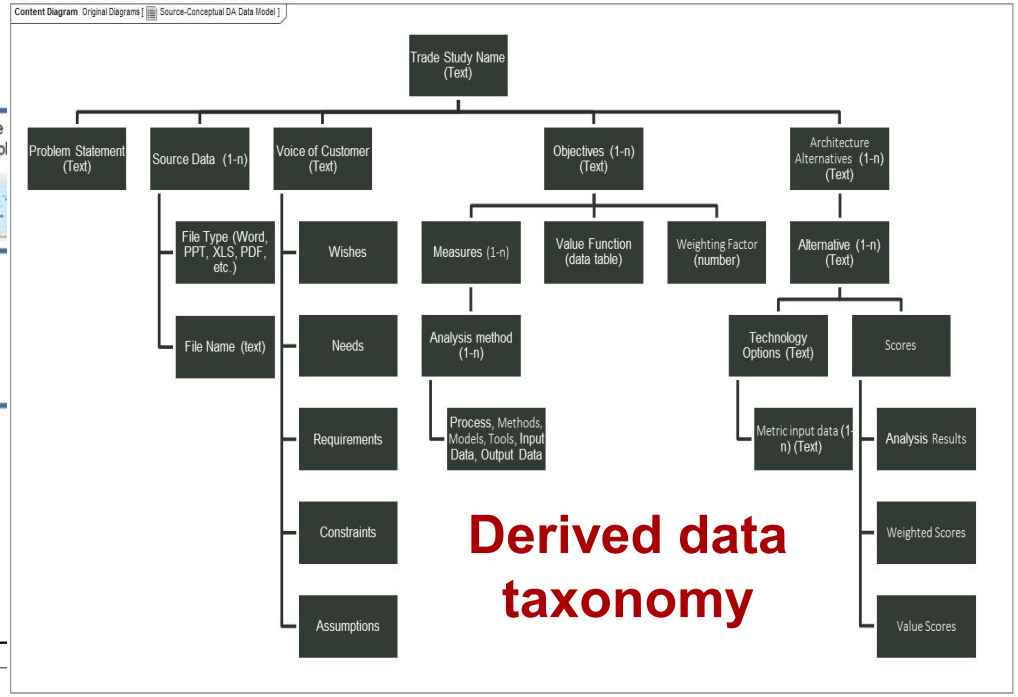
The purpose of the decision management process is "…to provide a structured, analytical framework for objectively identifying, characterizing and evaluating a set of alternatives for a decision at any point in the life cycle and select the most beneficial course of action."(*ISO/IEC/IEEE 15288*)

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

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

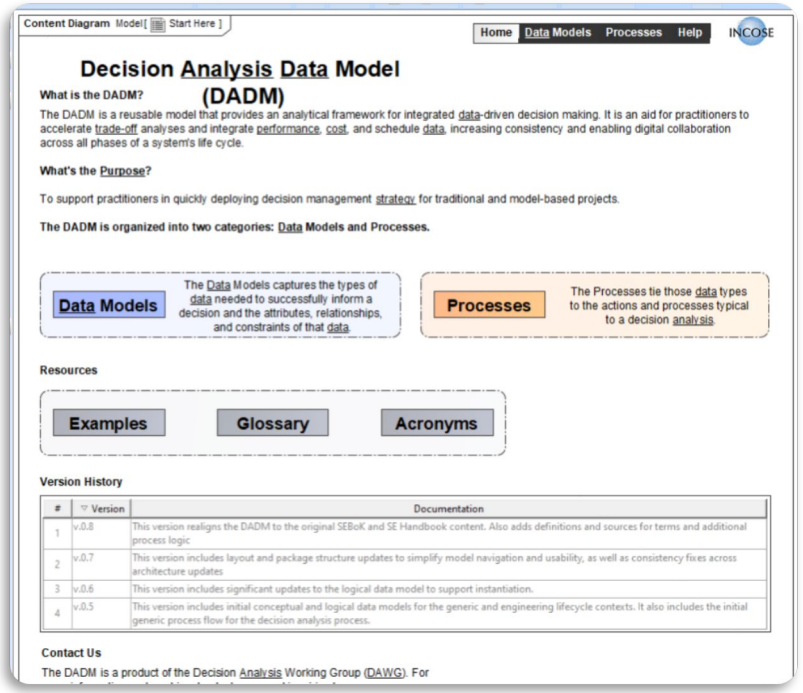
- Simple
- Strategic
- Foundation for design

