SYM-AM-22-044

Excerpt from the Proceedings of the Nineteenth Annual Acquisition Research Symposium

Acquisition Research: Creating Synergy for Informed Change

May 11–12, 2022

Published: May 2, 2022

Prepared for the Naval Postgraduate School, Monterey, CA 93943.

Acquisition Research Program
Department of Defense Management
Naval Postgraduate School

The research presented in this report was supported by the Acquisition Research Program at the Naval Postgraduate School.

To request defense acquisition research, to become a research sponsor, or to print additional copies of reports, please contact any of the staff listed on the Acquisition Research Program website (www.acquisitionresearch.net).

ACQUISITION RESEARCH PROGRAM
DEPARTMENT OF DEFENSE MANAGEMENT
NAVAL POSTGRADUATE SCHOOL

Organizational Change Considerations for Implementation of Performance-Based Logistics Contracts

Dr. Jake Smithwick—is a professor at the University of North Carolina at Charlotte, and works with acquisition professionals who want to elevate their team's capabilities through RFP optimization and organizational change. Smithwick has assisted hundreds of owners improve performance outcomes across thousands of projects ($15+ billion of procured services in construction, IT, auxiliary services, design, healthcare, insurance, and more). His industry experience also includes six years in the U.S. Air Force Reserve (emergency management / civil engineering squadron). He is an assistant professor in the Lee College of Engineering at the University of North Carolina in Charlotte, and serves as Corporate Secretary for the Center for Procurement Excellence. He received a PhD in Construction Management and a Master of Public Administration, both from Arizona State University. [Jake.Smitwick@uncc.edu]

Daniel Stroder—Graduate Research Assistant, Engineering Technology and Construction Management, William States Lee College of Engineering, University of North Carolina at Charlotte. [dstroder@uncc.edu]

Abstract

Performance-Based Logistics (PBL) administrators have long struggled with developing contracts that result in a win-win relationship for both the contractor and the customer in terms of costs under dynamic conditions, contract length, and sustained performance. These inefficiencies lead to a perpetual cycle of reexamining outdated data, due to current data unavailability, or lack of publications. Thus, outdated practices or cost barriers can often plague outcome-based contracts (OBC). This research entailed seeking out other industries that utilize OBC in asset maintenance. In particular, several state Department of Transportation agencies adopted and successfully implemented Performance-Based Maintenance Contracts (PBMC). In both the qualitative and quantitative spheres, three areas of concern were identified: internal resistance towards performance-based procurement, ineffective relationships between the contractor and customer, and misalignment between contractor performance and scope complexity. After examining 75 contract performance scorecards and conducting interviews with Department of Defense personnel, this research determined that the organizational change required to tackle these specific challenges suggest a paradigm shift in how PBL contracts are implemented and administered.

Introduction

PBL is a type of product delivery method that focuses on obtaining prescribed outcomes as opposed to the traditional/transactional method. Customers are not exactly purchasing an asset, whether this is an electronic component, engine system, or an aircraft fleet. Instead, PBL customers have a business need to fill and there exists a product that will aid in fulfilling the customers' needs. Consider a simplified example of purchasing an aircraft for the U.S. military. The military is primarily interested in the aircraft's operational performance when and where they need it (i.e., reliability). The military's interest is in providing the warfighter with the resources to accomplish the mission. Utilizing a PBL contract would ease the military's burden on maintenance and repair (M&R) of that aircraft because that responsibility would transfer to the contractor who provides that service. The contractor's purpose, in this case, is to understand the client's needs and provide a product that will deliver those outcomes.

While the two parties involved on the contract (i.e., service and buyer) have a mutual interest in a successful outcome, their own motivating factors can differ (a reasonable profit vs. acceptable performance). From the contractor's perspective, the ideal PBL is a firm fixed price (FFP) with the longest contract length (> 5 years). The reason being is that a key attribute of PBLs is innovation; thus, contractors who innovate, stand to make a higher return on investment (ROI) due to increased product reliability from a guarantee of a contract. Conversely, from the client's perspective, the ideal PBL is cost-plus-incentive fee (CPIF) with short contract lengths (<

5 years). The clients are counting on the unlikelihood that a product needs replacing or repairing; however, they are willing to provide monetary incentives (and disincentives) that may persuade contractors to make critical, persistent maintenance decisions.

