Business Case Analysis and the Confounds of Innovation Driven by Performance-Based Postproduction Support Strategies

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Abstract

The postproduction support cost of complex systems such as rail, power, and defense often exceed the cost of research, design and production. As such systems age and degrade the traditional maintenance, repair, and overhaul (MRO) approach does little to reduce their cost or improve performance. The failure of traditional MRO has given rise to a number of multi-year, performance-based, postproduction support strategies. These strategies drive investment to reduce cost, infuse innovation, and increase system performance. The dynamism and innovation associated with these strategies makes it difficult to conduct a business case analysis (BCA) that compares the return on sales model of traditional MRO to the return on investment model of performance based strategies. To address this gap in practice and theory we provide a framework for rationalizing performance-based and traditional strategies within the same BCA. We develop questions to guide the creation of BCAs that include performance-based options. Finally, we offer analytical guidance to support direct economic comparison between these two fundamentally different postproduction support strategies.

Keywords

Performance-based logistics; performance-based contracting; after market sales; business case analysis; performance-based outcomes

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Introduction

Maintaining complex systems such as aircraft fleets, rail systems, and production facilities can often exceed the cost of research, development, and production (Randall, Pohlen, and Hanna 2010). As systems age, they require more funds to deal with repairs, upgrades, or replacements (MaClean et al. 2005). Concurrently, operators of such systems are pressured to maintain performance on increasingly tight budgets. In meeting these challenges, the traditional, transactional postproduction support approaches are simply not keeping up.

Faced with these realities, a number of entrepreneurial operators and support providers have adopted a new group of postproduction support strategies. These strategies, commonly known as performance-based logistics (PBL), convert the year-after-year cost outlays of transactional maintenance, repair, and overhaul (MRO) into large pools of cost avoidance. These pools form a governance structure that encourages investment, innovation, and cost reduction (Carter 2009; Randall, Pohlen, and Hanna 2010). This governance structure recognizes that each system, and subsystem, has inherent cost avoidance potential. Improvements in technology, material, and processes will allow the providers to harvest this cost avoidance, given the correct contract governance structure.

Given a multiyear contract (or multiyear agreement) and the system cost avoidance potential, PBL encourages suppliers to make investments in technology, material, and process improvements that increase system reliability, maintain or improve system performance, and decrease life cycle cost (Berkson 2005; Kim, Cohen, and Netessine 2007; Sols, Nowicki, and Verma 2007; Fowler 2009). PBL uses objective performance (e.g., system up time), instead of purchased goods, to form the basis of the relationship between operators and support providers. Performance outcomes define the level of performance over some period of time. By doing so PBL moves beyond a transactional approach to embrace a multiperiod relationship.

The success of performance-type strategies does not merely represent an isolated case or niche. The US Department of Defense (DoD) and the United Kingdom Ministry of Defense have both saved billions of dollars using PBL (Fowler 2008; Cundy 2009; Fesquet 2009). In the commercial sector, Luftansa Technik possesses more than 1,600 aircraft from multiple airline operators under a PBL-type contract (Flint 2007; Sols, Nowicki, and Verma 2007). In addition, Boeing uses a performance-based approach, Boeing GoldCare, as the preferred approach for the new 787 (Boeing Company 2011). Siemens also has a broad range of integrated, outcome-based approaches for its rail sector (Siemens 2011). Similarly, the World Bank uses performance-based strategies for health services in developing countries (The World Bank 2008). And according to the Transportation Research Board, thirty-five countries are using performance-based approaches for highway management (Transportation Research Board 2009). Yearly the examples of PBL application increase.

As supply chain partners consider the adoption of a PBL strategy, a prevalent first step is the performance of a business case analysis (BCA) to determine if, when, and why it might be appropriate for a program to utilize a performance-based approach. Yet traditional BCA processes do not readily handle the dynamism of comparing the investment-innovation-return-on-investment aspects of PBL to the transactional approach of traditional postproduction support. This situation has created frustration and confusion. Practitioners struggle to define the key elements of a PBL BCA and understand why some elements (e.g., "known-unknown" factors such as anticipated introduction of improved technology) are not being considered (Sols, Nowicki, and Verma 2007; Government Accountability Office 2008).

The Government Accountability Office (2008) articulated this concern as part of a scathing assessment of the DoD's implementation of PBL contracts. Following this thread, the GAO (2008) and others (Sols, Nowicki, and Verma 2007) suggest there is a lack of a consistent understanding of how to approach the BCA process when one of the alternatives is PBL. Current methodologies and philosophies find that the underlying econometric and governance models at the core of PBL are incommensurable with transactional strategies of traditional sustainment. Attempting to understand how BCAs deal with PBL and traditional approaches combined leads to our research questions:

1. What are the key characteristics of a PBL that should be included in the BCA process and its supporting analytical models?
2. How is time-based innovation addressed within a traditional postproduction BCA?
3. How is system life-cycle affordability accounted for in the supporting cost models of BCAs that include a PBL alternative?

Answering these research questions will provide a frame of reference for academics and practitioners exploring PBL.

This article is organized as follows. First, we develop the background on both traditional and PBL sustainment strategies. Following we describe our sample, method, analysis, and results. Third, we provide a theory-based framework in the form of questions and guidance that practitioners should consider in future BCA decisions. Finally, we offer opportunities for future research in this area.