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

- Detailed
- Technology-Agnostic
- Foundation for Integration & Development

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

- Structured
- Technology-Specific
- Foundation for Implementation



A data and process model for world-class decision analyses

DADM includes the Processes and the Data

Process

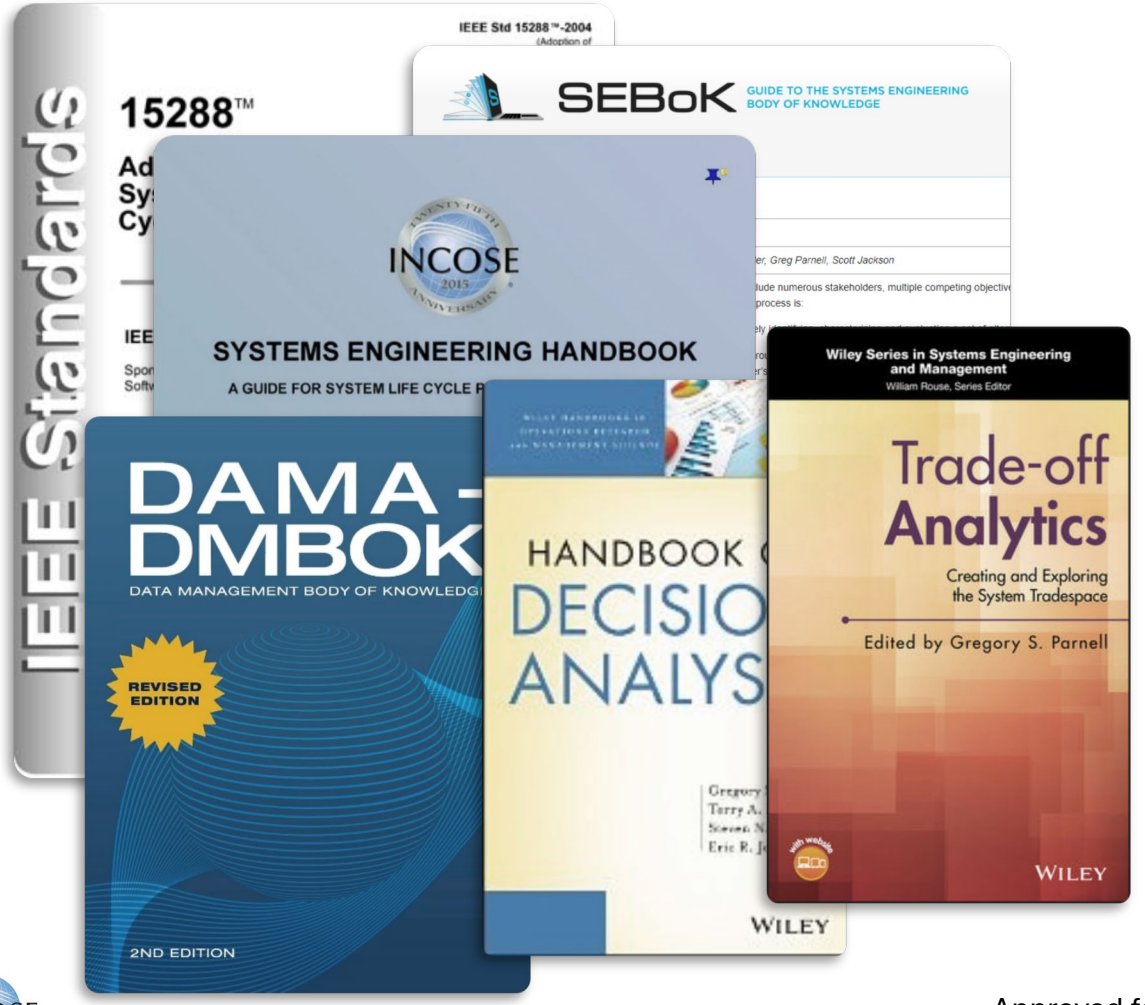
- Leverages decades of expert experience to definitively capture the decision analysis process
- Validates the data model by describing the data exchanged between all activities
- Aids users in performing consistent decision analyses and serves as the foundation for decision automation