If PBLs are an attempt to offer a support strategy that delivers positive outcomes, it is necessary to explore why there is resistance to full implementation of the method. The Department of Defense (DoD) performs business case analysis (BCA) on two procurement options: transactional and outcome-based. The analysis aims to determine which strategy will offer the greatest value at the lowest cost. There exist several reasons why many program managers are hesitant to go with the unfamiliar PBL option. The PBL BCA lacks a consistent method that sparks innovation, concrete cost avoidance atmospherics, and risk tradeoff studies (Randall et al., 2012). Simply put, there are not enough examples of PBL implementation that result in a sound BCA.

Adopting a performance-based strategy is not only limited to military assets, but occurs in a variety of other industries (e.g., healthcare, energy, transportation, etc.). This research effort is intended to defense professionals understanding and effort in this area. The research teams evaluated other industries to gather a well-rounded understanding of the PBL framework of both success and failure.

One of the most prominent studies is the Deloitte *Proof Point* research that unveiled challenges to the PBL structure. Table 1 lists the critical pain points that exists in PBL strategies. Additional comments in this study suggested a lack of commitment from top management and personnel reverting back to transactional practices due to PBL unfamiliarity (Deloitte, 2011).

Table 1. Proof Point—Challenges to Overcome (Deloitte, 2011)

Challenge Area	Description
Service equities	PBLs present the Services with a transformational change challenge that is both complex and most often involves the transfer of workload (accompanied by a sense of loss of control) to the commercial sector.
Full costing organic DoD sustainment	The full price of commercially provided PBL sustainment is clearly known by the Services—it is the amount paid to the provider. In contrast, fully costing organic DoD sustainment is difficult if not impossible given existing funds flows and accounting capabilities.
Absence of robust BCAs, agreed upon facts and transparency of data	Bottom line: in many situations, decision makers do not have the quantity and quality of information and data essential to execute their roles with confidence.
Speed-to-savings	Unlike transactional sustainment where savings can be harvested through the simple act of a budget cut, PBL savings are a lead time away from the initial planning process.

Gansler & Lucyshyn (2006) discovered six key areas that add to the complexity of successful PBL implementation: the cultural barrier, human capital, depot requirements, the type of money for funding, technical data rights, and loss of competitive pressure. These

strategic roadblocks have continued since their original discovery; however, identifying lessons learned may help identify underlying issues that seem to plague performance-based support.

Throughout performance-based contracting's history, there have been studies that have highlighted and collected lessons learned when implementing performance-based contracting (PBC). Randall et al. (2011) suggested that support from senior management, education with both internal and external stakeholders, and collaboration are paramount to ensure PBL effectiveness. The skeletal structure of PBL contracts should avoid ambiguity, require data sharing between parties, have client metrics clearly defined, and also hold the contractor accountability for explaining how they aim to achieve product innovation (Sols et al., 2007). Transitioning to the transportation industry's recommendation, stakeholders must acknowledge the baseline of performance before performance metrics are established, which will enable a more accurate incentive calculations when measuring actual performance in the future (Ozbek & de la Garza, 2011). Gelderman et al. (2019) interviewed industry experts in performance-based maintenance contracts (PBMC) and a unanimous series of recommendations were contract longevity, employee morale, and monitoring performance standards, along with their associated costs.

PBL has been the DoD's preferred weapons system support (WSS) strategy for nearly 20 years, and yet, this product support method has not evolved significantly since its inception. Reports on key areas in need of improvement have been a guiding rubric for PBL programs. Access to detailed PBL contract performance data was not available to the researcher. The research team pivoted and derived the root causes to PBL shortcomings and examined how other industries (e.g., Department of Transportation) addressed various issues in an effort to identify potential best practices for the Department of Defense. The team discovered that the internal resistance towards performance-based procurement, ineffective relationships between the contractor and customer, and misalignment between contractor performance and scope complexity are all the key contributors that disallow PBL to evolve into a consistent optimal outcome.

