

Strategic Decision Intelligence:

Safeguarding Product Development Success in Complex

Engineering Landscapes

Alper Murat, PhD¹, Ratna Babu Chinnam, PhD¹, Satyendra Rana, PhD¹

Stephen H. Rapp, PhD², Andrew Dunn², Ronald J. Renke², James E. Bechtel³, Kurt D. Hansen^{2,3}

¹ Agile Systems LLC, Rochester, MI

² USA AFC, DEVCOM –GVSC, 6501 E. 11 Mile Road Warren, MI

³ USA ARMY, PEO Ground Combat Systems, 6501 E. 11 Mile Road Warren, MI

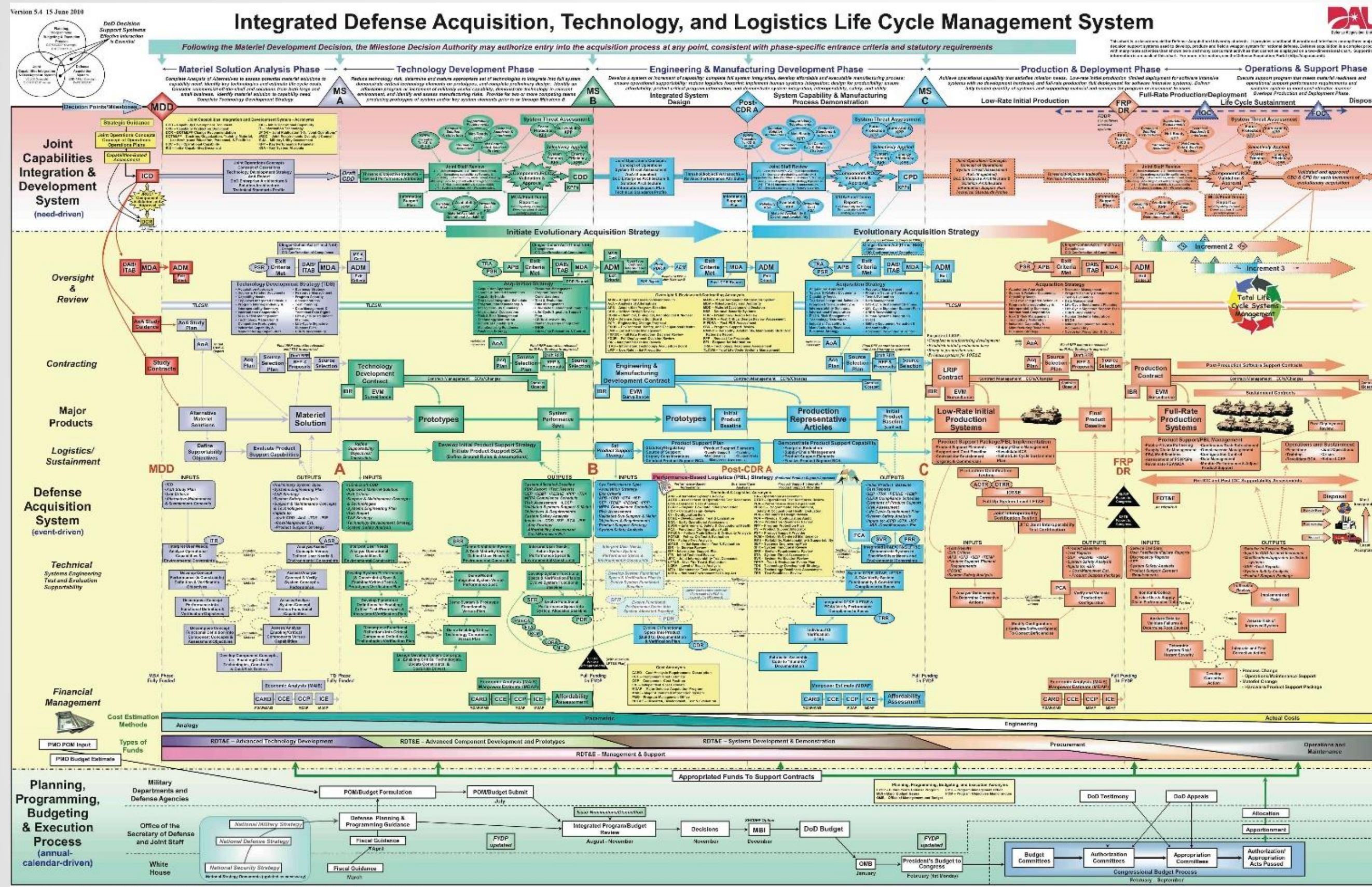


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Acquisition is Complex &

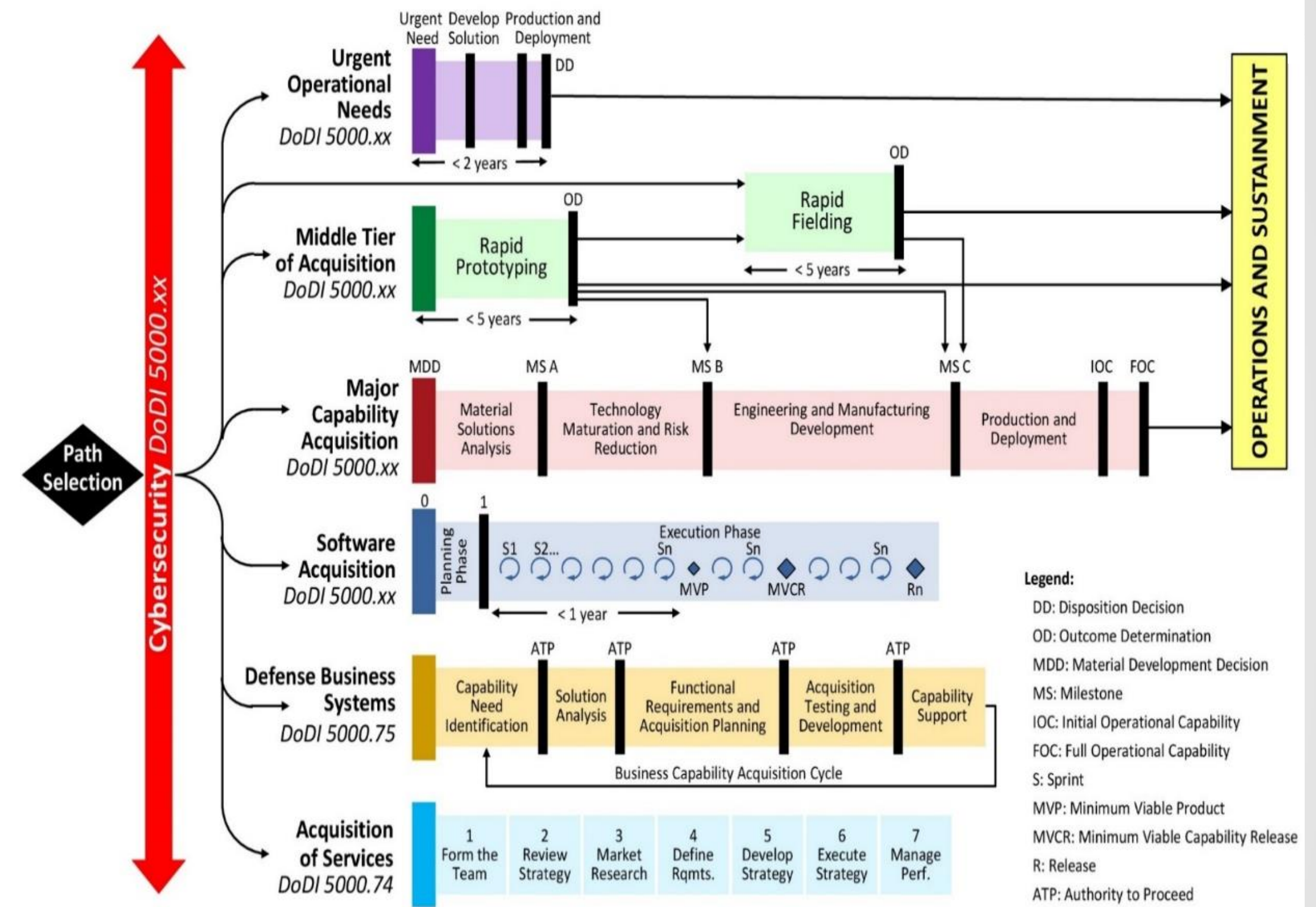
DoD Acquisition Process & Adaptive Acquisition Framework Bureaucratic