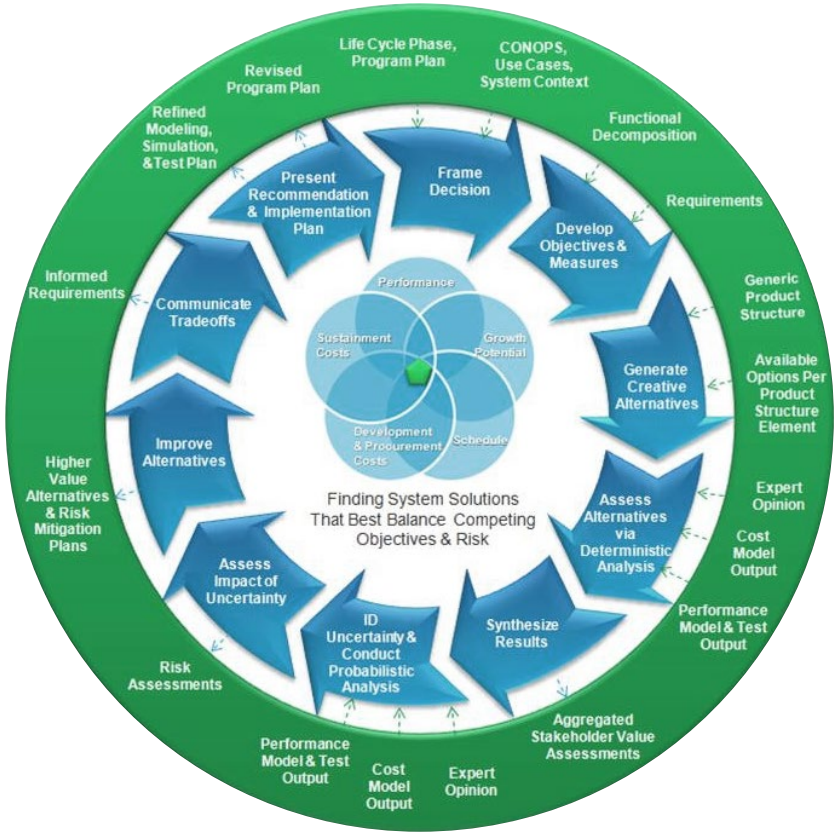
Data

- 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

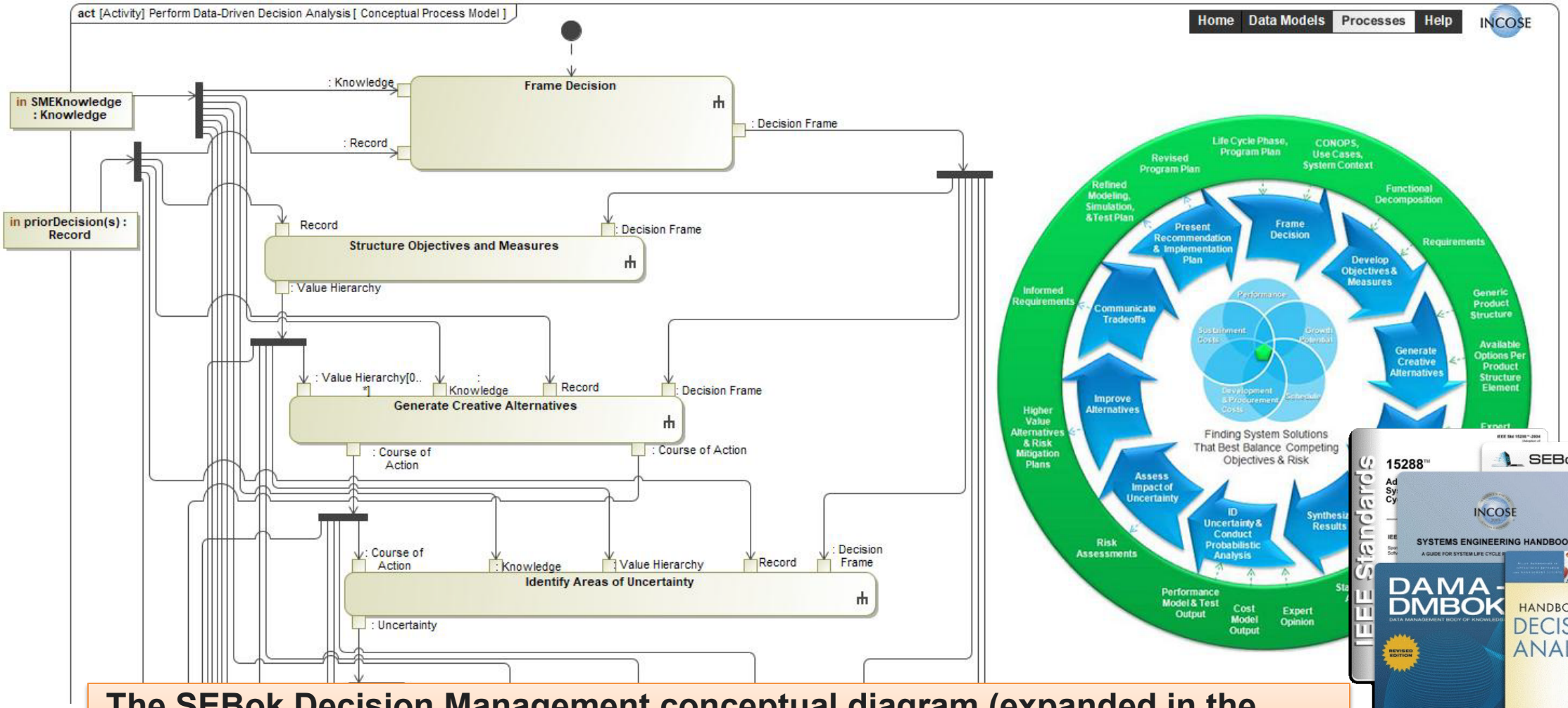
Decision Mgmt Fundamentals

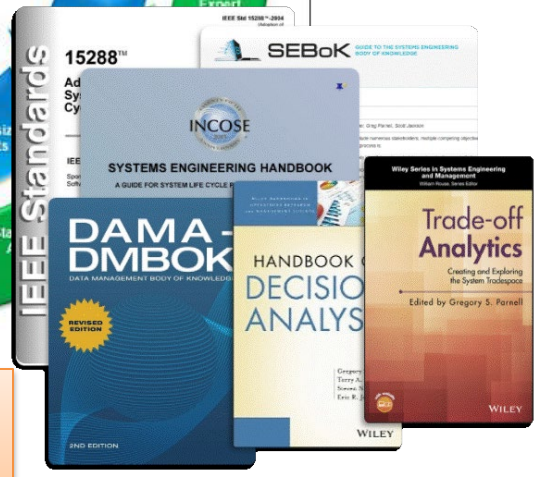
The DADM is rooted in industry standards and best practices