Literature Review

PBL and traditional postproduction support strategies each seek to efficiently fulfill demand (e.g., improve forecasting, balance inventory quantity and location against inventory pipeline and the use of express transportation). However, PBL takes this tradeoff a step further. PBL balances the cost of traditional functions, such as warehouse, inventory, and transportation, against the cost of improving reliability by redesigning out demand for spares and repairs. The PBL governance structure creates an incentive for suppliers to invest in innovations that decrease the costs associated with system failure (Randall, Pohlen, and Hanna 2010). Therefore, it is essential that when a BCA is to include PBL, there is a specific mechanism in place to quantify the economic impact of innovation.

Background: Performance-Based Logistics, Traditional Sustainment Strategies, and Business Relationship Management

A PBL strategy is instantiated through a contract or other relationship that specifies the outcomes and rewards between a supplier and a customer. In this way, a PBL strategy is consistent with principles that define sound supply chain business relationship management such as delivering solid value propositions (Lieb 2008) and high-quality logistical performance (Morash 2001). PBL supports Morash (2001, 50), who suggests that "value congruency recommends that once firms have developed minimum supply-side and demand-side capabilities to be order qualified, they should then concentrate on those capabilities and performance metrics that support their chosen value focus."

PBL strategies differentiate themselves in that they are holistically focused on value, while attempting to capture the synergistic benefit that comes with examining the intersection of system design and its post-production support network (Randall, Nowicki, and Hawkins 2011). This notion is confirmed in US DoD guidance governing the use of PBL:

> The Program Manager shall employ effective Performance-Based Life-Cycle Product Support planning, development, implementation, and management. Performance-Based Life-Cycle Product Support represents the latest evolution of Performance-Based Logistics. PBL offers the best strategic approach for delivering required life cycle readiness reliability, and ownership costs. (Department of Defense 2008, 29)

Under a PBL strategy, support providers agree to a level of performance over a specified period of time (e.g., power distribution system on line 99.999% of the time at a fixed cost per hour). At the same time, the customer agrees to provide stable funding and a share in cost avoidance. Ideally, PBL brings together a network of support providers who seek to fill demand efficiently while also searching for a way to cost-effectively design demand for MRO products and services out of the system. This philosophy is in line with DoD's Defense Acquisition University (2005, 1) definition of PBL:

> The purchase of support as an integrated, affordable performance package designed to optimize system readiness and meet performance goals for weapon systems through long-term support arrangements with clear lines of authority and responsibility. Simply put, performance-based strategies buy outcomes, not products or services.

PBL and its definitions were recently reviewed during a landmark evaluation that confirmed the efficacy of PBL (Carter 2009). That study outlined the ability of PBL to provide a financially efficient means for achieving postproduction support requirements. This is also consistent with Berkowitz et al. (2005) and their approach to a PBL contract structure and guidelines for PBL implementations.

Central to a PBL strategy is the idea that supplier networks for aircraft, roads, and high-speed rail are incredibly complex. Sources come and go, operating conditions change, and new materials, processes, and technologies appear every day. This dynamism provides opportunities for these systems to be evaluated, transformed, and innovated continuously (Sols, Nowicki, and Verma 2007). However, this focus on evolving the system makes predicting affordability and performance, the business case analysis, difficult.

The cost of postproduction support greatly impacts expense and profit (Keating and Huff 2005; Flint 2007; Kim, Cohen, and Netessine 2007). Typically, postproduction support costs are a function of system design. Once a system enters production, the die is cast on support costs (Sauser 2006). Other than serious reliability or safety concerns, the lion's share of effort in post-production support is on providing scheduled maintenance and inspections, and returning the system to operation when it fails (Flint 2007; Hamad, Andrew, and Mohamed 2007).

In the traditional model, the system operators end up integrating the various sustainment tasks required to maintain system performance.

This means operators accept significant risk since the lack of coordination within the supply chain, particularly at the third and fourth tiers, can lead to material shortages, diminishing sources of supply, and system downtime due to stock outages (Cooper and Ellram 1993; Fugate, Sahin, and Mentzer 2006). This structure also means that operators are saddled with the increasing costs associated with corrosion, fatigue, and obsolescence (MaClean et al. 2005). Experience shows that the traditional approach tends not to focus the upstream trading partners on outcomes that matter most to the operator—a system that meets operational requirements at the lowest possible cost (Geary and Vitasek 2008). Instead, trading partners attempt to maximize their own bottom line, which can have negative effects on system operators and end-users (Ellram and Cooper 1993; Wathne and Heide 2000).

Therefore, traditional sustainment can be viewed as a return on *sales* governance structure where suppliers are paid by the transaction. Under that structure, the more the end item breaks, the more the suppliers repair, and the greater suppliers' sales, the greater the suppliers' revenue and profit. On the contrary, PBL runs on a return-on-investment governance structure (Randall, Pohlen, and Hanna 2010). Smart investment by the supplier means better reliability and lower logistics costs, all of which translate to greater cost avoidance. Increased cost avoidance leads to improved return on the investment. Moreover, improved reliability means the end items break less often, which translates to more system up time for the end customer. Typically, PBL uses a firm fixed price (FFP), multiyear contract structure (Sols, Nowicki, and Verma 2007). However, a PBL can rely on a noncontract mechanism (e.g., government depots providing PBL support to government operators or industry support providers).