DoD 5000 Acquisition Process



DIGITAL ENGINEERING / SYSTEMS ENGINEERING

Adaptive Acquisition Framework



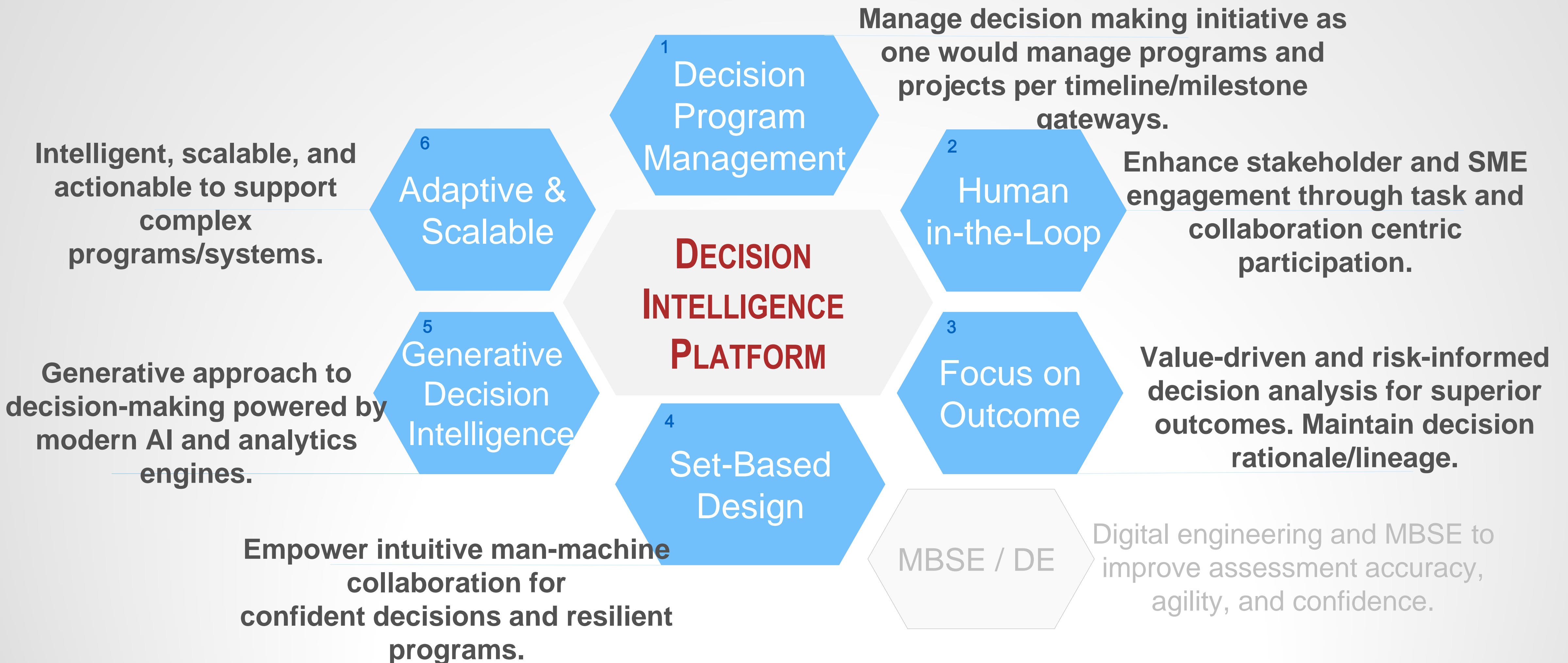
Development & Acquisition

Challenges
Reported by DoD, GAO, RAND, INCOSE, Literature

- Too many CAT 1A program failures and breaches.
 - Root Causes: Changing Requirements, Immature Technologies, Poor Estimation, Unstable Budgets, Development Complexity, Inadequate Risk Assessment & Mitigation
- Modeling studies to support programmatic decisions are too tedious and slow that decisions are often made before getting study results. - Col. Jurand, PM Maneuver Combat Systems (GVSETS 2022)
- *Ad hoc* management of stakeholder(s) inputs and participation in decision making.
- Lack of structured decision-making processes, *U.S. Army issued a SBIR RFP for enhanced decision intelligence platforms capable of promoting acquisition and*
- Failing to learn from historical programs and decisions. *development program resilience through Set-Based Design.*



Strategic Decision Intelligence



Need for Set-Based Design

(SBD) *Current State: Poor support for “First-Mile” and “Last-Mile” aspects of decision making!*

DECISION MAKING: MAJOR PHASES

“First-mile” FRAMING

- Framing the problem and scoping
- Establishing proper goals and objectives
- Understanding consequences

“In-between” ANALYSIS

- Expand and explore options
- Evaluation framework
- Decision model

“Last-mile” DECIDING & DOING

- Understanding outcomes risk
- Consideration for decision operationalization
- Knowledge management

CURRENT STATE

- > Mostly managed as an *ad hoc* qualitative process
- > Inadequate engagement of all key stakeholders and collecting proper information
- > Inadequate treatment of multiple perspectives

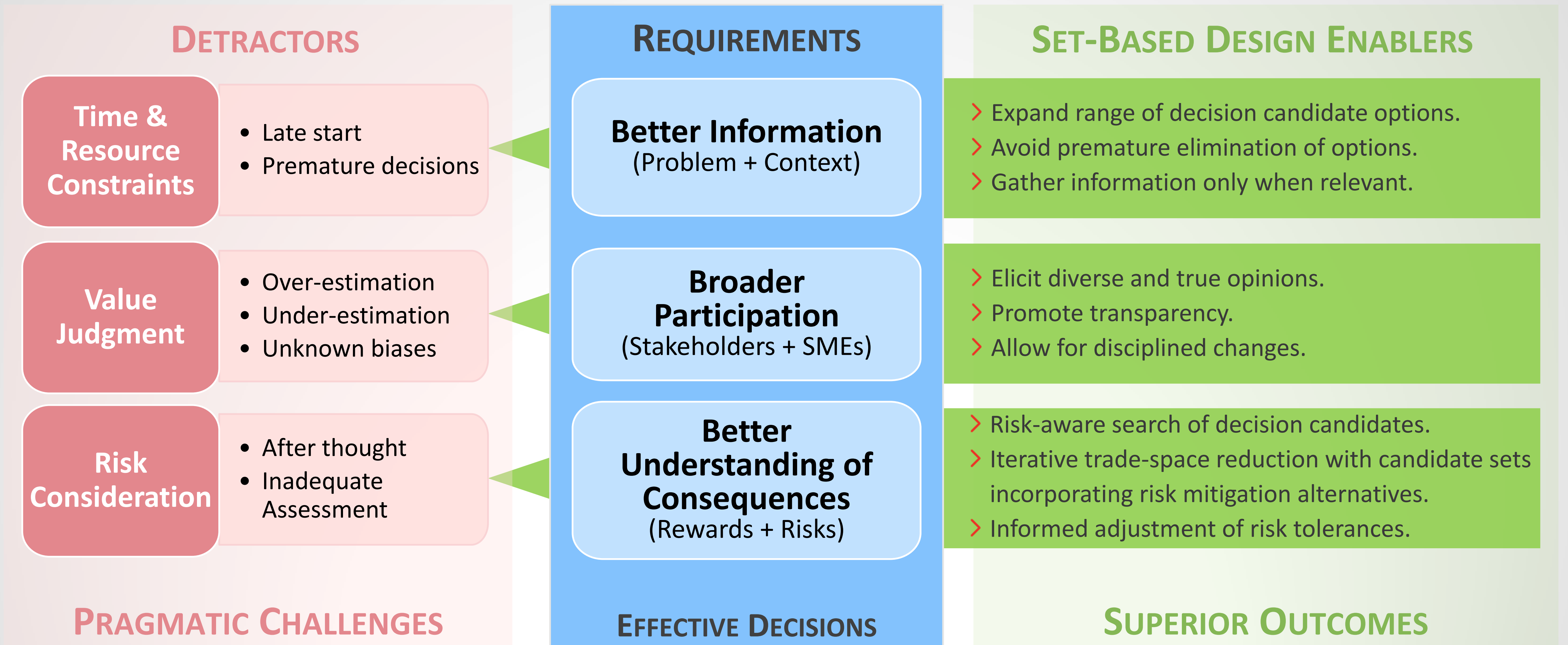
- > Dominant focus of “Decision Analysis”, since its inception in 1964 by Prof. Ron Howard
- > Gaps with treatment of uncertainty and scalability

- > No buy-in into the decision or solution
- > Decision lacks robustness for implementation
- > Program breaches, delays and rework



SBD Leads to Superior

Practice pioneered by Toyota Motor Corp. for two decades!