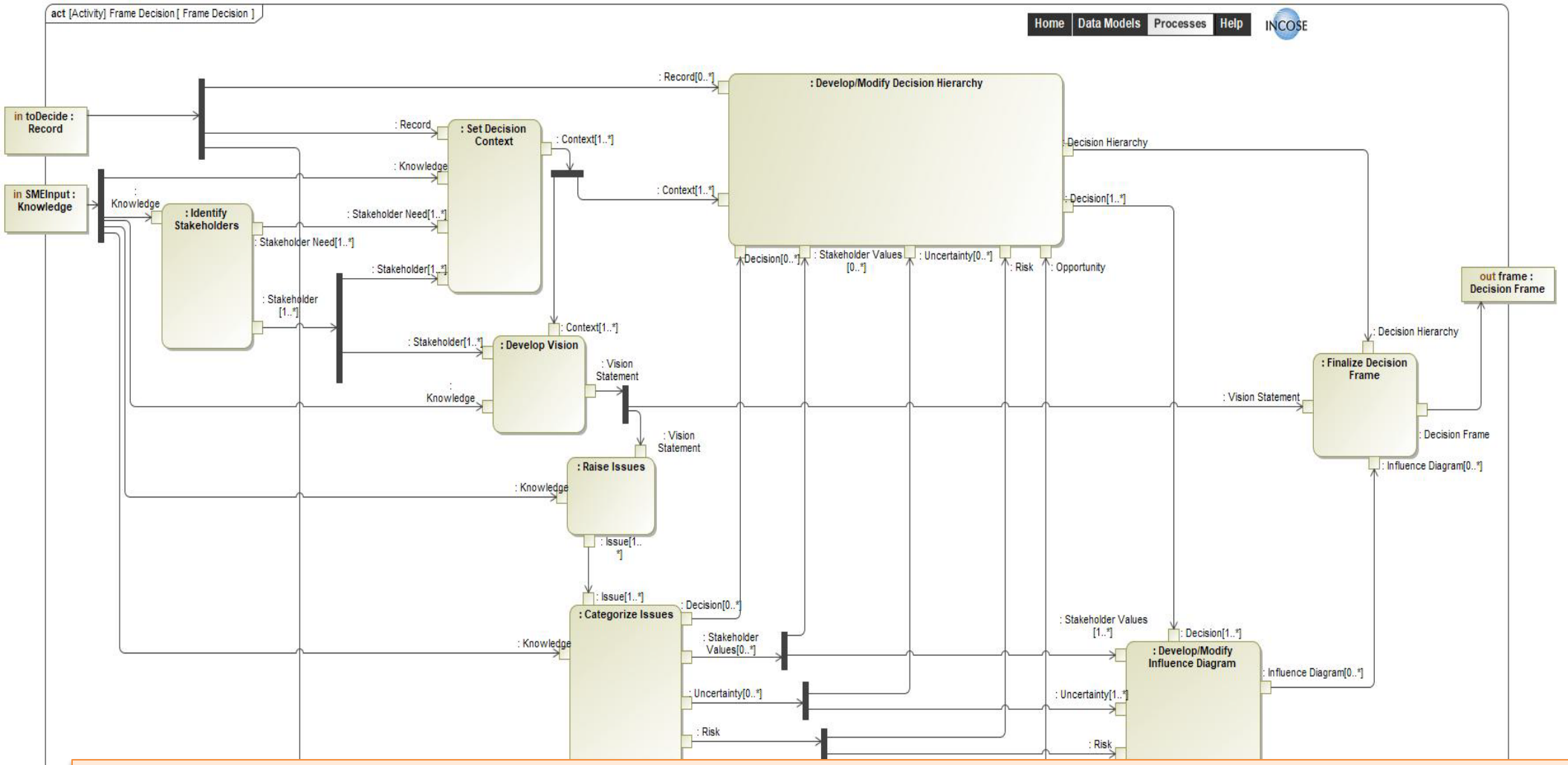
Conceptual Process Model





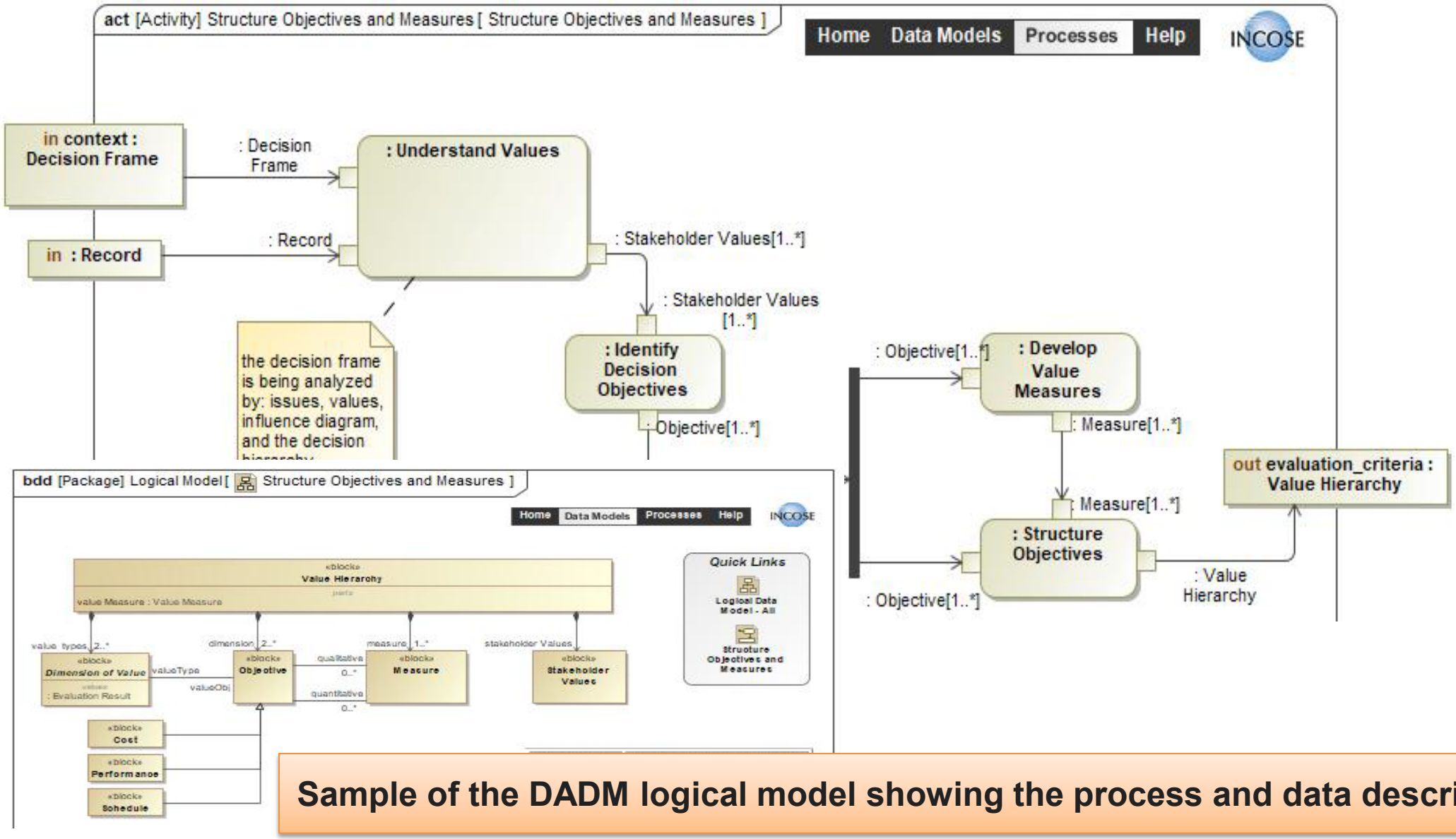
The SEBok Decision Management conceptual diagram (expanded in the Trade-Analytics Textbook) provided the foundation for the more complex logical model but more information was required to complete the model.