Background

The premise of PBL is to encourage collaboration through innovation that results in a "win-win" relationship between the customer and contractor. This paper focuses primarily on the customer's perspective. One of the challenges with broader adoption with PBL is limited training and educational opportunities. When insufficient training is provided, employees who are unsure how to enact the change within their job functions will typically revert back to their traditional practices (Lines & Smithwick, 2018). In this case, program managers should anticipate longer than expected timelines when measuring PBL effectiveness.

Randall et al. (2012) recognized that PBL practitioners have both system knowledge and source knowledge, but have limited supply chain knowledge (i.e., partners, relationships, customers, and interactions). Adopting new practices related to PBL, especially after spending years of executing contracts in a certain method, can be a hinderance. One fundamental solution to PBL adoption resistance is to receive senior management's support. This commitment enables teams to utilize resources (e.g., training) needed to facilitate relationship-based initiatives (Aldossari et al., 2021).

The research team also found that reliability is the best metric. When juxtaposed with transactional contracts, PBC have shown to be 20%–40% more efficient in terms of addressing the mean time between unplanned removals (MTBUR; Guajardo et al., 2011). Sols et al. (2007) identified four categorizations of aircraft assets with respect to reliability in PBL assessments: operational, planned maintenance, aircraft on ground, and under maintenance. Performance-based strategies are not just confined to military assets. Industries, such as transportation,

healthcare, and energy, also implement what is referred to as performance-based maintenance contracts (PBMC), or some close variant. Hyman (2009) reported that 80% of the respondents believe that PBMC fosters creativity and innovation on the part of the contractor(s) because they are generally free to achieve the performance targets or standards in any manner they choose (Gelderman et al., 2019). States that are active practitioners of PBMC, such as Florida, can experience a 2%– 2.5% increase over traditional contracting, which leads to a substantial increase in the condition of the assets. In fact, Florida stated that they were not losing money with the PBMC (Gelderman et al., 2019).

Case Study

The research team was able to secure an interview with one branch's logistics division, whose mission is to deliver life cycle logistics support to ensure sustainable materiel readiness for various aviation equipment and missile systems worldwide. The topics covered during the interview with logistic division's subject matter provided excellent insights, as highlighted below.

PBL Advantages (customer perspective)

- Smaller inventory pipeline
- Efficiency
- Less flexible

Incentives

- FAR adherence
- Metrics can lead to undesired behaviors
- Not all incentives or disincentives are monetary
- Time can be an incentive
- Firm Fixed Price is ideal
- The customer measures risk with in-house data

PBL Contract

- Subcomponents on PBL may have different payment structure
- Key stakeholders (e.g., engineers) aid in defining scope of work

PBL Advantages (supplier perspective)

- Consistency of funding
- Vendors want to be known as the best
- Vendors are eager to participate in PBL
- Vendors get visibility

PBL Disadvantages

- Division's expectations are transactionally oriented
- Forecasting attempts to account for demand 2–3 years out
- Institutional resistance
- Sole source stifles competition

After concluding the meeting, the team found that the listed topics offered a plethora of starting points to unravel PBL challenges. Having access to data that would support some of these concerns would establish a sound foothold in the PBL research initiative. However, due to confidentiality protocols, the research team was not provided with pertinent data that would permit detailed analysis.

In May 2021, a follow-up interview was conducted with an experienced PBL practitioner who dealt mainly with a specific type of military aircraft. This project manager had 13 years of experience in military procurement and was familiar with recurring PBL studies. The following are the key comments discussed during the interview:

- Owner's internal poses challenges to successful PBL implementation
- Internal environment poses challenges to PBL scalability (i.e., when demand for flight hours decreases, PBL contracts do not allow the metrics to decrease). The PM's counter argument to this was that when assets are not flying, it still requires services and maintenance.
- System's Analysis Program (SAP) is primarily used for forecasting and replenishing parts.
- Services prefer internal depots when they own intellectual property.
- Business case analysis (BCA) is performed every 4–5 years for PBL contracts.