PBL checks increasing costs by using up-front investment to achieve savings in future years (Sols, Nowicki, and Verma 2007). This practice is a significant departure from traditional postproduction support where operators lack the capital funds needed to invest in long-term affordability improvements (Geary and Vitasek 2008). A properly structured PBL transforms the year-to-year spending on repairs into incentive pools that drive investment in improvements and ultimately reduce costs (Berkson 2005; Kim, Cohen, and Netessine 2007; Sols, Nowicki, and Verma 2007).

The savings associated with PBL-type strategies have been significant. Defense agencies have saved billions of dollars by utilizing a PBL approach (Kratz 2007; Fowler 2008). For example, the British military has saved $250M on the CH-47 helicopter program, the US Air Force $477M on the C-17 airlifter program, the US Navy $688M on the F/A-18 fighter program, and the US Army $350M on the AH-64 attack helicopter program

(Fowler 2009). Commercial MRO companies also use PBL, with 70 percent of the $40 billion per year spent on MRO using PBL-type contracts (Nativi and Barrie 2006; Flint 2007; Hamad, Andrew, and Mohamed 2007). Clearly, practitioners have found success in implementing PBL. However, getting through the PBL business case has been problematic.

Background: Business Case Analysis

Several books have been written in the past forty years that outline ways to conduct a BCA. These books delineate strategies and techniques for evaluating make-or-buy and lease-or-buy decisions, and provide general guidance for the conduct of a BCA in a governmental setting (Allen and Hawkins 1968; Schmidt 1999; Brannock 2004; Klein 2008). The Department of the Air Force published an Instruction (US Air Force 2008) and a Manual (US Air Force 2008) designed to guide the conduct of a BCA for Air Force programs. This guidance suggests that "a BCA is considerably broader in scope" (US Air Force 2008, 3) than a simple cost comparison between two alternatives, and requires a focus on an economic analysis that considers desired outcome.[1]

Conducting a BCA is not a straightforward process, especially when considering the intricacy of a PBL (Harada 2010). While the BCA (or as DoD refers to it, an "Economic Analysis") is designed as a decision support process aimed at choosing "the best method of allocating sparse resources to achieve a given objective" (Maroni 1995, 9), the current process has a limited ability to meet this charter. Policy directs the analyst to collect the cost and benefit data for various alternatives using a *historical* perspective, and then use that information to determine the net savings or profits in support of alternative selections (Maroni 1995; Klein 2008). While recent guidance suggests considerations of longer time horizons (US Air Force 2008), no specific guidelines exist with respect to investment and innovation, neither does the guidance address the dynamism of innovation over time (Miller 2008).

There is no standard formula for business case analyses when one option is PBL. The processes appear to be ad hoc, drawing from a variety of cost, analysis, and systems engineering approaches (Smith 2001; Franck 2004; Stacey 2006; Shick 2007; Klein 2008). The guidance covers a wide swath of topics such as reliability rates, elements of risk, and tradeoffs between fixed costs and variable costs, supply chain partnerships, and outsourcing risk (Freeman and Cavinato 1990; Su et al. 2009) but there is no integrated formula or framework.

Many of the current post-production support BCA approaches focus on overall analysis of the obvious or tangible costs associated with one alternative or the other (Leander 2002). These modeling approaches do not address wholesale outsourcing of the postproduction support infrastructure or the associated impact of long-term, contractually motivated innovation across the life of the program (Knemeyer and Paul 2005; Sols, Nowicki, and Verma 2007). While some guidance considers the impact of time and risk, this analysis typically focuses on the probability of negative outcomes rather than the probability of positive ones (Smith 2001; US Air Force 2008). When a BCA considers a PBL alternative, there is little practical and quantifiable guidance aimed at a holistic analysis. In short, there exists no framework that incorporates the key strengths of a PBL alternative.

Logistics research recognizes the need for a holistic approach for contracting out part of the supply chain (Christopher, Peck, and Towill 2006; Sols, Nowicki, and Verma 2007). Yet, despite the success of PBL, there is a surprising gap in academic and practical literature guidance and frameworks supportive of informative BCA when one alternative is a PBL strategy. The current postproduction BCA frameworks do not conceptualize or model strategies that drive investment and innovation across the life cycle. There is a gap in literature and practice when performing a BCA where one of the alternative's key strengths involves an ability to drive cost-reducing innovations over the life of the program. Such an oversight is significant as cost-reducing innovations and their impacts on revenue, costs, and performance are central to a successful PBL program.

Method

This research uses a grounded theory (GT) approach and leverages the previous theoretical framework of Randall, Pohlen, and Hanna (2010). In that research, issues with BCA were frequently noted. Also during that time, a number of controversial (multibillion-dollar) PBL-related BCAs were ongoing (Air Force Audit Agency 2009; Cook et al. 2011). These generated considerable conversation among practitioners (Government Accountability Office 2008). Business case analysis difficulty was identified, highlighted, and coded during the Randall, Pohlen, and Hanna (2010) PBL study. That documentation provided both initial insight and sources of empirical data to support the investigation.

