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Business Case Analysis and Contractor vs. Organizational Support: A First-Principles View

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**Business Case Analysis and
Contractor vs. Organic Support:
A First–Principles View**

23 September 2004

by

**Raymond (Chip) Franck, Senior Lecturer,
Graduate School of Business & Public Policy**

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Abstract

The Business Case Analysis (BCA) is regarded as a highly-useful management tool. BCAs are mandatory, among other things, for formulating Product Support Strategies (PSSs) in the development of major systems. While defense managers appear to have sufficient guidance regarding BCA documentation, a comparable level of guidance regarding analytical methods is not evident. In fact, there is extant OSD guidance which leaves analytical methods as a task for the services. Accordingly, this essay addresses theoretical foundations useful for BCAs, and practical foundations for analysis in the defense arena—with special attention to the choice of contractor vs. organic support in the formulation of Product Support Strategies (PSSs). The report concludes with a proposed partnership involving the Navy with the defense academic and analytical communities. It also offers words of advice based on current state-of-the-art for Program Managers doing BCAs assessing contractor vs. organic support.

Keywords: Business Case Analysis (BCA), Product Support Strategies (PSS), Program Management, Contracts, Outsourcing, Cost-Benefit Analysis (CBA), Transactions Cost Economics (TCE).

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About the Author

Raymond E. Franck (Chip), Senior Lecturer, Graduate School of Business & Public Policy, Naval Postgraduate School, retired from the Air Force in 2000 in the grade of Brigadier General after thirty-three years commissioned service.

BGen Franck was born in Sac City, Iowa, on August 28, 1945. He graduated from Denison Community High School, Denison, Iowa, in 1963. Upon graduation, BGen Franck entered the United States Air Force Academy, earning his Bachelor's degree in 1967. The recipient of a National Science Foundation Fellowship, he entered Harvard University, receiving a Master's degree in Economics in 1969. He completed his Doctorate in Economics in 1983. BGen Franck is a graduate of Squadron Officer School, Air Command and Staff College, the National Security Management course, and Air War College.

Following his tour at Harvard University, BGen Franck entered Undergraduate Pilot Training at Columbus AFB, Mississippi in July of 1969. His first operational flying assignment was as a B-57 Canberra pilot and instructor pilot. These duties took him to Holloman AFB, New Mexico; MacDill AFB, Florida; Ubon RTAFB, Thailand; Kadena Air Base, Japan; and Malmstrom AFB, Montana.

In 1975, BGen Franck was assigned as the Officer-in-Charge, Air Force Element of the Joint Operational Control Center at Keflavik Naval Station, Iceland. In 1976, he returned to the United States as Instructor and Assistant Professor of Economics in the Department of Economics, Geography, and Management at the Air Force Academy.

In 1980, BGen Franck was assigned to the Pentagon. He served as Staff Analyst for Bomber Programs, Office of the Assistant Secretary of Defense for Program Analysis and Evaluation. In 1985, he returned to operational flying. After B-52 training, he was a flight commander and on the operations staff of the 2nd Bomb Wing, Barksdale AFB, Louisiana. BGen Franck reported to Headquarters, Strategic Air Command, Offutt AFB, Nebraska, in 1985. He served as Deputy Chief, Program

Evaluation Division, and was later assigned as Special Assistant to SAC's Commander-in-Chief.

He assumed duties as Permanent Professor and Head, Department of Economics and Geography, United States Air Force Academy, in 1989. From 1994 to 1996, he served at the Joint Military Intelligence College as Visiting Professor and Associate Dean, School of Intelligence Studies in Washington, D.C. and returned to the Academy in the summer of 1996.

His responsibilities at NPS have included the interim chairmanship of the newly-formed Systems Engineering Department from July 2002 to September 2004.

BGen Franck is a Command Pilot with 2300 flying hours. His military decorations include the Defense Superior Service Medal, the Legion of Merit, Defense Meritorious Service Medal, Meritorious Service Medal, Air Force Commendation Medal, Vietnam Service Medal, and Armed Forces Expeditionary Medal. He is a member of the Air Force Association, the American Economic Association, the Western Economic Association, and the Order of Daedalians.

BGen Franck is married to the former Meredith Ann Ballard of Broken Bow, Nebraska. They have two children, Gretchen Marie and Matthew Edward.

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Chapter 1. Introduction and Overview

Business cases and Business Case Analyses (BCAs) have become a fact of life for DoD Program Managers. Used well, they can do much to make sense of the very difficult environment of contemporary defense management. Defense decision-making must take into account a threat environment that has become increasingly difficult. We've traded the insecurities of the Cold War, along with the analytical comforts of dealing with one main enemy for a more favorable military balance, along with a multiplicity of national security concerns. Included are terrorism, drug trafficking, and the rise of new powers (China, India, Brazil, …).

Related to the changed environment are DoD initiatives toward "transformation" of military forces for more effectiveness in the new national security environment. Accordingly, to take one example, the Navy finds itself considering a large number of new classes of warships as candidates for development. At the same time, funding is scarce and so is end-strength—while operating and personnel tempos are very high.

In an era of new complexities, new mandates, and worrisome resource constraints, it's especially important that defense managers of all types, but Program Managers especially, make resource-allocation decisions informed by solid analysis. BCAs are intended to provide that basis.

