RESEARCH SUMMARY

Early Predictive Indicators of Contractor Performance

A Data-Analytic Approach

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ISSUE

A recurring challenge to successful acquisition program execution is poor contractor performance. The Deputy Assistant Secretary for Acquisition Integration, Office of the Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics (SAF/AQX) asked RAND Project AIR FORCE to develop and prototype data-analytic methods on a variety of disparate and disjointed government and external data sources to identify potential execution performance and relative contractor performance risks earlier than would be typically reported via traditional methods. In this report, the authors discuss initial insights and approaches in exploring and prototyping these methods. Subsequent work and further development are ongoing.

- What techniques can be employed to assess program execution performance and risks as early as possible?
- How can program managers (PMs) and stakeholders leverage available government and external data to assess these concerns?
- What data sources are available and useful?
- What practical concerns arise when implementing such assessments?

APPROACH

1. Review corporate performance and risk literature and existing business intelligence tools to determine how performance and risk can be measured and what methods exist to analyze these factors.
2. Identify leading indicators of performance.
3. Develop a taxonomy of potential risk measures beyond those traditionally examined in program management and that use relative performance against those of their peers or fixed thresholds to highlight risk indicator outliers to government acquisition professionals.
4. Identify potential data sources and algorithms for these measures.
5. Obtain relevant data, including development of software to extract, transform, and load data into a custom database and processing environment.
6. Develop a research prototype database and software system to test and refine the concept. Cross-reference data sources to associate contracts and contractors with Department of the Air Force (DAF) programs and build a simple user interface to view results from both a contractor and program perspective.

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CONCLUSIONS

- Automated tools could be created to ingest, aggregate, and analyze data that could focus managers' limited resources on early indicators of performance issues and potential risk indicators buried in large, diverse data; this could help inform mitigating actions by management based on effectiveness, program relevance, and risk tolerance.
- Some data that are important for assessing relative contractor risks are difficult to obtain—even for DAF officials and federally funded research and development centers.
- Further work is necessary in developing a prototype with a significant critical mass of data sources and measures to test and refine this approach. User feedback on utility and design is also needed.

OPPORTUNITIES

- Integrating and assessing traditional and nontraditional data sources could provide useful indications of potential areas of concern.
- With further refinement, this approach could be a powerful tool to help PMs and stakeholders leverage vast amounts of data to identify performance and risk indicators for further due diligence, confirmation, and proactive management.
- Additional data and the inclusion and validation of more metrics and implementation details are needed to make these two factors more robust; data availability, accessibility, and analysis are key.
- This is a research prototype. Despite its limitations, this approach is more sophisticated in some ways (e.g., through company-level metrics, such as financial health or supply chain risks, and predictive indicators of future performance) than other available systems and may point to features or concepts that could be added to DAF or U.S. Department of Defense systems that assess potential contractor risks.

TABLE S.1
PERFORMANCE INDICATORS AND ASSOCIATED DATA

Metric	Description
Cross-cutting metrics	
Sentiment analysis	Assess whether the summary green, yellow, or red ratings for a report appear better than the text of Monthly Acquisition Report assessments
News reports	Filter news reports that appear to indicate performance issues or situations that could lead to future performance issues
Program Assessment Reports (PARs)	Program status reports for major programs from the Defense Contract Management Agency
Rayleigh Function[a]	Predicts the final costs and schedule by curve-fitting earned value (EV) data to date to a prototypical Rayleigh curve shape
Cost metrics	
Cost Performance Index (CPI)[b]	Measures the amount of completed work for every unit of planned cost spending (i.e., the inverse of actual spending to date relative to scheduled spending to date)
Cumulative CPI versus To-Complete Performance Index to Meet the Estimate at Completion ($TCPI_{EAC}$)	Measures the amount of work that must be done for every dollar spent to meet the current EAC (i.e., the difference between cost efficiency to date and the needed efficiency to meet the EAC)

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TABLE S.1—CONTINUED

Metric	Description
Range of independent estimates at completion (IEACs)	Estimates four different IEACs under the following assumptions: • Future cost performance will be the same as all past cost performance • Future cost performance will be influenced by past schedule performance • Future cost performance will be influenced by past schedule and cost performance • Similar to previous assumption, except increased weight is placed on CPI.
Schedule metrics	
Schedule Performance Index (SPI)[b]	Measures the percentage of budgeted work actually performed to date
Time-Based Schedule Performance Index (SPI_t)	Measures the average percentage of scheduled work actually being completed to date
Schedule Slippage Indicator (SPI_t vs. To-Complete Schedule Performance Index to Meet the Estimate Duration [$TSPI_{ed}$])	Estimates the difference between schedule progress to date (SPI_t) and remaining planned efficiency (i.e., does the current remaining schedule reflect the same schedule slippage rates?)
Independent Estimated Completion Date based on earned schedule (IECDes)	Generates a predicted project completion date assuming future schedule slippage will match current slippage in percentage
Contract health metrics	
Work-content growth	Measures the growth in the amount of work content added to the contract to date

NOTES:

[a] The Rayleigh Function has been modeled but not implemented in the research prototype.

[b] This is a traditional EV management metric.

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