We then sought additional archival data, interviews, and practitioner engagement to advance this study. The methodology followed in this study was parallel to the one followed by Randall, Pohlen, and Hanna (2010). In total, the PBL and PBL BCA research generated seventy different recorded interviews. Each interview lasted between forty-five and seventy minutes. In addition, BCAs were discussed as part of a panel at three national conferences and one international conference each with over 200 practitioners (Randall 2008, 2009, 2010; Johnston, Randall, and Nowicki 2010). One of these panels was specifically devoted to the difficulties associated with conducting a BCA where one alternative was a PBL (Johnston, Randall, and Nowicki 2010). The sample included a broad range of individuals involved in both PBL and, to a lesser extent, non-PBL programs. Specifically, we ensured representation from participants at various levels of expertise (executive, engineer, logistician manager, and technician), supply chain position (supplier and customer), and program stage (PBL, non-PBL, and converting). This approach to sampling ensured that we adopted a multidimensional approach for each construct (Charmaz 2006). In addition, the sample included contractor and government employees, and covered a variety of DoD air and land programs. During the investigation, the initial interviews we undertook focused on the following questions:

1. What does the term *PBL* mean?
2. What does a PBL strategy require?
3. What factors encourage or discourage success in a PBL strategy?
4. What is a business case where PBL might not be effective?
5. What are the positive and negative consequences of a PBL strategy?

As BCA became recognized as an area of interest, we focused follow-up interviews, practitioner engagement sessions, and reengagement within the original transcripts on the following BCA-specific questions:

1. What is different about a BCA when a PBL alternative is involved?
2. How are innovations in a BCA accounted for?
3. How is a multiple year original equipment manufacturer (OEM) and supplier investment accounted for in a BCA?

The investigation employed multiple iterations of the process shown in figure 1. Step 1 involved identifying the research question, the initial sample, and the interview protocol.

Constant Comparison

During steps 1 and 2, we reviewed policy statements, meeting memos, and government accountability office reports dealing with the BCA process. At step 2 we began initial coding and the process of constant comparison. Constant comparison emphasizes the "discovery of what concepts and

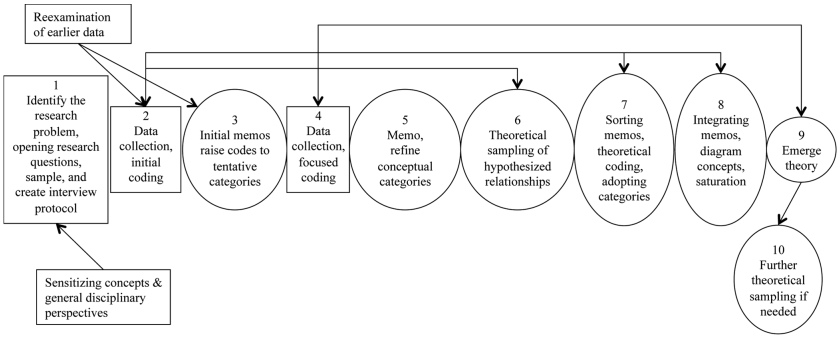

Figure 1 The Grounded Theory Process
Source: Adapted from Charmaz 2006 and Randall, Pohlen, and Hanna 2010

hypotheses are relevant for the area that one wishes to research" (Glaser and Strauss 1967, 2). Constant comparison involves finding themes in interviews and the archival data and then testing to see if those themes remain consistent in follow-on interviews as shown in steps 3, 4, and 5 (Glaser and Strauss 1967; Charmaz 2006).

Theoretical Sampling

Positing and testing relationships using a new sample is known as theoretical sampling (step 6) (Glaser and Strauss 1967; Glaser 1978). In GT, memos are used to document the process of theoretical sampling and constant comparison. Memos track how a particular concept, category, or relationship emerges. This process of positing relationships, testing them, capturing their evolution in memos, and then sorting the various pieces into an initial theoretical structure is shown in step 7.

Validation through Constant Comparison and Saturation

The key to a GT is validation (Glaser and Strauss 1967; Charmaz 2006; Cho and Trent 2006). The mechanism of theory validation in GT is theoretical sampling and *saturation*. Saturation, step 8, means that the researcher gathers data until no new insights are obtained (Strauss and Corbin 1998; Cho and Trent 2006; Bowen 2008). In this research, saturation, and thus validity, occurred when additional interviews demonstrated consistency in the findings. The final GT step is theory emergence, which occurred during step 9. This research documents the emerged theory structure in a framework and group of questions from which practitioners can approach a PBL and non-PBL BCA.

Assessing Grounded Theory—Fit

Flint, Woodruff, and Gardial (2002) suggested researchers ensure any proposed GT framework *fits* the practitioners' interpretation of the phenomena. Because GT uses direct insight and interpretation of the practitioners, it should be recognizable to those practitioners. To gain fit, two of the researchers volunteered to act as part of an industry panel focused on BCAs (Johnston, Randall, and Nowicki 2010). Over 200 industry participants attended this panel. During this session the framework and key questions were presented and discussed. The researchers also wove these findings into two other PBL industry panels. These practitioner groups concurred with the findings and interpretation.

Assessing Grounded Theory—Workability

Another key to GT research involves *workability*. Glaser (1978) terms workability "getting the facts" straight. Workable theory should be recognizable by the practitioners; they should identify their own experiences in the research findings. The practitioners indicated that the emerged framework, the questions, and the return-on-sales versus return-on-investment conceptualization provided sound insight into the source of difficulty and tension associated with a PBL BCA, thus further validating our findings and conclusions.