There's much useful guidance regarding the major steps to doing a BCA, and, with it, useful templates for producing one. However, there is much less that's visible regarding the methodological foundations that make BCAs analyses and not just reports and briefings. In fact, one authoritative DoD source (Wynne) explicitly leaves development of analytical methods to the services. Accordingly, this study reports on analytical foundations of useful and effective Business Case Analyses. There is, however, a focus (sometimes implicit) on analytical methods useful for making organic vs. contractor support decisions, as part of choosing the best Product Support Strategy (PSS) for a new system.

Chapter 2 discusses the theoretical foundations of methods useful for BCAs. It starts (Section 2A) with a general discussion of problem-solving methods, and states a theme that runs throughout this discussion. Next, 2B is Input-Output Analysis, a method of tracing the interdependencies of complex economies, with obvious applications (potentially) to complex organizations such as the US Navy. The central idea is that outsourcing decisions reduce military manpower requirements directly in the activity that was outsourced, but also indirectly in the support structure for those personnel. Following, 2C is Transactions Cost Economics (TCE), a relatively recent branch of economic theory. It starts with the notion that markets are not frictionless media, and that activities in any market have associated costs (called "transactions costs"). Therefore, while outsourcing promises savings in production costs, it involves greater participation in market activities—and increases transactions costs. Moreover, TCE strongly indicates that the size of the transactions costs is highly sensitive to the nature of the outsourcing action. Finally, 2D is Cost Benefit Analysis (CBA). BCAs are intended to find best-value solutions, and cost benefit analysis is a highly-developed analytical method to find best value (defined as "benefits minus costs").

Chapter 3 considers some practical foundations for putting such analysis into Business Case Analysis. Section 3A considers BCAs, as currently viewed by DoD, and discusses their nature, intent, and capabilities. Next, 3B lists defense-related methods which are conceptually akin to the input-output perspective—DRM for costs (3.B.1.) and Navy manpower calculations with supporting data bases (3.B.2.). Both are described and assessed. The tentative conclusion is that neither is well designed to support determination of the indirect manpower effects of outsourcing actions. Also, in all likelihood, they cannot be made to do so in a timely manner (even as a special project). (Testing that proposition would be an interesting topic for further research, but is outside this project's scope.) Finally, Section 3C considers outsourcing methods. The A-76 process is discussed in Section 3.C.1. Also, a risk-assessment method for outsourcing actions arising from a recent NPS thesis (Powell) is summarized (3.C.2.).

This report concludes with Chapter 4. This section sketches out a proposed research program to carry out the Navy's mandate to develop analytical foundations for BCAs. It also offers some interim thoughts on how to frame the choice between organic and contractor support for new systems.

Chapter 2. Theoretical Foundations

2A. Structuring and Solving Problems

A METHOD FOR STRUCTURING AND SOLVING PROBLEMS

Finding the best (or least bad) solution to a problem with significant stakes attached warrants careful and systematic attention to fully understanding the problem itself; identifying and developing alternatives for its solution, determining with reasonable completeness the consequences associated with each alternative, assessing those consequences, and, finally, using that analysis to make a decision or recommendation.[1]

1. Understand the problem. Recognizing there is a difficult problem and having considerable relevant expertise does not guarantee sufficient understanding to reach the best solution. It's important first to thoroughly understand the context. To take a very simple example, suppose our "problem" is to insert a fastener in a block of wood. If at first inspection the fastener appears to be a nail, it is natural to consider alternatives that involve hammers. If a closer look reveals the fastener is a screw, then it's apparent the hammers in our toolbox are less useful than the appropriate screwdriver.[2] That is, lack of understanding can greatly affect the solution.

A related issue of perhaps greater importance is the understanding of objectives. What do we want to accomplish? Are we willing to cut back in achieving one objective for the sake of better meeting another? Perception of objectives can and does affect the nature of solutions. Suppose, for example, customers must frequently wait to be served at our facility. This is causing considerable dissatisfaction among those in our

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[1] This discussion borrows heavily from Stokey and Zeckhauser. However, that approach is not the only effective method for structuring and solving problems. For example, Hitch and Ragsdale also offer useful problem-solving frameworks.

[2] An extensive repertoire of problem-solving methods is also valuable. "If all you've got is a hammer, everything looks like a nail," is an old saying with considerable truth.

clientele who can and will take their business elsewhere. If we define our objective as reducing wait time, we will consider solutions that increase ability to quickly take care of customers when they arrive. If we define our objective as (more generally) increasing customer satisfaction, we might also consider solutions that make waiting for service less irksome.

Likewise, if we decide in the interests of economy, or effective support, to consider outsourcing certain functions, then it's important to fully understand the context. What does the function in question do for the organization? Who's affected by the quality of performance? Affected in what way? We can then more completely define the tasks to be accomplished and the relevant standards of performance.[3]

2. Develop Alternatives. If we understand the problem, then we can consider useful ways to solve (or at least mitigate) it. Typically, a number of alternatives are available. They are best understood as "courses of action" or "programs," not as titles. It is accordingly useful to develop (as outlines) alternatives suitable for plans which might actually be executed, rather than as entries on a briefing chart.

3. Predict consequences associated with each alternative. Consequences typically are manifest in both effectiveness (what's gained) and costs (what's given up or risks incurred). While alternatives in real problems have a large number of consequences, some tell more about achieving the objectives than others. In many complex problems, prediction involves modeling, a formal process of relating key features of the alternatives to their important consequences.