The research team conducted follow-up a different military agency to better with a long history of PBL implantation. The goal of this second phase of research was to gain a better understanding of PBLs through recorded metrics since its inception. The agency's corporate communications provided the responses from subject-matter experts who have knowledge to the corresponding questions:

1. On a system level, how does the agency identify key impact areas that drive performance while reducing life-cycle costs?

[Response] PBLs inherently drive performance while reducing life cycle costs. The main focus of our PBLs is performance and our main metric is availability. The contractor is paid for performance so if they meet their metrics and deliver the performance that's required under contract, they get paid fully. If they fail to achieve metrics, then there are contractual downward price adjustments. Our financial mandate that's required for all PBLs is break even or better. Using a BCA, we measure/forecast what our costs would be under traditional support. We are not authorized to spend more than what it would cost us to support the system using a traditional support strategy. Using our experienced contract negotiators, we often award at less than traditional support costs which contributes to reducing life cycle costs. In addition, we often benefit from improvements (process and reliability, etc.) that we often get under PBL which also contribute to reductions in life cycle costs.

2. What is the general workflow in determining performance metrics on a system in PBL?

[Response] Our primary metric is availability, and we measure this using an SRT (supply response time) metric. The SRT metric is calculated by our research department based on our retail sparing levels.

3. How has the agency responded to contractors who desire a long-term fixed price contract in order to meet desired performance-based outcomes? Any insights on how the contract length is negotiated between the government and the supplier?

[Response] PBLs are predicated on long term FFP contracts, so it is the government who sells the benefit to industry. If the contractor is already on board, then there's nothing to sell. With few exceptions, our PBLs are a minimum of 5 years and we have the ability to go as long as 10 years. The maximum we can do for a base term is 5 years. We typically will go with the longest base term possible and option years are also typically grouped as long as possible so for example, if we were doing a 10-year contract we would offer a 5 year base with a 5 year option. All options must be priced.

4. During the end of a PBL contract, what analysis does the agency execute in determining whether the current costs are on track to reduce life cycle costs, thus total cost of ownership?

[Response] All of our contracts require full cost reporting so we can determine profit margins and re-baseline costs for follow-on contracts to make sure that profits earned by the PBL provider are not in perpetuity. New BCAs are run for all follow-on contracts as well.

5. What post-PBL implementation results have you seen or experienced? Any positive outcomes or great lessons learned you'd like to share?

[Response] The following sample results illustrate positive outcomes of PBL contracts:

- Increase material availability
    - Display panels: 47%–99%
    - Satellite communications terminals: 78%–93%
- Decreased response times
    - Tires: 4 days world-wide
- Decreased repair turn-around-times
    - 25% reduction and 75% decrease in work-in-process
- Near elimination of awaiting parts problems
- Major reduction in backorders
    - Stores management system: 489 to 0
- Reduced logistics footprint
- Retail allowance reductions: tires decreased by two-thirds; $7 milion savings

The research team also contacted non-military users of PBL (or similar) contracts to develop an initial assessment of best practices and lessons learned. There are several other industries that use performance-based contracting practices in order to achieve outcomes over implementing the transactional approach. Of some of these industries, departments of transportation are prominent entities who exercise performance-based maintenance contracts (PBMC). What distinguishes PMBC from PBL is primarily the asset of concern (highway maintenance versus military fighter plane).

The team interviewed a PBMC representative from a state's DOT sector who administers performance-based contracts across several districts. Relevant background details of the state include:

- Performance-based contracting is associated with Asset Management (AM) contracts.
- This DOT organization implements AM contracts in three types of assets: roadways, bridges, and facilities.
- There are several in-house challenges in adopting performance-based contracting—as opposed to the traditional method of dictating courses of actions.
- One issue with PBCs is that it won't be perfect, yet stakeholders are paying for perfection.
- There seems to be difficulties in determining the "color of money" that results in poor expenditure oversight.