Analysis and Results

The investigation relied on active and direct engagement with practitioners (Reason and Bradbury 2001, 2006; Stringer 2007) while following the process-oriented engine of GT's constant comparison (Glaser and Strauss 1967). This resulted in an analysis that formed a dialogue with our participants. This dialogue allowed us to understand the key sources of tension associated with a PBL-traditional BCA.

The Basis: Knowledge and Decision

The core element in PBL resides in knowledge and innovation. Randall, Pohlen, and Hanna (2010, 53) found knowledge and decision to be at the center of the PBL theory: "Performance-based outcomes will lead managers to co-create and exchange knowledge across a supply chain to achieve continuous value creation for the end user and the entire network." The interviews suggest that PBL is inherently knowledge-centric, continuous, and evolutionary. The knowledge centrality of PBL, coupled with a continuous and dynamic nature, is what first sets PBL apart from the non-PBL strategies.

The Value of Underlying Governance Structures

We found the key difference between a PBL approach and a traditional approach resides in the underlying governance structure and ensuing economic models. This pursuit of dynamic application of knowledge appears to be what confounds the PBL and non-PBL BCA process. Non-PBL BCA processes look at historical costs and extrapolate those costs into the future. A relatively simple algorithm is used that discounts a series of transactional and return-to-specification exchanges into a single, net present value number. In some cases, a more advanced computation may exist where echelons within the supply chain are consolidated or economies of scale are calculated. Either way, the numerical analysis of the traditional BCA process does not consider the difficult challenge of predicting technology infusion against corporate investment.

PBL focuses on a return-on-investment governance structure where decisions are made to convert knowledge into cost avoidance. The focus in that model is on knowledge application and the decisions that lead to innovation. This knowledge-decision-investment-innovation process is what sets PBL apart from the return-on-sales, return-to-specification approach of traditional sustainment. We found the core elements key to properly predicting PBL's impact on future life-cycle affordability deal with (1) supplier

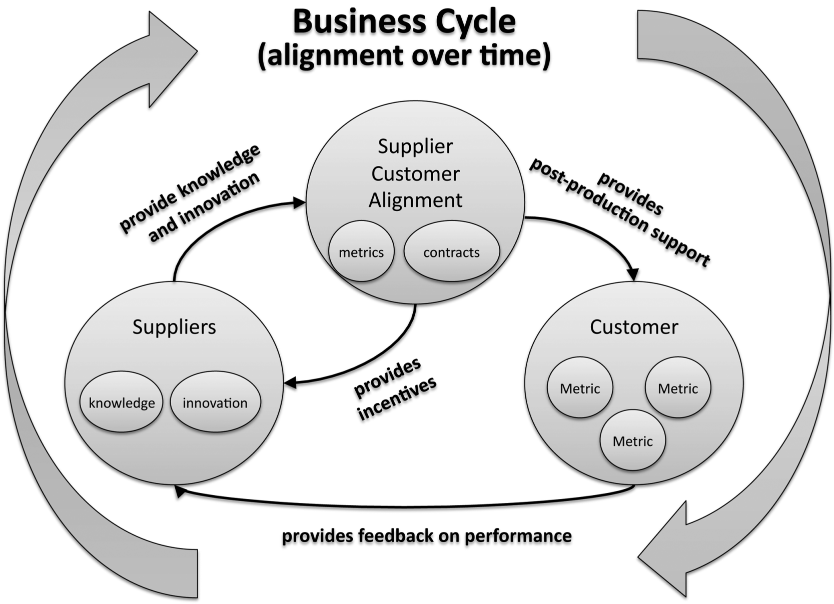

Figure 2 PBL BCA Model

network knowledge, (2) a business cycle aligned by achievement of performance metrics and incentives, (3) an alignment focused on performance, not parts, and (4) cost incentives to invest in long-term system improvements. Figure 2 outlines these constructs and their relationships. Each element is described below.

Supplier Network Knowledge and Dynamic Nature

Knowledge and knowledge management came up hundreds of times during the interviews. The more advanced the PBL strategy, the more intricately imbued was the discussion of knowledge management and knowledge-management systems in the quest for superior financial performance. Knowledge management was what linked together decisions, the supply chain network, and a performance output. According to a senior manager of a system designed to use PBL postproduction support,

> We have to have knowledge of everything that impacts the system performance outcome, so that when we look at it, it is not just a number . . . we say “here is the metric” . . . what are the restrictors to achieving that metric? What are the things that we can control? What are the things that we cannot control? What are the worst-case resources? Are there certain resources that we need, that are going to, because of non-availability or lack of ready availability that could impact that performance outcome? What is the availability of that resource? Is it lead-time? If I am not going to get there, what is the next option? What are the restrictions the customer must figure a way around?

This interview segment suggests that PBL requires the following:

1. Knowledge of the system
2. Knowledge of how the system is performing
3. Understanding of how the customer perceives that performance (outcome)
4. Knowledge of increased value potential in the network
5. Ability to leverage network value potential
6. Awareness of the role of knowledge management and an ability to respond with that knowledge
7. Pursuing decisions that affect the system

The ability to leverage knowledge from the network partners in a timely and efficient manner creates value. This value creation requires knowledge not only of the customer's perception of performance requirements, but also knowledge management that is fundamentally relational with the supply chain network. According to a senior supplier manager, "So it is not like we are dictating down to the vendors, it is like they're helping us. Because they have all this wealth of knowledge."