4. Assess the consequences associated with the alternatives. This may be relatively easy or quite difficult. Alternatives which are less effective and more costly than others are said to be "dominated," and are not candidates for implementation. Similarly, if all available alternatives are equally costly (or equally effective), then the most effective (or least costly) alternative is clearly best.

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[3] This is not new information for those who have participated in outsourcing studies.

Other comparisons are more difficult. If Alternative A is both more costly and more effective than B, then sorting between the two entails further analysis. Available methods include multi-attribute utility or cost-benefit analysis.[4] In choosing between two support alternatives, such as organic and contractor, a well-crafted statement of work can facilitate comparison based on equal effectiveness.

*5. **Make a decision*** or provide a recommendation. In many respects, this phase of the process involves reconsideration and review of the entire process, especially the quality and relevance of the analysis. It's useful to consider whether further iterations of the process are useful.[5] If our analysis includes assumed, or baseline, values of key parameters, it's important to consider how our results vary (if at all) with different values of those parameters (sensitivity analysis).

When we're convinced our reasoning is sound, that further analysis will not improve the quality of our conclusions, or we've just run out time, it's appropriate to make our best decision, or make our best recommendation to the decision makers.[6]

2B. Input-Output Analysis

Input-output analysis originated as a method of studying the operations of an entire economy. It postulates a number of sectors (or industries) and a number of primary factors of production (the most important being labor).[7] The primary factors (or inputs) support the various industries. Industries support each other; intermediate goods flow within industries and between industries. Thus, for example, a finished

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[4] Clemen and Boardman offer excellent textbook treatments of multi-attribute utility analysis and cost-benefit analysis, respectively.

[5] The process outlined here is inherently iterative. Analysis may lead directly to a conclusion. It might also surface insights that warrant further analysis. If, for example, a new alternative surfaces, then it's appropriate to go back to the second step, developing alternatives, and re-accomplish part of the problem-solving process.

[6] The time dimension is not trivial in problem-solving processes. In particular, a good decision (or recommendation) that's timely is better than a decision that's perfect but too late.

[7] Excellent discussions of input-output analysis are available in Henderson and Baumol.

automobile may have an engine supplied by another automobile firm, and tires purchased from the rubber products industry. Every primary input is supplied to the goods-producing sectors. For example, labor services are part of every industry's production process.

Industries also supply goods and services that directly enhance society's material well-being. This is called "final demand." A van delivered to a household is part of final demand, while a van supplied to a delivery service is a shipment to another industry. (Some of the latter van's deliveries are eventually part of final demand.)

There are some relationships which are always true in this model. First, the sum of deliveries from each industry to final demand plus all deliveries to other industries adds up to total output of that industry. If there are *m* industries (or sectors) in an economy, then:

$$Q_i = q_{i1} + q_{i2} + \ldots + q_{im} + F_i = \sum_{j=1}^{m} q_{ij} + F_i, \text{ where } i = 1, \ldots, m, \qquad (2.B.1)$$

where Q_i is Industry *I's* total (or gross) output, q_{ij} is deliveries from the *i-th* industry to the *j-th*, and *Fi* is deliveries from the *ith* industry to final demand.

Standard input-output analysis assumes that every unit of Industry *J's* output entails a specific amount of output from Industry *I*. For example, it's safe to say that new automobiles include five tires (with rare exceptions with more)—which are almost always a delivery from one industry to another. Thus:

$$Q_i = a_{i1} Q_1 + a_{i2} Q_2 + \ldots a_{im} Q_m + F_i = \sum_{j=1}^{m} a_{ij} Q_j + F_i, \qquad (2.B.2)$$

where a_{ij} is the deliveries from Industry *I* associated with each unit of Industry *J's* output, and other terms are defined as in Equation (2.B.1).

Frequently, these relationships are summarized in an input-output table that looks something like Table 2.B.1 below. The economy represented has *m* industries

and r primary inputs. For the simple case of two industries and one primary input (usually labor), we have the situation described in Table 2.B.2.

Table 2.B.1. An Input-Output Table

Sectors	1	…j	m	Final Demand	Total Output
1	a_{11}	a_{1j}	a_{1m}	F_1	Q_1
…i	a_{i1}	a_{ij} *	a_{im}	F_i	Q_i
m	a_{m1}	a_{mj}	a_{mm}	F_m	Q_m
Primary Inputs					
m+1	$a_{m+1,1}$	$a_{m+1,j}$	$a_{m+1,m}$	---	---
…	$a_{m+i,1}$	$a_{m+i,j}$	$a_{m+i,m}$	---	---
m+r	$a_{m+r,1}$	$a_{m+r,j}$	$a_{m+r,m}$	---	---

* Note: each unit of output for Industry J entails a_{ij} units of Industry I output.

Table 2.B.2. Input-Output Table with Two Sectors and One Primary Input[8]

Sectors	1	2	Final Demand	Total Output
1	.2	.4	F_1	Q_1
2	.6	.3	F_2	Q_2
Primary Input				
3	.2	.3	---	---

As noted above, the following must be true for the simple economy of Table 2B.2:

$$Q_1 = .2\,Q_1 + .4\,Q_2 + F_1$$

$$Q_2 = .6\,Q_1 + .3\,Q_2 + F_2. \qquad (2.B.3)$$

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[8] Taken from Henderson.