- The contractor knows the true costs of performing a service [the military interviewee also mentioned this].
- This DOT organization has a good working relationship with contractors.
- In-house is short staffed—which may lead to loss of institutional knowledge.
- This DOT organization attempts to put themselves in the contractors' shoes. They limit repetitive deductions.
- This DOT organization PBC staff has a high turnover rate, no handover of PBC practices, and what training that does exist, happens on Microsoft Teams or in-person groups.
- Sharing risks is an ongoing challenge. Right now, the contractor's risks are capped until a certain amount, then the State takes over.
- The Performance Evaluation Report (PER) is a means to periodically assess an asset maintenance (AM) contractor's performance in predetermined contract areas.
- This DOT organization personnel's recommendations: establish trust, change RFP for different programs, and communication.

The state provided detailed performance grades that covered contractor performance metrics, random sampling results, and the level of involvement between the department's personnel and the contractor.

The representative provided the team with 13 comprehensive grade reports that expanded each weighted section that resulted in the final period's performance score. Moreover, the section that covered the department's level of involvement between the department's personnel and the contractor and how that dictated the contractor's section score was insight as to the contractor's ability to perform well on a contract. This section included comments as to why a contractor was given a particular score for that period.

The DOT's performance-based contracts grade report was revised and updated in 2018. The report listed out the performance grade for 75 different contracts, each covering one or more items within their scopes: roads, bridges, rest areas, structures, weigh stations, and other. Within each contract, weighted subscores were divided into five sections (see Figure 1): Section I Performance Indicators, Section II Rest Area, Section III Structures, Section IV Roadway, and Section V Contractor Performance. The final score for each grading period comprised the weighted average from the section that corresponded with the scope of work for each contract (i.e., if the scope did not include rest areas, then no score for Section II was annotated).

Rating Date	Final Score	Section I	Section II Rest Area	Section III Structures	Section IV Roadway	Section V Contractor Performance
Jun-15	**95.4**	100		93	97.9	90
Feb-15	**95.9**	100		93	100	90
Sep-14	**96**	100		93	98.6	95
Mar-14	**96**	97		93	100	95
Sep-13	**97**	100		97.4	98.6	95
Mar-13	**98**	97		99.3	100	95
Sep-12	**90**	94		100	73.4	90
Mar-12	**96**	90		100	97.2	97.5
Sep-11	**88**	94		93	80	85
Mar-11	**88**	94		97.7	100	55
Sep-10	**90**	94		91.8	93.8	80
Mar-10	**92**	94		100	90	82.5
Sep-09	**93**	97		93	100	80
Mar-09	**93**	97		93	100	83
Sep-08	**93**	97		93	100	83

Figure 1. Sample Performance Evaluation Report

In Section V, Performance Intangibles are subjective due to an assigned department personnel who associates a contractor's performance with a numerical value. However, the DOT organization's management team would inquire about a poor performance if the rest of the PER consistently demonstrated otherwise.

Section V: Performance Intangibles

Contractor's 2017 Grading Period (Poor Performance)

Scope: Roads, Bridges, and Structures (Group 3)

A. Interaction/Cooperation/Coordination with adjacent contracts, other government agencies, the public, and other customers.

The Contractor has regressed in their interaction with the public. Several customers have been ignored due to their repeat status. On several occasions, I was asked by the adjacent Construction Project and Local Government Offices to get answers or commitments from [Contractor] because they were unresponsive. **Score 7/10**

B. Cooperation with department personnel.

At times, the Contractor has not returned emails or phone calls on pressing matters. Cooperation with the District Permits office has been poor. **Score 6/10**

C. Quality control and compliance with contract.

The Contractor has regressed with their Quality Control. The Guardrail Inspection report was submitted with 7 missing sections. As well as errors with the Crash Cushion Inspection reports. **Score 6/10**

D. Department efforts required for contract administration and inspection.

The Department was required to spend some effort and resources on the contract. **Score 7.5/10**

Section V: Performance Intangibles

Contractor's 2018 Grading Period (Good Performance)

Scope: Bridges and Structures (Group 2)

A. Interaction/Cooperation/Coordination with adjacent contracts, other government agencies, the public, and other customers.