Set-Based Design (SBD) is a practice that keeps requirements and design options flexible for as long as possible during the development process.



Decision Program Management

Manage decision making as one would manage projects.

- **Requirements for Enhanced Support:**
 - **Rigorous Decision-Making:** Utilizing digital engineering and analytics. Integrating human judgment, uncertainty, and analytics.
 - **Comprehensive Stakeholder Engagement:** Involving all parties in the decision process.
 - **Single Source of Truth:** Centralized digital engineering data.
 - **Milestone Analysis:** Detailed tracking of milestones and progress. Live dashboard for real-time status updates.
- **Dynamic Workflow Management:**
 - **Centralized Platforms:** Real-time communication and task tracking.
 - **Adaptability:** Adjusting workflows to meet evolving project requirements.
 - **Real-Time Updates:** Immediate reflection of changes in project status and plans.



Generative Decision Intelligence (GDI)

- **Structured Decision Representation:** Clearly defined decision spaces and outcomes.
- **Decision Alternative:** A composition of structural building blocks (design components or options), following specific composition grammar.
- **Dynamic Generation of Alternatives:** Creating multiple decision paths based on current data.
- **Intelligent Algorithms for Optimization:** Using AI and analytics to find optimal and robust solutions among alternatives.



DI: Demonstration Case Studies

- **Automotive-Mobility Modeling Use Case:**
 - **Platform Application:** Decision intelligence in an automotive context.
 - **Highlight:** Digital Engineering (DE) enabled mobility trade study.
 - **Results:** Enhanced decision-making and streamlined processes.

- **Program Protection Use Case:**
 - **Risk Assessment and Mitigation:** Utilized decision intelligence platform to identify and address risks.
 - **Outcomes:** Improved PP risk management and decision-making efficiency.



Alpha

- Goal: Conduct whole system trade through high-fidelity co-simulation of the entire vehicle's multibody dynamics and road/terrain interactions.
- Employ high-fidelity models to instill confidence and enhance decision-making in exploring promising vehicle concepts.
 - Leverage CREATE-GV's MERCURY simulation capability for precise mobility assessments.