If we know final demands (the *F's*) and the technical characteristics of the economy (the *a's*), then we can find the total output for each industry (the *Q's*). Thus,

$$Q_1 = 2.1875 \ F_1 + 1.25 \ F_2$$

$$Q_2 = 1.875 \ F_1 + 2.5 \ F_2. \tag{2.B.4}$$

Also, the primary input needed turns out to be

$$Q_3 = .2 \ Q_1 + .3 \ Q_2 = .2 \ (2.1875F_1 + 1.25F_2) + .3(1.875F_1 + 2.5 \ F_2) = F_1 + F_2. \tag{2.B.5}$$

A Military Input-Output Model

A simple input-output model based on the military establishment is more hierarchical, and also simpler. Suppose we have three sectors: "capability" (or operations), designated *C*, direct support, designated *S*, and infrastructure, designated *I*. In addition, there is a fourth variable: personnel (or manpower), designated *P*. Our input-output model would then look something like Table 2,B.3.

This model is hierarchical, as indicated. There are the four sectors indicated above. The Capabilities Sector makes "deliveries" only to "Final Demand" (or operational capabilities) and the Capabilities Sector itself. The Support Sector provides support for the Capabilities Sector and itself. The Infrastructure sector makes deliveries to the Capabilities and Support Sectors, as well as itself. Finally, the Personnel Sector supports all the other sectors, as well as itself.[9] Labor, or personnel, is shown as a sector instead of a primary factor since it provides support to itself in the form of personnel support, or overhead.

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[9] Because the Personnel sector provides support for itself, the model has been reformulated. Table 2.B.3 is a "closed" input-output model; the models summarized in Tables 2.B.1 and 2.B.2 are "open."

Table 2.B.3. A Military Input-Output Model

"Sectors"	C	S	I	P	Final Demand	Total Output
Capability (C)	a_{CC}	0	0	0	F_C	Q_C
Support (S)	a_{SC}	a_{SS}	0	0	0	Q_S
Infrastructure (I)	a_{IC}	a_{IS}	a_{II}	0	0	Q_I
Personnel (P)	a_{PC}	a_{PS}	a_{PI}	a_{PP}	0	M

*Note: Q_k is total output for Sector k. F_C is total operational capabilities.

If we include the complication of using contractor services in lieu of organic activities (except for the Capability Sector), we now have total sector outputs as follows:

$$Q_C = (1 - a_{CC}) Q_C + F_C$$

$$Q_S = Q_{SO} + C_S = a_{SC} Q_C + a_{SS} Q_S$$

$$Q_I = Q_{IO} + C_I = a_{IC} Q_C + a_{IS} Q_S + a_{II} Q_I$$

$$P = P_O + C_P = a_{PC} Q_C + a_{PS} Q_S + a_{PI} Q_I + a_{PP} P_O, \qquad (2.B.6)$$

where P_O is total military personnel, P is total personnel billet-equivalents (from organic or contractor sources) and C_k is contractor services provided in Sector K (to include personnel services). It's useful to remember that some inter-sector "deliveries" take the form of goods and services provided to support each sector's productive activities, and some involve support of the military personnel in those sectors. Hence, deliveries from the personnel sector involve, for example, people on operational unit rolls and the overhead personnel which support them.

We can solve the system of equations stated in (2.B.6) above:

$$Q_C = F_C/(1-a_{CC}) \tag{2.B.7.1}$$

$$Q_{SO} = F_C * \{a_{SC} / [(1-a_{CC})(1-a_{SS})]\} - C_S \tag{2.B.7.2}$$

$$Q_{IO} = F_C * \{[a_{SC} a_{IS} + a_{IC} (1 - a_{SS})] / \{(1-a_{CC}) (1-a_{SS}) (1-a_{II})\} - C_I \tag{2.B.7.3}$$

$$P_O = \{F_C a_{PC}/[(1-a_{CC})(1-a_{PP})]\} + \{F_C(a_{PS}a_{SC})/[(1-a_{CC})(1-a_{SS})(1-a_{II})\}$$

$$+ \{F_C a_{PI} a_{IC}/[(1-a_{CC})(1-a_{SS})(1-a_{II})]\}$$

$$+ \{F_C a_{PI} a_{IS} a_{SC}/[(1-a_{CC})(1-a_{SS})(1-a_{II})(1-a_{PP})]\} - C_P/(1-a_{PP}) \tag{2.B.7.4}$$

The results stated in Equations (2.B.7.1) – (2.B.7.4) are consistent with intuition. Total level of activities in the Capabilities Sector depends directly on operational capabilities delivered (F_C). The appropriate levels of activity in the Support and Infrastructure Sectors depend on final operational capabilities required and the extent to which organic activities (subscripted O) is replaced directly by contractor support activities (C_S and C_I).

The solution for P_O is more conveniently stated as:

$$P_O = \{[a_{PC}Q_C + a_{PS}Q_S + a_{PI}Q_I]/(1-a_{PP})\} - \{[a_{PS}C_S+a_{PI}C_I+C_P]/(1-a_{PP})\}$$

$$\tag{2.B.8}$$

This model indicates there are both direct and indirect military manpower reductions possible with contractor support. Directly, contractor support leads to replacements in organic manpower in the affected organization; *indirectly*, there is a reduction in the personnel support tail. Associated with military personnel billets are support personnel—recruiting, training, personnel, administration of pay, public works, etc.