Knowledge of the system and an ability to convert that knowledge to an outcome generates value. The suppliers co-create with the operator a value proposition by harnessing knowledge today in a more efficient and effective manner than yesterday.

Business Cycle Aligned by Achievement of Performance Metrics and Incentives

PBL involves long-term contracts, knowledge management, supplier investment, and supplier incentives that drive that investment. These elements focus on long-term performance. The performance-oriented incentives create a sustainment "business cycle." According to one industry PBL strategist,

> [In PBL] your business decision cycle, your performance incentives, and your performance outcomes have to be aligned. If you can align those three things, your chances of success are multiplied immensely. Your decision cycles, and what you reinforce, and what you are trying to achieve, are all aligned with an output type of metric as opposed to sub-metrics of a transactional nature (spare levels or repair times). When you tie that all together, you can optimize toward the end result that you really want.

The engine of the business cycle involves aligning performance incentives with performance outcomes. We found that the incentive focuses the integrator and the supplier base toward long-term, continuous value creation. Value is created by lowering repair costs, improving the repair process, or improving the reliability of the part in a continuous fashion. As a senior manager working on a PBL program for a major OEM put it:

> *Interviewer*: So maybe the (system) three years from now will be better?
> *Participant*: Right, but the incentive for them to do that, because

> they have always had that capability, is how do you get them to want to infuse that technology, or capability? In the past, they have been paid on breakage. If it breaks, I will pay you for it. The new paradigm is now: you are going to get paid a dollar per usage. So, as long as that thing keeps working, you are getting paid.

Alignment Focused on Performance (Metrics)

The practitioners insisted that PBL metrics improve the probability of achieving performance and affordability goals by aligning effort across the supply chain. PBL creates a process wherein decision cycles are reinforced by incentives that are tied to network level goals. One supplier manager working for a major OEM vocalized it this way: "We are selling a service ultimately (as defined by a metric). Not parts. You know we are in it to make a profit, but also bring a reduced cost for sustainment to the government."

Incentivizing Long-Term System Improvements (Repair, Process, and Reliability)

To gain return on investment, system-level improvements must reduce costs. PBL provides a governance structure that spurs investment and innovation, both of which create cost-avoidance pools. A manager responsible for heavy maintenance (major overhaul) stated:

> If you are trying to reduce, or control costs, and the predominant cost is in repair, you can reduce costs in one of two or three ways. Either [you] find a lower cost repair source in terms of labor rates, you find a way to improve the reliability of that part, or you improve the repair process.

We found that effective long-term PBL arrangements involve translating knowledge into innovation. Short-run innovation aims at improving existing processes (e.g., warehousing, inventory, transportation, and repair), while long-term cost reduction is pursued through reliability improvement. PBL's focus on knowledge sharing and application creates an evolving inter-firm knowledge management process that leads to new value creation. PBL governance structures reward awareness and dissemination of knowledge that reduce postproduction support costs. Value is created when the decision maker acts on knowledge in a way that leads to long-term cost avoidance and generates a positive return on investment. In this structure, the central production operation is decision making. Decisions are what convert knowledge into innovation, innovation into cost avoidance, and cost avoidance into return on investment.

PBL is about applying knowledge and innovation, while improving performance and affordability. PBL supplants a cost for repair with a capability to provide a price for value. That price-value dynamic capability is the core competency of the PBL supplier network. This is not a new capability. This industry has "always had the capability," but application was rarely rewarded.

PBL is a contract, a relationship, a group of performance metrics, and a governance structure that activates the supplier network's ability to turn knowledge into value. Furthermore, PBL encourages the supply chain to invest, drive out cost, and share in that cost avoidance. Innovations are created through the application of new materials, processes, and technologies.

These areas suggest four key variables that a PBL BCA should address, including the following:

1. Incentive sharing structure
2. Contract length
3. Probability that the supplier network will invest in material, process, and technology
4. The efficiency with which the investments convert knowledge into cost avoidance

Findings

The foundation for PBL success is a multiple year, firm fixed-price contract (or agreements) written with performance- and outcome-focused incentives.[2] Successful PBL providers are able to build on this foundation through the application of what we see as *informed experience*. The PBL providers, particularly those involved in development and production, possess an inherent skill set that enables them to meet the requirements of the performance contract, while reducing cost by high return on investment application of knowledge, skills, and ability.

Several concepts coalesced as a result of the interviews, archival research, literature review, and active research engagement. As discussed in the literature, a PBL can take a number of contract types, including firm fixed-price, fixed-price award fee, fixed-price incentive fee, and cost-plus-incentive fee (Sols, Nowicki, and Verma 2007). Additionally, PBL can adopt a noncontract agreement structure. In our interviews, we found that firms feel the pure, multiple year firm fixed-price contract, or multiple year agreement, is a necessary precondition for a successful PBL. In several instances, we interviewed organizations involved in PBL contracts that were either multiple year or firm fixed-price contracts or, in some cases, neither. In these cases, the providers made it clear that the short-term nature of the contracts and the constraints those contracts place on return on investment hinder their ability to make a proper investment case. The customers were just as clear that the cost-plus contracts result in uncertainty on their end and hinder their ability to plan. The non-multiple year performance strategies can work, but the suppliers' focus on cost avoidance through investment and innovation appears reduced.