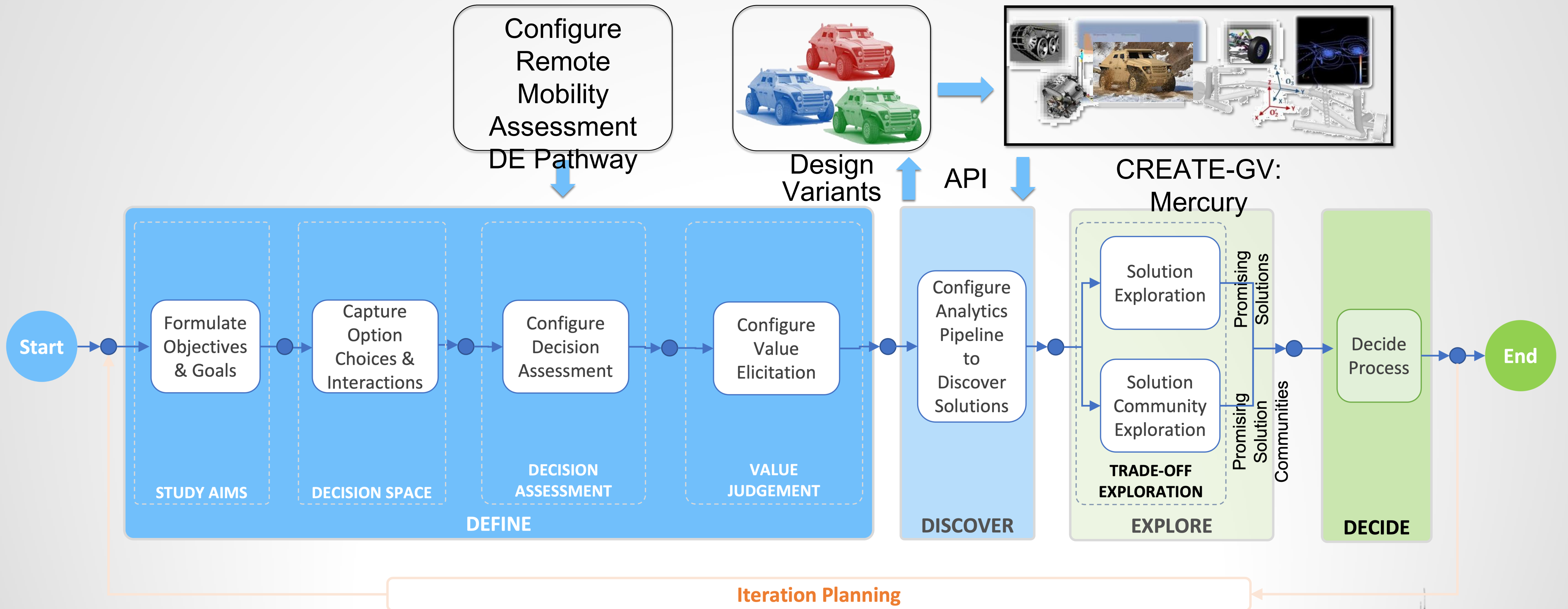
AI Solution Methodology

Automotive Mobility - FED

DIGITAL ENGINEERING /
SYSTEMS ENGINEERING

Alpha

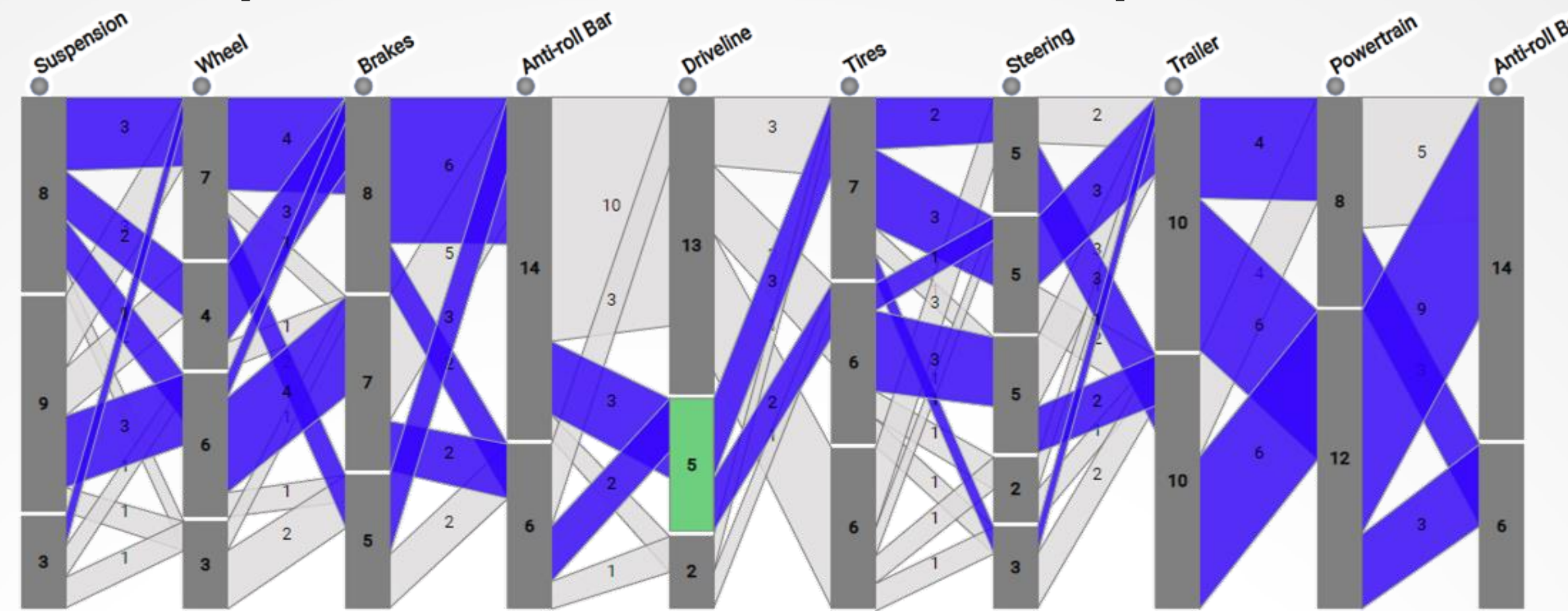
- Combinatorial Mobility Trade Study Process