In particular, there is a "mulitiplier" of personnel reductions possible with contractor support:

$$dP_O/dC_S = -a_{PS}/(1-a_{PP}), dP_O/dC_I = -a_{PI}/(1-a_{PP}),\text{ and } dP_O/dC_P = -1/(1-a_{PP}).$$

(2.B.9)

That is, every direct reduction in military personnel billets results in additional reductions because of decreased personnel support needs. For example, contractor services replacing support activities (C_S) lead to direct replacement of ($a_{PS} C_S$) the number of military billets. At the same time, there is a corresponding reduction in support billets associated with the personnel directly replaced. There is also a reduction in support billets associated with the original support billets reduced, and so on. The multiplier for total personnel reductions vs. direct reductions is $1/(1-a_{PP})$.[10]

Certainly, contractor personnel have some sort of support "tail" as well, which includes recruiting, training, human resources services, administration of pay, medical care, etc. These needs are similar to those of military personnel. However, support of contractor personnel is reflected in the contractor's proposal. It is not readily visible in the contractor support alternative for DoD decision making.

Hence, the military input model above indicates there are real savings in personnel support, above and beyond those not directly involved in the organic support alternative.

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[10] Suppose 100 military billets are associated with a set of activities, and that five such billets entail one personnel support billet (a_{PP} = 0.2). Thus, 100 military billets entail 20 personnel support billets; those 20 billets, in turn, require 4 billets, and so on:

$$P_O = 100 \sum_{i=1}^{\infty} .2^{\wedge} i = 125 = 100^* \left[\frac{1}{(1 - a_{PP})} \right].$$

2C. Transactions Cost Economics

There is a private-sector counterpart to the choice of support-service sourcing with organic assets or contractors. It has become a standard part of economic theory. The seminal work is generally acknowledged as coming from Ronald Coase in 1937. If most productive tasks can be accomplished with greater efficiency elsewhere, then what reason would firms in search of profit have to produce those goods and services within the enterprise boundaries?[11] The answer to the question is that going to the market to acquire such goods and services carries with it certain "transactions costs," which might well turn out to be greater than the added costs associated with production in-house.[12] Thus, study of make-or-buy decisions and similar issues is often called "transactions cost economics."

More generally, the make-or-buy decision is considered part of the issue of the firm's "vertical" boundaries. This is a standard topic in economics texts, especially those with a managerial bent.[13] The productive processes associated with bringing a good to market are viewed as being a chain of activities, or a series of vertical steps. One such representation appears in Besanko (111) and is shown in Table 2.C.1 below.

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[11] In more modern terms, one would expect businesses to restrict production to their core competencies and acquire the other parts of their products from outside suppliers. Thus, one would, for example, expect an automobile manufacturer to accomplish the final assembly of the cars it sells, but acquire tires from outside companies. These seem to be fairly clear-cut decisions. A question with a less obvious answer is the car's windshield.

[12] To use a physical analog, the market is not a frictionless medium. Operations in the marketplace require expenditure of time, resources, and management attention.

[13] Besanko and Rubin.

Table 2.C.1. A Vertical Chain of Production

PRODUCTION PROCESSES	SUPPORT PROCESSES
Raw inputs (e.g., trees, iron, cows)	Accounting
Transportation and Storage	Finance
Intermediate goods producers (e.g., lumber mills, steel manufacturers, metalworking shops, tanneries)	Human Resources Management and Support
Transportation and Storage	Legal Support
Furniture Manufacturers	Marketing
Transportation and Storage	Planning
Retail Outlets	Other Support Activities

Furniture carpentry, for instance, is relatively uncomplicated. It can be represented as a series of steps, or stages, of production. A more complex production process might appear more like a PERT chart. In any case, every firm in this industry must decide how much of those production and support processes will be conducted within the boundaries of the firm, and how much will be performed within other enterprises.

DISADVANTAGES OF ORGANIC ASSETS

Lost Economies in Production. Firms specialize in certain goods and services because they are particularly good at performing them. (Also, as firms specialize, they increase their proficiency at certain processes and become even better.) Within a competitive market, firms are highly motivated to operate at the most efficient scale.[14] Furthermore, competitive markets provide powerful incentives for the participating firms to produce a least-cost product mix both to enhance profit and fend off rivals. That is,

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[14] Firms in perfectly competitive markets will move toward the lowest point of their average cost curve in pursuit of profit. That is, these firms can be expected to take full advantage of economies of scale.

firms in a competitive market are also motivated to fully realize economies of scope.[15] Finally, such firms are engaged in production continuously (more or less) and are thus well positioned to achieve economies available from learning; they can move down whatever learning curve applies and stay there. Furthermore, outside firms in a competitive market are motivated to pass the savings to their customers. Prices charged in competitive markets are close to marginal costs, which have been driven down as a result of exploiting available economies of scale, scope and learning.[16]

Production of such items within the firm is unlikely to be as efficient. In general, rates of production are too small to fully realize available economies of scale. Only by happy coincidence would the firm's demand for goods of a particular type correspond closely with the most efficient scale of production. Likewise, the mix of products needed would correspond with available economies of scope only by coincidence. Finally, in-house production may well operate only intermittently, which means less opportunities to exploit economies from learning by doing.[17]

"Agency" Costs. In addition, production in-house means an enterprise (or division) with a protected customer base. There is, accordingly, less incentive to improve product quality or efficiency of production. Basically, the problem is to make sure the in-house operation performs diligently and in ways consistent with the profitability of the larger enterprise.[18] While management oversight can address these

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[15] If two products can be produced together more cheaply than they can be produced separately, then there are economies of scope. Opportunities for economies of scale and scope pretty much define the firm's natural "horizontal boundaries."