[Contractor] addressed issues in a timely manner and work orders were thoroughly completed. Contractor interaction with the public and other customers was excellent. **Score 10/10**

B. Cooperation with department personnel.

The Contractor is always willing to go above and beyond the basic scope language to provide the Department with a quality product. They take great pride in the services they provide and continue to keep close coordination. [Contractor's] cooperation with the Department personnel is excellent. **Score 10/10**

C. Quality control and compliance with contract.

[Contractor] followed the contract documents and provided innovative ways for accomplishing work. The contractor was willing to listen to Department concerns and address the issue. [Contractor] is quick to respond to emergencies and looking for innovative ways to perform work while keeping traffic moving. **Score 10/10**

D. Department efforts required for contract administration and inspection.

[Contractor] makes the Contract Administration possible by supplying the District Manager with materials they need in a timely fashion. Time spent administering this contract is minimal and makes it a success. **Score 10/10**

Results

ANOVA

An ANOVA was performed to measure whether there was any statistically significant difference between a contract's performance grade and scope complexity (see Figure 3). Since the report included contracts at various points within their timeline, only contracts that provided the first five years of performance grades were included in the ANOVA. This allowed all measured contracts to have 10 performance grades (each performance review occurred bi-annually). The contracts were then separated into corresponding scope complexity: 1, indicating that the contractor had only one main asset to maintain, and 2, indicating that the contractor had two assets to maintain; this expanded all the way to 4. For each scope group, the average for each grading period was accounted for as providing a sound gauge of how several disparate contracts performed under similar scope complexity. For Group 1, there were 10 contracts observed; for Group 2, there were 11 contracts observed; for Group 3, there were 11 contracts observed; and for Group 4, there were 3 contracts observed. All averages from each group, covering the first five years, were the representative data used for the ANOVA test.

Cohen's D

A Cohen's D effect size was calculated to determine the magnitude of how each group's performance differed (see Figure 2). Cohen's D is a statistical measure that evaluates the means between two groups and indicates the degree of difference based on a pooled standard deviation. This measurement took the average of all individual performance grades in each

group. For each group, the standard deviation decreased with increasing scope complexity, minus the similarities between the variance between Group 2 and Group 3. The groups were compared one way—meaning that switching the order (e.g., Group 1 compared with Group 2 vs. Group 2 compared with Group 1) would not change the effect, only the mathematical signs would change. It is important to note that in Cohen's D calculation, the pooled standard deviation was used, not an average of the two groups. The comparison between Group 1 and Group 2 illustrated the largest pooled standard deviation and had an effect size of |0.63|. The pooled standard deviation and smallest effect size occurred between Group 3 and Group 4 of 6.44 and |0.11|, respectively. After conducting both ANOVA and Cohen's D tests on four groups of this population, the role of both performance achievement and consistency indicated a unique balance associated with scope complexity.

	Mean	SD	N
Quant 1	86.236	10.296	100
Quant 2	91.660	6.623	110
Quant 3	90.076	6.740	110
Quant 4	90.803	5.154	30

M_1-M_2	-5.424		**M_2-M_3**	1.584
Pooled SD	8.570		**Pooled SD**	6.682
Cohen's d	-0.633		**Cohen's d**	0.237
M_1-M_3	-3.840		**M_2-M_4**	0.857
Pooled SD	8.618		**Pooled SD**	6.342
Cohen's d	-0.446		**Cohen's d**	0.135
M_1-M_4	-4.567		**M_3-M_4**	-0.727
Pooled SD	9.381		**Pooled SD**	6.439
Cohen's d	-0.487		**Cohen's d**	-0.113