While these contractual elements of PBLs appear necessary, they are not sufficient to guarantee PBL success. An expected component of a PBL is the existence of metrics and incentives focused on performance objectives. This performance orientation is in contrast to that of traditional strategy that focuses on delivery of a product (parts) or discrete service (repairs). In fact, it is perhaps the one aspect of a PBL, by definition, that must be included in a PBL contract or agreement—otherwise the effort is not performance-based. Incentives are tied to the metrics. These metrics, and the corresponding incentives, provide the mechanism that enables suppliers to judge how well their investments function to drive down costs while meeting the customer's performance goals. This dynamism of metrics and cost avoidance provides a governance structure that makes opportunism over the long-term contract difficult. In our discussions, it became clear that properly written incentives, along with the aforementioned long-term, preferably firm fixed-price contracts, encourage the supplier to look beyond simple efficiency gains. In these instances, suppliers are able to focus not only on *what* they are providing, but begin to also address the *why*. Using this structure, the supplier can seek better ways of delivering performance. Knowledge is, therefore, central to PBL, and the types of knowledge leading to success in PBL are the following:

1. System knowledge (technical knowledge concerning the system being sustained)
2. Supply chain knowledge (partners, relationships, customers and interactions)
3. Knowledge of the sources of new knowledge, innovation, materials, and processes

These aspects of knowledge are critical enablers for firms seeking to satisfy existing requirements, while simultaneously planning for and predicting future requirements and opportunities. Time and again, the PBL providers, with the mix of knowledge listed above, are able to anticipate requirements and act in advance of changes either to decrease costs or forestall increases, all while continuing to hit performance targets. An example of this foundational knowledge sharing occurs during what the US Army calls "Alpha Contracting." Instead of the arm's-length negotiation of typical postproduction support relationships, Alpha Contracting is a PBL strategy where customers and suppliers sit down, describe the desired relationship, and address desired outcomes. Alpha Contracting represents an integrated team approach to involving principals and getting buy-in before misunderstandings can emerge (Kirzow and Sweeney 2009). Practitioners stated that Alpha Contracting establishes an improved foundation and is associated with superior performing relationships.

In addition, combining the knowledge set with a multiple year and fixed-price agreement enables the customers and providers to build an experience base. There is tacit knowledge, structure, value, and learning created by the long-term and intimate contact made essential by the tying of incentives to performance. In observing the PBL teams, it was clear that customers and providers focused on overcoming the adversarial relationship that sometimes surrounds the cost-based focus of traditional sustainment. They instead possessed a long-term outcome focus driven by a joint desire for success. It is this blending of experience, informed by the knowledge brought into the arrangement, that we designate *informed experience*.

When those conditions exist, the stage is set for innovation to emerge. The ecosystem (long-term, fixed-price contracts with informed experience driving the process toward outcome-focused performance and incentives) provides an environment where the provider is able to create a PBL foundation. PBL trades a near-term, efficiency-driven transactional mindset for a more entrepreneurial mindset that seeks investments that, while perhaps increasing near-term costs, result in significant and sustained long-term affordability improvements. By taking the long-term view, the providers shift their focus. The service provider develops the innovations necessary not just to meet demand, but also to improve the process by removing demand and thereby effectively changing the game.

From this discussion, we show that our research has led us to an understanding of the relationships and necessary conditions for successful PBL arrangements and subsequently successful PBL-traditional BCA. This relationship is reflected in figure 3 and builds on the essential elements of a performance-based contract (long-term and performance-oriented) and is what supports PBL as a transformational postproduction support strategy that delivers long-run value.

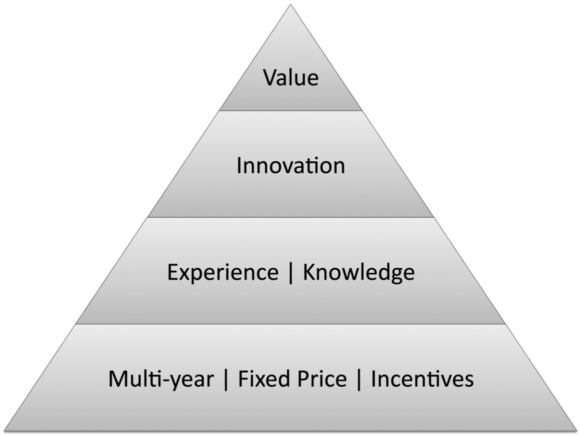

Figure 3 Considerations for a Performance-Based Logistics Business Case Analysis

Conclusions

The current approach to performing BCAs lacks the following: a consistent and applicable method to model innovation; a true, multiple year implication analysis process; and a sound econometric model for creating incentive, investment, cost avoidance, and risk tradeoff studies. One senior program manager in particular who works for the DoD seemed to sum up the issue with PBL versus non-PBL BCAs:

> I was just reviewing a BCA being done by an independent company. The BCA was to convert an entire system from a non-PBL post production support strategy to a PBL strategy. The BCA has been through a number of reviews. These folks had done a lot of work. But as I looked at it, it struck me that they really had not clearly defined the alternatives, they had not presented an economic analysis. They had "four alternatives" but really nothing was defined. So I did not think it was appropriate for this to go further up the chain. We got the contractor on the phone. They said the issue was that they could not figure out how to conduct the economic analysis. But, you know, their gut instinct was the PBL was a better approach.