[16] The difference between marginal cost and price varies inversely with the price elasticity of demand for the vendor's product. An inherent feature of competitive markets is the availability of a large number of close substitutes for any firm's product. Therefore, price elasticities of demand are quite high, and the difference between marginal cost and price are correspondingly quite small. (In the limiting case of perfect competition, price elasticity of demand for any firm's product is infinite, and price is equal to marginal cost.)

[17] With extended production runs, firms become more proficient with the processes involved, and therefore able to achieve lower cost. As Besanko (91) puts it, "cost advantages … Flow from accumulating experience and know-how."

[18] This is frequently referred to as the "principal-agent problem." Methods to address it are sometimes grouped as "agency theory." Kreps, Besanko.

problems, it carries a cost. Oversight requires time, effort and, therefore, commitment of resources. Yet, outsourcing part of the production chain accordingly avoids agency costs.

"Influence" Costs. Production in-house also generally entails the corresponding division of the enterprise having a seat at the table for corporate decisions and strategy. In all likelihood, the division will espouse policies and resource commitments that enhance its position and capabilities, and will likely oppose those which call for its dissolution. The possible distortions of corporate decision-making (and attendant losses of competitiveness and profits) can be regarded as influence costs, and are worth consideration in organizing productive processes.

DISADVANTAGES OF OUTSOURCING

Coordination Difficulties. Efficient production requires extensive synchronization of a number of complex activities. This is especially true in the practice of "lean" production, featuring "just-in-time" deliveries with attendant reduction in inventory costs. Coordination with an outside enterprise may well prove more difficult than with an in-house division. There is likely to be more commonality of objectives between two divisions of the same enterprise than with an outside firm. Also, any disagreements about deliveries, schedules and similar issues are generally settled more quickly and in ways suitable to the enterprise if it has authority over all parties. (One way to have that authority is to own all the divisions, i.e., to produce in-house.)

Loss of Sensitive Information. Enterprise operations involve information, some of which is proprietary, classified or otherwise sensitive. Close coordination with an outside supplier of goods or services involves the exchange of information, some of which is sensitive. Passing this information outside corporate boundaries accordingly lessens ability to control its dissemination. Thus, involving outside suppliers involves risks of compromising corporate (or government) secrets.

Transactions Costs. Outsourcing important parts of one's business means depending on the chosen supplier. This dependence may be of trivial importance. For

example, purchase of paper clips involves a one-time transaction for office supplies.[19] If a paper clip source proves unsatisfactory for some reason, it's readily possible to find another supplier. On the other hand, outsourcing a major management information system involves a long-term, highly-complicated relationship. During the process of executing the agreement, the supplier acquires expertise in this particular system, which confers a market niche. At some point, the relationship progresses from a customer entering a competitive marketplace with a number of suppliers to a relationship with one buyer and one qualified seller. Thus, close-in bilateral bargaining replaces the impersonal (arms-length) arrangements of the competitive marketplace. Outsourcing relationships of this nature entail a basic transformation from competitive bidder (prior to source selection) to monopolistic supplier (after source selection).

Having one supplier with unique expertise provides monopoly power; there are no close substitutes for this particular contractor's services. Accordingly, the firm is now vulnerable to "opportunistic behavior"[20] from the contractor. Unforeseen circumstances may prompt large charges for special services for which there are no readily available substitutes.[21]

The supplier may, in fact, exploit its power in the relationship to renegotiate the basic agreement to its disadvantage, threatening to dissolve the agreement. In the Transactions Cost Economics literature, this is called a "holdup."[22]

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[19] Actually, a series of one-time purchases of paper clips.

[20] Williamson defines "opportunism" as "self-interest seeking with guile…"

[21] Besanko and others have labeled the transition from one prospective buyer and many sellers to one buyer and one seller, from competitive market to a one-on-one relationship as the "fundamental transformation." This transformation occurs, at least to a certain extent, after the completion of every source selection process.

[22] An even worse case is the possibility that a holdup might be unilaterally executed. According to Besanko, "a holdup problem arises when a party in a contractual arrangement exploits the other party's vulnerability due to relationship-specific assets."

RELATIONSHIP-SPECIFIC INVESTMENTS

Frequently, an outsourcing arrangement involves enhancing or changing the capacity of the supplier to more effectively meet customer needs. Investments can take on relation-specific qualities from some combination of characteristics, including the following:

location: e.g., the supplier's production facility is located close to its customer;

physical assets: e.g., the supplier's plant is specialized for the customer's needs, and much less profitable if serving other customers;

human assets: the supplier's work force skill set is oriented toward the primary customer's needs and is much less productive when dealing with other customers.

Relation-specific investments facilitate economies in production because of the specialized capabilities involved. They also increase risks to both parties. The specialized supplier is more efficient in providing the outsourced component, and thus can potentially raise its price—and still remain the least-costly supplier. At the same time, the supplier's specialization makes it more vulnerable to its one customer. The customer can potentially exploit the supplier's dependence by lowering the price of the outsourced component. That is, relation-specific investments increase the total gains from the outsourcing arrangement, but also increase risks of both parties to a holdup or to opportunistic behavior by their partners.