Figure 2. Results of Cohen's D Analysis

	0.5 Y	1 Y	1.5 Y	2 Y	2.5 Y	3 Y	3.5 Y	4 Y	4.5 Y	5 Y	AVERAGE
QUANTITY 1	80.9	74	73.6	75.2	66.3	42.5	62.9	59.8	70	67	86.6
	66.8	85.6	75.6	86.8	90.4	96	84.3	86.6	87	91	82.3
	87.8	72.2	89.4	92.2	92.2	94.7	96.3	93.9	95	98	85.4
	90.2	83.9	95.2	96.4	96.3	94.8	96.4	98	96	96	85.7
	74.7	68.9	76.1	77	75.4	79.6	79.5	68	78	80	86.3
	93.5	92.8	92.2	91.9	88.4	88.4	92.2	90.7	92	91	85.7
	93	95	96	94	92	90	92	92	92	91	86.9
	92.9	87.7	79.2	66.9	80.9	82.5	80.7	86.9	89	85	86.3
	93.4	70.6	84.4	82.9	86.4	92.8	88.6	90.6	94	94	88.5
	92.7	92.7	92.3	94.1	95.1	95.5	95.9	96.8	91.6	93	88.6
QUANTITY 2	97.8	98.4	98.1	98.6	98.4	98.9	97.8	98	99	96	90.2
	85.4	90.7	72.4	91.4	88.4	89.5	89.2	89.7	71	78	90.5
	97.2	94.7	93.9	92.2	96.1	91.9	98.4	98	96	96	90.6
	96.7	98.3	98	97.5	96.9	98	95.6	97	95	96	
	84.8	81.2	93.1	87.7	82.3	88	94.6	91	89	90	91.7
	91	93	87	80	95	93	96	68	92	92	92.5
	94	92	94	90	91	89	92	91	91	91	93.4
	94.9	94.4	96.5	96.5	97.6	97.6	96.8	93	93	95	92.6
	85	91	90	88	92	92	74	92	93	93	91.2
	95.2	90.6	96.1	96.2	93	96	92	92	95	93	91.7
	70.2	71	77.9	90.8	86.6	98.9	92.1	93.9	95	93	92.1
QUANTITY 3	95.4	95.9	96	96	97	98	90	96	88	88	90.9
	93.2	95	96.7	93	91	93	95	98	94	97	90.3
	87.7	75	77.4	83	82	80	79	80	71	75	91.8
	96	94.4	95.9	97.3	97.5	96.8	98.2	94.5	94	97	91.5
	97.7	93.3	96.3	90.6	93.5	91.4	88.6	90.6	86	85	89.9
	94.2	86.9	93.5	94.9	91.8	94.5	97.3	96.7	96	95	90.4
	84.3	81	84	88.6	94.9	88.3	87.3	89.8	90	90	89.9
	97.5	96.7	96.7	86.8	81.5	82.4	88.2	87.3	88	65	90.8
	92.4	95.8	95.4	90.2	80.5	85.4	82.6	90.5	94	82	88.5
	90.8	94.3	93.3	95.8	94.8	94.8	96.5	98	88	94	86.7
	70.5	85.5	84.2	89.9	84.9	90.1	86.4	82.8	84	86	
QUANTITY 4	96	87.9	82.8	90.3	84.6	81	89.8	81	88	90	91.9
	88.8	86.5	93.6	95	97.7	94.1	96.2	97.8	94	93	88.1
	91	90	94	93	95	86	97	97	92	81	90.1
											92.8
											92.4
											87.0
											94.3
											91.9
											91.3
											88.0

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Quantity 1	10	862.36	86.24	3.06
Quantity 2	10	916.60	91.66	1.07
Quantity 3	10	900.76	90.08	2.23
Quantity 4	10	908.03	90.80	5.72

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	172.00	3	57.33	18.99	1.49172E-07	2.87
Within Groups	108.70	36	3.02			
Total	280.70	39				

Figure 3. Results of ANOVA

Summary

Successful PBL contracts require a shared commitment from both the buyer and the services provider. The unique aspects of a PBL agreement (e.g., long-term nature of the contract, need for rapid repair/replacement of components, development and maintenance of unique assets) can pose a significant challenge to government agencies that are unfamiliar with its overall structure and related best practices. Adopting new contracting mechanisms requires the owner and service providers alike to adopt organizational change best practices. Leaders who are facilitating the adoption of these new practices should seek a strategic, measured approach that truly recognizes the substantial hurdles in place in making the change.