Frame Decision



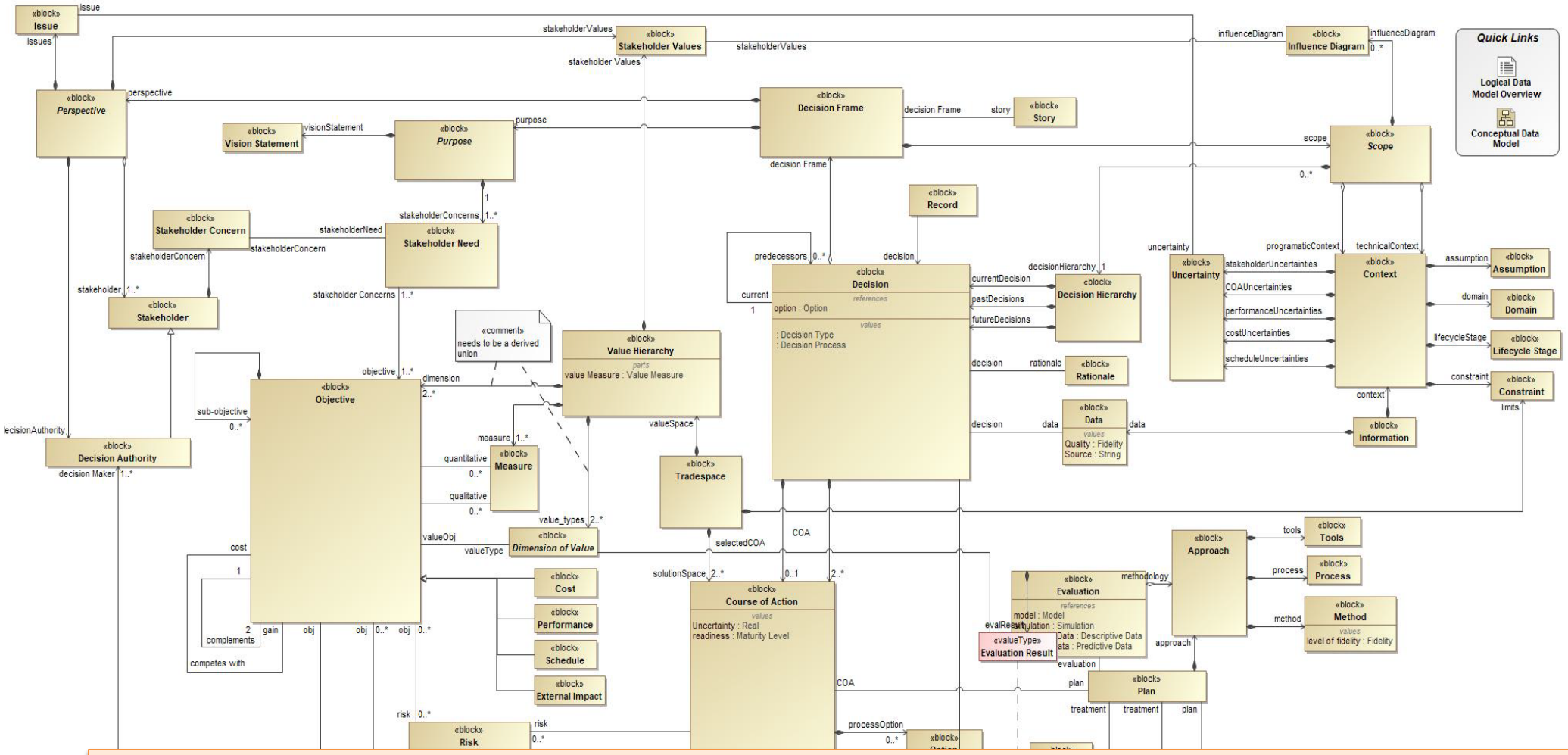
The logic level modeling required SME conversations helping to improve understanding and will result in changes to the SEBOK, the INCOSE Handbook, and other sources.

Structure Objectives and Measures



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

Logical Data Model



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

Next Steps

2024

- Release the model (4th 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

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.