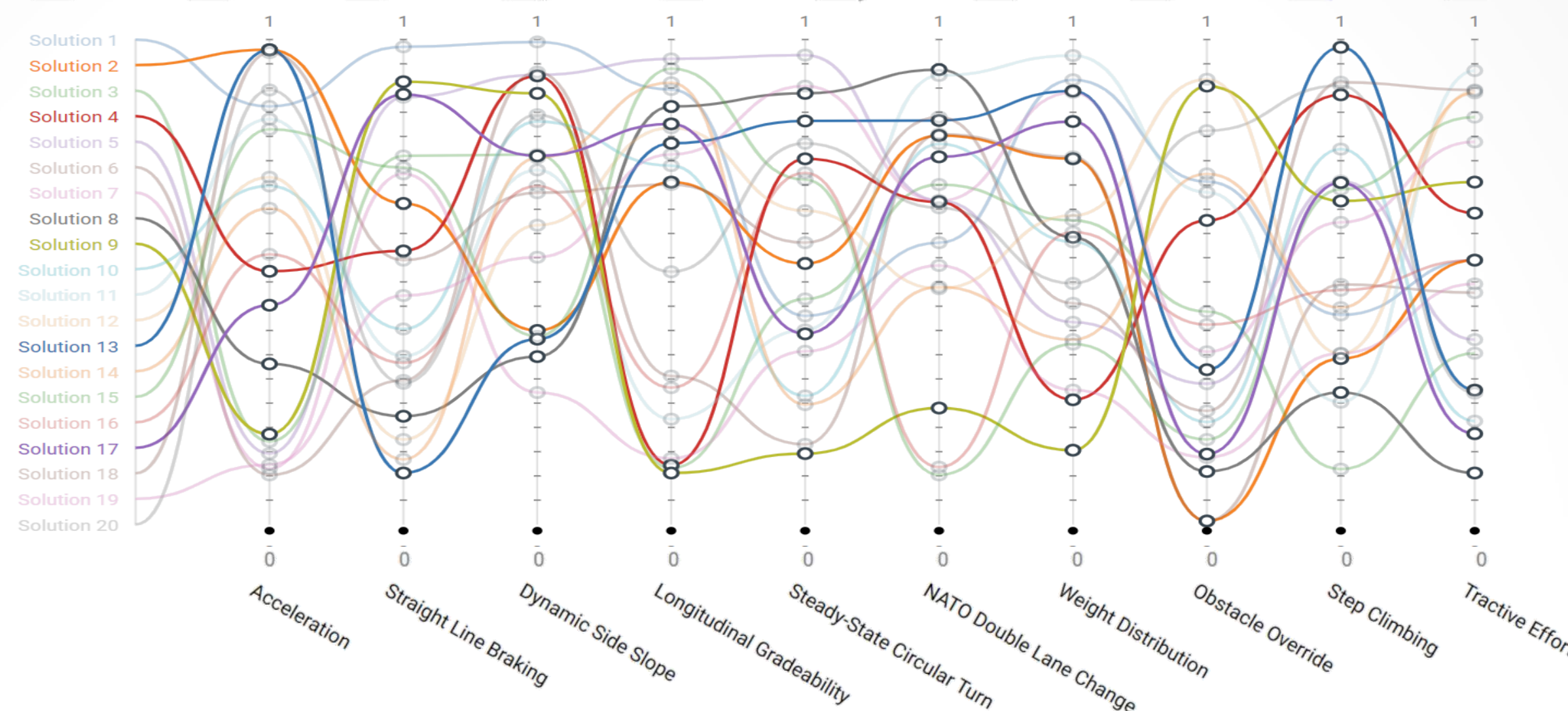
Alpha

- Identified set of Pareto-optimal vehicle concepts

STRUCTURE



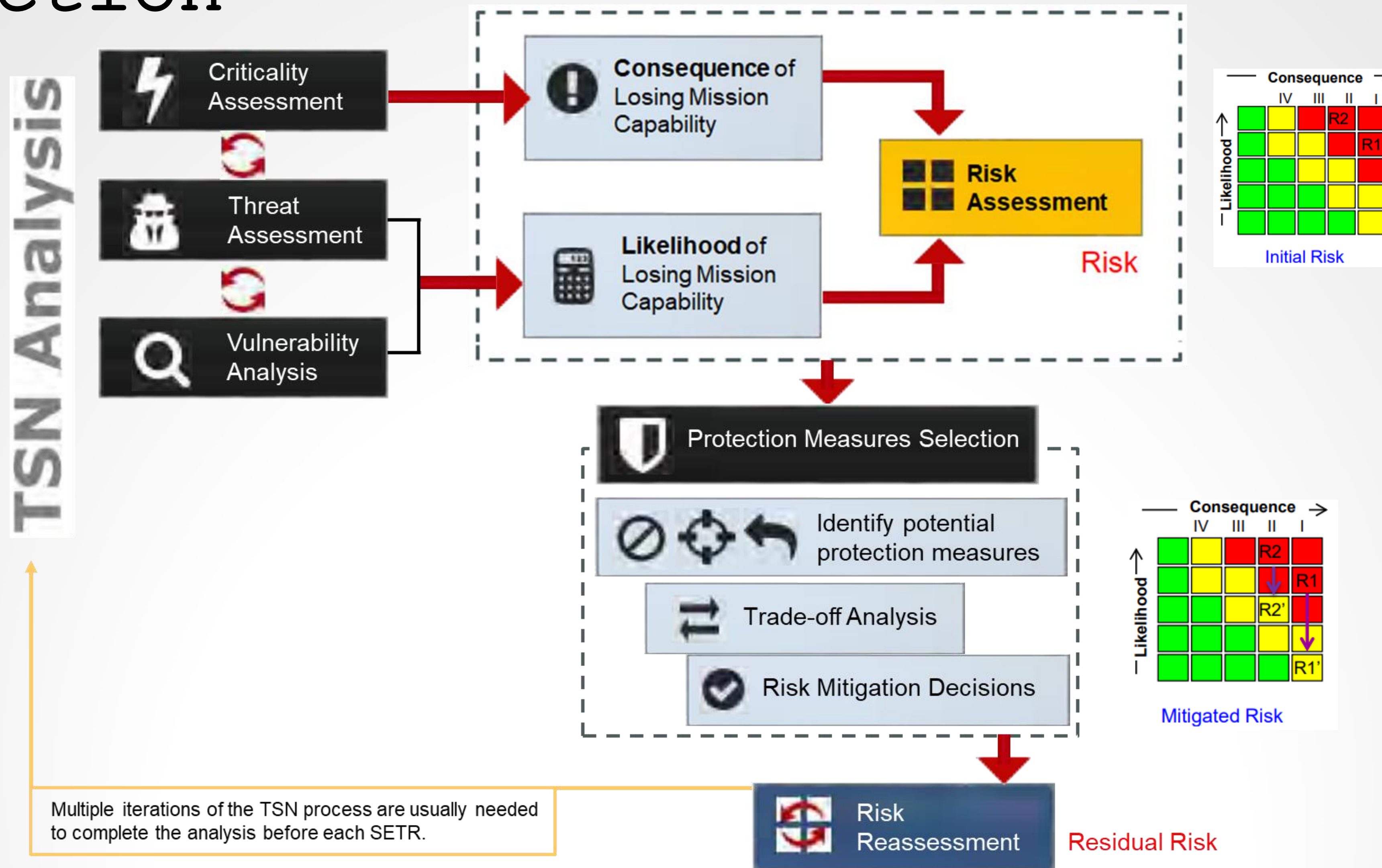