RELATION-SPECIFIC INVESTMENT AND POTENTIAL FOR HOLDUP: A HYPOTHETICAL EXAMPLE[23]

Boutique Motor Corporation (BMC) features highly decorative cup holders in its automobiles. General-purpose plastics suppliers can provide those unique cup holders for $4 per unit. BMC, however, forms a long-term relationship with Mom & Pop Plastic

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[23] Besanko has a similar example on page 153.

Fabricators (M&P) to get those cup holders at a cheaper price, say $3 per unit for 500,000 cup holders per year. As part of its part of the relationship, M&P modifies (and specializes) its plastic molding machinery to make the distinctive BMC cup holder more efficiently. M&P invests $1 million in the modifications, and can then produce each unit for $1 each.[24] M&P's modified plant can still produce general-purpose cup holders, but average variable cost goes up to $2.90 per unit with the special-purpose machinery. The prevailing market price for general-purpose cup holders is $3 per unit.

In this simple example, M&P's costs are as follows:

Total Cost = $140,000 + $1 * Q,

where Q is annual production (500,000 for BMC), and annual payments of $140K will retire a debt of $1 million at 6.64% (APR) over ten years. If M&P produces only for BMC, then total cost is $640,000. Revenues from BMC are $1.5 million (500,000*3).

Thus, M&P earns profits of $0.86 million per year as a result of the relationship with BMC; it would absorb losses of 90K per year if it diverted its production capacity to 500,000 general-purpose cup holders.[25] Likewise, BMC adds $0.5 million to its profits since it pays $3 per unit for its cup holders, instead of $4 (500,000*[4-3]). In short, the agreement provides significant benefits to both parties. The total benefit (or "surplus") is $1.45 million (.86+.09+.50) after the relationship between the two companies is formed.

However, this total surplus can be contested. Suppose BMC demands M&P lower its price to $2. If that happens, then M&P's profits decrease to $0.36 million (500,000*2 – 640,000), and BMC's profits increase by $0.50 million. At the same time, M&P may insist on a price increase to $3.50 per unit. If that happens, then M&P's profit

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[24] Marginal Cost = Average Variable Cost = $1.

[25] Before making its relationship-specific investment (or prior to the transformation), M&P reckons its advantage as $0.86 million per year minus its profits as a general-purpose supplier. After the investment, M&P's benefit from the relationship with BMC is $.95 million per year with production of 500,000 per year. (If M&P were to produce those cup holders at variable costs of $2.90 per unit and sell them at $3.00, it would incur a loss of $90K per year [revenue = $1.50 million; cost = $1.59 million]).

increases to $1.11 million, and BMCs benefit declines to $0.25 million.[26] In short, BMC and M&P can dispute shares of the total benefit from the relationship.[27] As indicated, the standard term for such attempts to alter the relationship is "holdup."

ADDRESSING THE "HOLDUP" PROBLEM

While corporate partnerships and relation-specific investments increase the benefits to both parties, they make both vulnerable to opportunistic behavior, or a holdup, by the other party. Vulnerability to these events can be significantly decreased through well-crafted contracts. However, contracting (a) involves expenditure of resources, and (b) cannot completely eliminate risks associated with opportunistic behavior from partners.[28]

The process of contracting includes drafting the relevant documents, negotiating the version of the contract that is signed, taking actions to enforce that contract, and renegotiating when needed. These tasks entail, at minimum, the services of skilled people who develop local knowledge of the specific business relationship. There may also be costs associated with litigation, to include both direct (e.g., monetary) and indirect (e.g., time delay) components. Furthermore, the basic contract may well need considerable administrative and management attention throughout its life, even if full-scale renegotiation is not undertaken. Accomplishing these tasks satisfactorily involves expenditure of resources and management attention. These "transactions" costs can negate a significant portion of the savings involved with outsourced production.

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[26] It's unlikely that a holdup by either party would be presented this crudely. BMC might plead hard times and assert the need to negotiate lower prices from suppliers. M&P might point to increases in input costs, and assert the need for a higher price in order to remain in its relationship with BMC.

[27] There are obvious limits to this behavior. If M&P demands more than $4 for each cup holder, then BMC would find it advantageous to buy its cup holders from other sources (at $4). Likewise, if BMC forces the price below $1.10, then M&P would choose to make general purpose cup holders and sell them for $3 per unit (at a unit cost of $2.90).

[28] Costs associated with contracting, and the holdup risks remaining are major components of what are generally termed "transactions costs."

The future is not amenable to perfect prediction—a well-known fact of life. The obvious implication is that a contract cannot foresee all possible contingencies throughout the period of its execution. That's true regardless of the skill of the legal staff, and the expertise of the contracting personnel.[29] In some cases, this is not worrisome, as, say, for the one-time purchase of paper clips. However, in long-term, complex outsourcing relationships, this may prove very costly during the execution of the contract.

This problem can be further complicated by asymmetric information. Suppose that during contract negotiations between BMC and M&P, BMC is aware of a contingency in the execution of the contract that will give it scope for opportunistic behavior. Suppose also that M&P is not aware of this. BMC is unlikely to disclose this contingency during contract negotiations.[30] Also, enforcement of clearly-written contracts may be problematic. It may be difficult to specify, measure and demonstrate material breach of contract. Furthermore, it is impossible to foresee all situations in which a contracting party might wish to demonstrate that breach.