This situation was no isolated incident; we have seen other circumstances where involved parties simply conducted a historical-based cost analysis and came up with the number. What happens when decision makers are faced with situations like this?

Certainly the PBL BCA is difficult. Under the current BCA process, a firm is to be applauded for providing a BCA with explanations and no numbers, as opposed to providing a number that simply ignores half the equation, that is, the innovation benefits that come to a PBL over time. Strategies like PBL are on the rise in both the public and private sector. Our research has shown that converting from a traditional postproduction approach to a PBL approach requires a totally new BCA strategy. Merely using existing BCA policy and templates will result in erroneous and costly recommendations. Failing to integrate the innovation and investment aspects of the underlying PBL econometric model when comparing a PBL with a non-PBL strategy will likely result in public funds being squandered or shareholder value not being maximized.

During the last decade, an increasing number of end-users, original equipment manufacturers, and other postproduction support providers have begun to employ a performance-based, multiple year approach that shifts the focus from return on sales to return on investment. The common elements of these PBL relationships are collaboration, long-term contracts, supplier network investments, service performance measures, and incentives that produce sustainment cost reductions for the end-user (Kim, Cohen, and Netessine 2007; Sols, Nowicki, and Verma 2007; Geary and Vitasek 2008; Randall, Pohlen, and Hanna 2010). While successful, the fundamental econometric model at the core of these PBL strategies has confounded the BCA process.

This investigation makes it clear that performance-based, outcome-focused arrangements are fundamentally different in the way they deliver postproduction support services. Unlike transactional, cost-plus arrangements, PBL contracts often seek a blend of near-term and long-term cost reductions while simultaneously maintaining or improving performance. Achieving cost reductions in near- and long-term time horizons requires a mindset focused on driving out waste in the existing processes, while also focusing on innovation and product improvements that drive down life-cycle costs.

PBL differs from traditional sustainment in that PBL takes a multidimensional approach to demand fulfillment. The first dimension is to efficiently meet demand within the current supply chain structure. The second dimension is to design out demand. That reduction is achieved through improvements in material, process, and technology.

Traditional BCA generally fails to capture time, innovation, and the impact innovation can have on both lowering costs and improving performance. When making a choice between PBL service providers, one is faced not only with a decision regarding who can do the job as it is today, but also which organization is able to provide innovations that will either improve performance and/or drive costs down *in the future*.

We believe there is a strong case for developing a BCA structure that not only evaluates the performance among competing traditional sustainment support options, but also evaluates the unique aspects that define a PBL. Then, a reasonable and informed comparison can be made between the two. Such decisionmaking is central in this new approach to BCA.

As we conducted our research, we found a wide range of success in PBL arrangements. Much of the variance was due to the level of investment and innovation infused in the process. When conducting a BCA, either for supplier selection or in evaluating the effectiveness of an existing contract, the analysis needs to consider the probability of innovation. We suggest creating a series of questions for the BCA built around an assessment of each of the building blocks leading to innovation. Questions critical to this approach are the following:

1. Are the incentives designed to reward achievement of the outcome?
2. Does the provider have adequate knowledge across the identified domains to harvest potential cost avoidance?
3. Does the provider have informed experience?
4. What are the possibilities for innovation in the system being sustained?
5. What timelines are appropriate for making a comparison for cost savings?

Each of these questions is designed to incorporate the building blocks for a successful PBL BCA and set up follow-on questions that provide a multiple year apple-to-apple evaluation of the bottom line. A year-to-year contract may experience immediate short-term gains, while a PBL contract may experience a near-term increase in costs as suppliers invest in innovation and longer-term life-cycle affordability improvements.

In this article, we have discussed the shortcomings of conducting traditional BCA studies in assessing the performance of PBL arrangements. In the process, we outlined the areas that distinguish PBL arrangements from traditional postproduction support contracts and thus hinder direct comparisons in a BCA. Finally, we suggested a series of questions that should guide the discussion and development of BCAs. PBL BCA must consider multiple year cost and cost avoidance streams in order to create a more direct comparison between two different approaches to life-cycle postproduction support. The singular difference in PBL versus the traditional approach to postproduction support is that PBL seeks not only to fill demand efficiently in the short term, but also to make investments that design out demand in the long term. In this PBL is inherently resource conservative. Future research efforts should be directed at developing specific models for measuring innovation and quantifying the impact of innovations on postproduction support.

Notes

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1. Very recently, the Department of Defense (DoD) released a DoD Product Support BCA Guidebook (Department of Defense, 2011). In that document, DoD discusses the inclusion of process efficiencies, but does not directly provide a framework for addressing innovation, or reliability driven, cost avoidance governance structures inherent in a PBL strategy.
2. Non-fixed-price contracts are sometimes used successfully in PBL when the system is immature and future cost has high potential variance. During this period the risk premium associated with a multiyear contract is simply unaffordable for a given firm. In this situation, the government is in a superior position to cost-effectively bear that risk burden.

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