PERFORMANCE



* Selected Solutions with ShaftsDriveline4WD



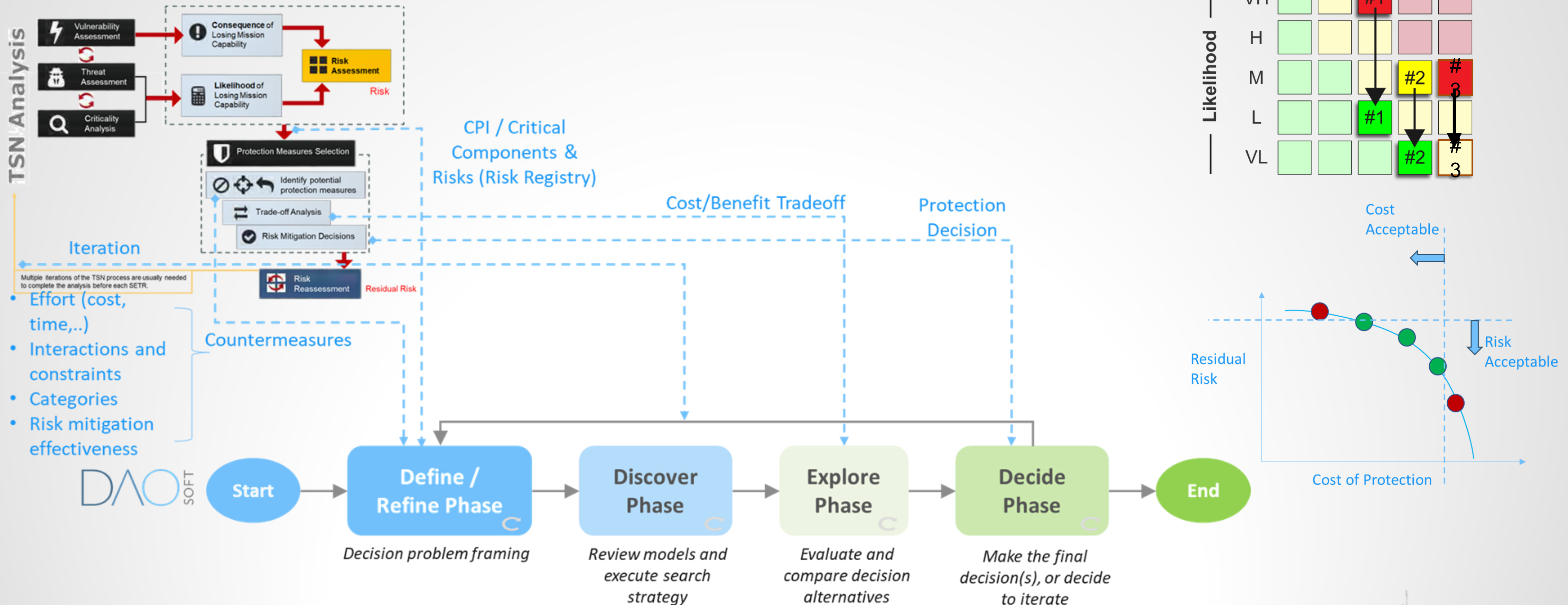
Case Study setting TSN Analysis for Program Protection