The research team evaluated performance of non-DoD PBL/PBL-like contract as to ascertain performance outcomes and lessons learned that might benefit DoD agencies who use PBL. One state transportation agency's asset management program developed a performance evaluation scorecard of all PBL contracts. The research team found statistically significant difference in terms of the service providers as well as the types of contracts performed. Interviews with the DOT identified that regular evaluation (and constructive feedback to the contractor) was beneficial in delivering a sustainable PBL program for the state.

Limitations

The inability to receive detailed PBL data, as it relates to specific military branches, significantly hindered efforts to use military-based examples that were up-to-date and served to derive any relationships between contractual attributes and PBL performance. The research team pivoted in pinpointing the root cause of PBL performance outcomes by examining state transportation agencies. Comparing DOT agencies PBMC contracts to PBL contracts does not encompass the same level of asset maintenance. Future research would benefit from evaluating DoD PBL contract performance data, which may provide better insights on intra-contractual performance. That is to say, instead of providing baseline data and then highlighting the end-of-life performance metrics, monitoring periodic feedback between the customer and the contractor throughout the life cycle would show the beginnings of a trend towards success or failure.

References

Aldossari, K. M., Lines, B. C., Smithwick, J. B., Hurtado, K. C., & Sullivan, K. T. (2021). Employee reactions to adoption of alternative project delivery methods within the AEC industry. *International Journal of Construction Education and Research*, 1–18. https://doi.org/10.1080/15578771.2021.1900463

Deloitte. (2011). *Proof point project a study to determine the impact of performance based logistics (PBL) on life cycle costs* [Review of *Proof Point Project A Study to Determine the Impact of Performance Based Logistics (PBL) on Life Cycle Costs*]. Office of the Deputy Assistant Secretary of Defense (Materiel Readiness).

Employment of Veterans in the Federal Executive Branch. (2020). https://www.fedshirevets.gov/veterans-council/veteran-employment-data/employment-of-veterans-in-the-federal-executive-branch-fy2018.pdf

Gansler, J. & Lucyshyn, W. (2006). Evaluation of performance based logistics. 54.

Gelderman, Semeijn, & Vries. (2019). Contracting for road maintenance in the Netherlands—the downside of performance-based contracting. *Infrastructures*, *4*(3), 41. https://doi.org/10.3390/infrastructures4030041

Guajardo, J. A., Cohen, M. A., Kim, S.-H., & Netessine, S. (2011). Impact of performance-based contracting on product reliability: An empirical analysis. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1807049

Hyman, W., 2009. *Performance-based contracting for maintenance,* NCHRP Synthesis Report. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_389.pdf

Lines, B. C., & Smithwick, J. B. (2018). Best practices for organizational change management within electrical contractors. *International Journal of Construction Education and Research*, *15*(2), 136–159. https://doi.org/10.1080/15578771.2018.1479723

Ozbek, M. E., & de la Garza, J. M. (2011). Comprehensive evaluation of Virginia Department of Transportation's experience with its first performance-based road-maintenance contract. *Journal of Transportation Engineering*, *137*(12), 845–854. https://doi.org/10.1061/(asce)te.1943-5436.0000294

Sols, A., Nowick, D., & Verma, D. (2007). Defining the fundamental framework of an effective performance-based logistics (PBL) contract. *Engineering Management Journal*, *19*(2), 40–50. https://doi.org/10.1080/10429247.2007.11431730

Wesley R. S., Brady, S. P., & Nowicki, D. R. (2012). Business case analysis and the confounds of innovation driven by performance-based postproduction support strategies. *Transportation Journal*, *51*(1), 33. https://doi.org/10.5325/transportationj.51.1.0033

Wesley, R. S., Nowicki, D. R., & Hawkins, T. G. (2011). Explaining the effectiveness of performance-based logistics: a quantitative examination. *The International Journal of Logistics Management*, *22*(3), 324–348. https://doi.org/10.1108/09574091111181354

Acquisition Research Program
Naval Postgraduate School
555 Dyer Road, Ingersoll Hall
Monterey, CA 93943

www.acquisitionresearch.net