Enhancing Decision Accuracy in DoD Acquisition: Integrating Artificial Intelligence with Reference Class Forecasting

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Abstract

This capstone examines how integrating artificial intelligence (AI) with reference class forecasting (RCF) can improve decision accuracy in Department of Defense (DoD) acquisition. Persistent cost overruns and schedule delays, driven by optimism bias and planning fallacy, highlight the limits of traditional forecasting. These shortfalls routinely undermine mission readiness and erode fiscal discipline. While RCF enhances accuracy by anchoring estimates in historical data, its use in the DoD is limited by scalability and data-access challenges.

This study uses a qualitative design combining policy review, comparative case analysis, and conceptual modeling. The findings indicate that AI can support the automation of reference-class construction from unstructured acquisition data and enable probabilistic forecasting, improving cost and schedule realism. Supported by prior literature and simulated analysis, the results also suggest that this approach can strengthen technology readiness assessments (TRA) by incorporating risk-based probability bands, thereby highlighting the value of probabilistic evidence in early acquisition decision-making.

Recommendations include phased AI–RCF implementation, governance standards for transparency, and integration into milestone artifacts like TRAs and Life-Cycle Sustainment Plans. Institutionalizing this approach would embed empirical rigor into acquisition decisions, reduce systemic risk, and advance the DoD's shift toward data-driven reform.

Methods

- Conducted a qualitative research design that combined policy review, comparative case analysis, and conceptual modeling.
- Analyzed historical acquisition documents—including Modernized Selected Acquisition Reports, Selected Acquisition Reports, Defense Acquisition Executive Summary reports, and Government Accountability Office assessments—to identify recurring cost, schedule, and technology-maturity patterns.
- Used artificial intelligence–assisted text parsing to extract structured information from unstructured acquisition documents, such as risk narratives and technology readiness indicators.
- Developed a conceptual model that integrates natural language processing, clustering techniques, and probabilistic forecasting to automate the construction of reference classes.
- Compared traditional single-point estimates with simulated probabilistic median (P50) and conservative (P80) forecasts to evaluate improvements in realism and visibility of risk.

Results & Impact

- AI automated the extraction of cost, schedule, and technology-maturity indicators from unstructured acquisition documents, enabling scalable reference-class construction.
- Probabilistic AI-RCF forecasts produced more realistic P50/P80 cost and schedule ranges compared to traditional deterministic estimates.
- Analysis showed that AI-RCF improves early-phase forecast accuracy and highlights risk earlier, strengthening decision quality at Milestone A/B.
- AI-RCF enhanced TRA insight by applying probability bands to technology maturity, improving visibility into CTE-driven risk.
- Results indicate that integrating AI-RCF can reduce systemic optimism bias, increase transparency, and support more defensible acquisition decisions.

Future Research

- Evaluate AI-RCF performance using real acquisition program data as DoD releases additional MSAR/SAR updates.
- Assess whether AI-RCF improves TRA accuracy across multiple program types and technology domains.
- Expand AI-RCF to Life-Cycle Sustainment forecasting to analyze long-term O&S cost realism and readiness impacts.
- Compare AI-RCF forecasting outcomes with other Services (Army/Air Force) to identify governance or architectural factors affecting accuracy.
- Examine whether AI-RCF–informed corrective actions produce durable reductions in systemic cost and schedule risk across acquisition cycles.

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