AI Solution Methodology

TSN Analysis for Program Protection

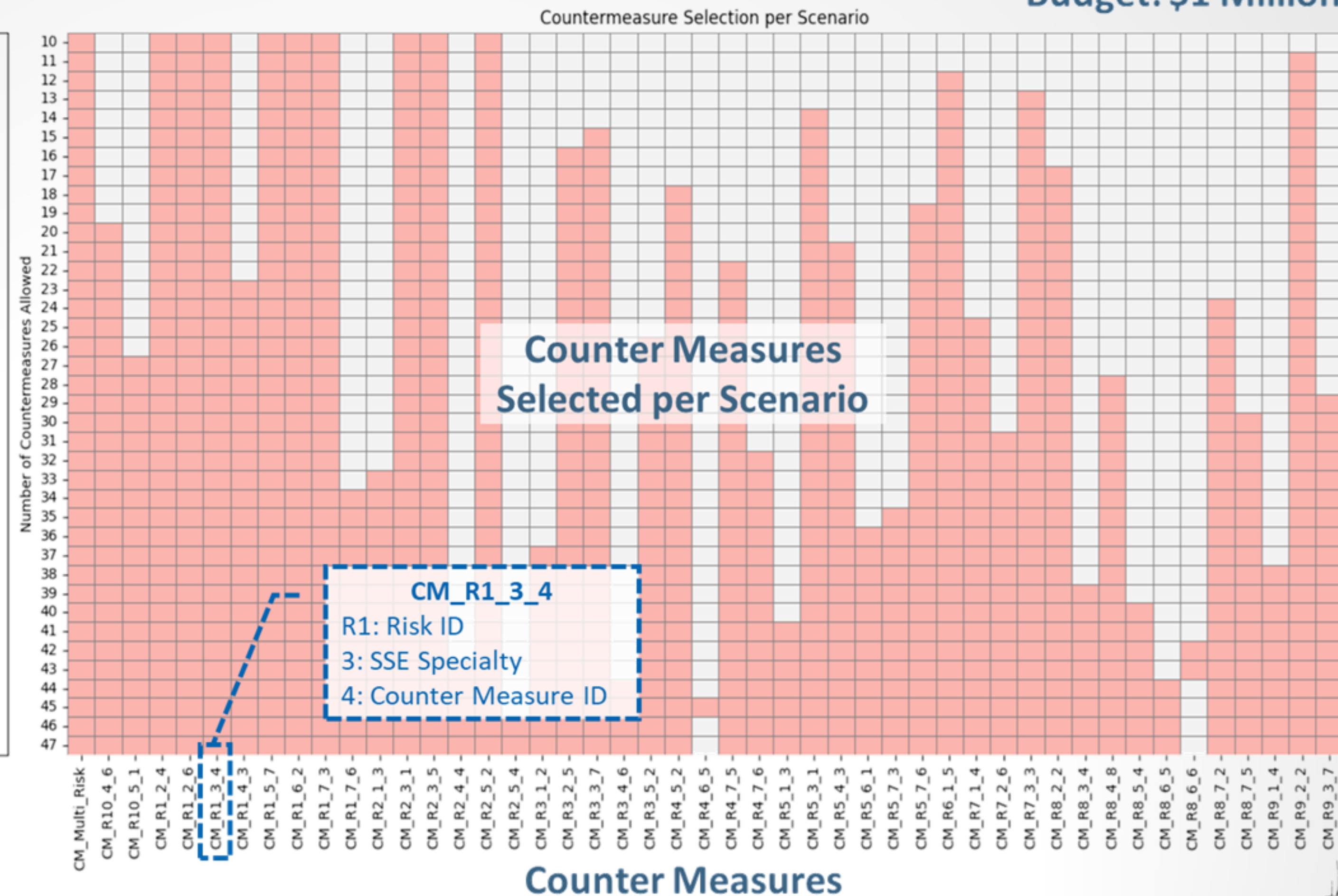
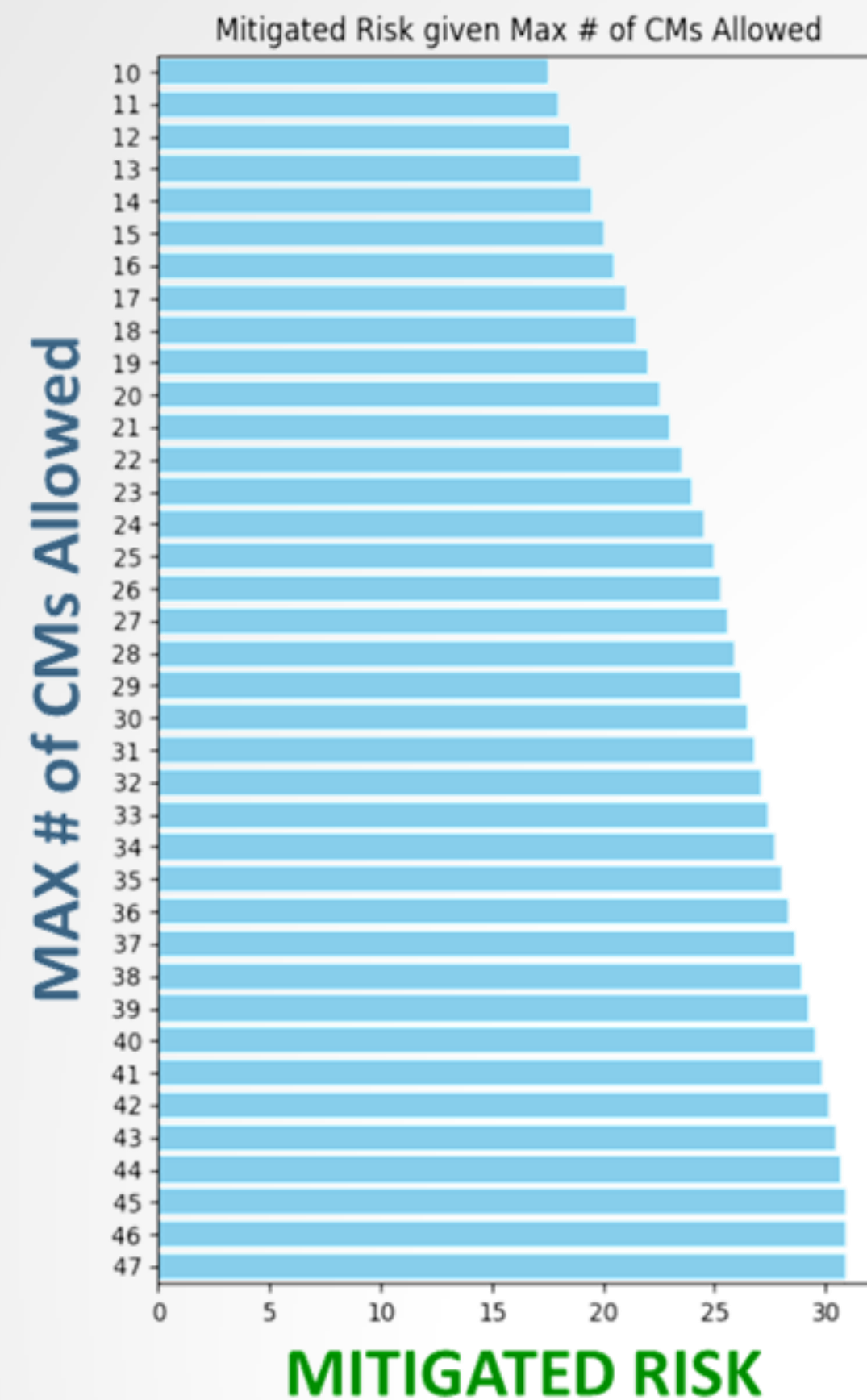
Program Protection Process



RESULT: PROTECTION PLANS TSN Analysis for Program Protection

- Identify cost-effective portfolios of Counter Measures for PP

Budget: \$1 Million



DEMO

DAOSoft

Generative Decision Intelligence®
PLATFORM



Conclusion

- **Summary of Key Points:**
 - **Importance of Decision Intelligence (DI) in PDD:** Critical for navigating complex engineering landscapes.
 - **Key Requirements and Technical Aspects:** Overview of essential components for effective DI platforms.
 - **Benefits Demonstrated through Case Studies:** Real-world examples of success.

- **Final Thoughts:**
 - **Future Directions:** Potential advancements in DI platforms.
 - **Call to Action:** Encouragement to adopt and integrate DI platforms in PDD processes.



Contact Information

■ Authors' Contact Details:

- Alper Murat: amurat@agilesyslabs.com
- Ratna Babu Chinnam: rchinnam@agilesyslabs.com
- Satyendra Rana: srana@agilesyslabs.com
- Stephen H. Rapp: stephen.h.rapp.civ@army.mil
- Andrew Dunn: andrew.g.dunn.civ@army.mil
- Ronald J. Renke: ronald.j.renke.civ@army.mil
- James E. Bechtel: james.e.bechtels2.civ@army.mil
- Kurt D. Hansen: kurt.d.hansen.civ@army.mil