Because contracts cannot completely hedge against risks of opportunistic behavior, other risk reduction measures may prove advantageous. The enterprise that's outsourcing may retain some in-house (perhaps standby) capability to provide the good or service in question.[31] This, and similar measures, could enhance bargaining position in the event of renegotiation or contract-enforcement actions. Changing the ownership of assets associated with relation-specific investments could reduce the scope for opportunistic behavior; this may take the form of government-furnished equipment in federal transactions. However, hedging measures also entail costs, and can likewise dissipate the potential gains from outsourcing.

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[29] This is a manifestation of what's sometimes called "bounded rationality."

[30] BMC may stay mum, intending to force concessions from M&P later. However, BMC may have no intentions of bad faith, but distrusts M&P's intentions. BMC may therefore preserve this option for opportunistic behavior as a hedge against bad behavior on the part of M&P.

[31] This is sometimes called "tapered integration."

THE STANDARD BOTTOM LINE

The conventional wisdom in the transactions costs literature is that the decision to outsource should not be taken lightly. While the potential production-cost savings may well be tempting, there are associated costs and risks, albeit less obvious. They are less important (and might be negligible) for simple, one-time transactions where alternate suppliers are readily available. They can be critically important when the outsourcing arrangement is such that there is only one supplier readily available in a complex and lengthy relationship.

Hence, the decision to outsource must weigh production cost savings against the costs and risks associated with a critical source of supply being outside the firm's control. Those are generally referred to as the transactions cost of the outsourcing relationship. Thus, outsourcing is preferred only if the total costs are less than the costs of production with the firm's (in-house, organic) assets. That is, a firm should outsource only if the following is true:

Cost of in-house production > Outsourcing + Transactions Costs.

2.D. Cost-Benefit Analysis (CBA)

Any problem-solving process inevitably involves comparison of alternatives. Sometimes this is easy; one alternative may provide more advantages (benefits or effectiveness) than all the others, while having fewer disadvantages (costs and risks). That alternative is clearly best (being "dominant"). It may also be that a number of alternatives may have equal cost (or effectiveness) with differing effectiveness (or cost). In that case, the alternative with greatest effectiveness (or least cost) is clearly best.

A more difficult case arises when there are alternatives in which attaining higher effectiveness (or lower cost) means finding an alternative with higher cost (or lower effectiveness). Then, the basic assessment question involves a determination of willingness to incur higher costs to achieve higher levels of effectiveness. One way of assessing alternatives based on a willingness to pay is Cost-Benefit Analysis (CBA).

CBA is a well-defined method to "appraise an investment project which includes all social and financial costs and benefits."[32] It is the subject of extensive literature that includes standard textbooks such as Boardman. The basic foundation of standard CBA methods is total willingness to pay. The basic criterion for the assessment is simple (perhaps deceptively so):

Net Benefit = Benefits – Costs.[33]

The complicated task is finding all the benefits and costs, which entails a detailed and systematic analysis. One industry standard for the major steps in a well-done CBA comes from Boardman, and is summarized as follows:

1. Specify the set of alternative projects.
2. Decide whose costs and benefits count. Who has "standing," or is a legitimate stakeholder?
3. Catalog impacts, and select metrics.
4. Predict the impacts over the life of the project.
5. Attach monetary values to all impacts.
6. Discount benefits and costs for each alternative to Present Values (PV).
7. Calculate the Net Present Value (NPV) for each alternative.
8. Perform an appropriate sensitivity analysis.
9. Make a best-value recommendation based on the NPV and the sensitivity analysis.

CBAs can be performed on both projects and alternatives (bundles of projects) when formulating investment strategies (including Product Support Strategies).[34]

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[32] From a dictionary of economics compiled by Bannock, *et. al.*

[33] One immediate complication is that subtracting costs from benefits in any meaningful sense means that the two terms are stated in common units. The main task in conducting a CBA is putting all the dimensions of cost and benefit into monetary units.

[34] A short digression on terminology: In CBA terminology, a group of projects constitutes an alternative. In Business Cost Analysis (BCA) terminology, a portfolio of initiatives constitutes an alternative— "initiative" being a reasonable analog of "project."

Completed CBAs can then support decisions, using the following general rules:

1. A project is worth doing (valid) if its net benefits are positive: i.e., benefits exceed costs.

2. A project that can be undertaken at various levels should be expanded as long as incremental benefits cover incremental costs.

3. The alternative (or strategy) with highest net benefit offers best value and is, therefore, preferred.

While all the above is fairly straightforward, there are many devils in the details. As Boardman (among others) points out, a CBA can cost one million dollars and take one year. Thus, a large-scale CBA should be undertaken only if the value of the information expected can outweigh the associated cost and potential delays.

Chapter 3. Practical Foundations

3A. Business Case Analysis

As part of making DOD decisions more efficient, the art of Business Case Analysis (BCA) has become a major, and required, part of systems-acquisition and systems-management processes. As one OSD source puts it, "a properly prepared business case represents an effective tool to improve the decision making process and foster timely and accurate decisions" (DUSD [Logistics]).

BCAs are regarded as a major, and necessary, tool for program managers. For example, OSD directs a Product Support Strategy (PSS) prior to Milestone B for any ACAT1 program. The PSS is, in turn, the foundation for a BCA to be completed by Milestone C (Wynne). Some extant OSD guidance goes further, and describes the BCA as "an integral part of every competent manager's decision process" (DUSD [Logistics]).

Business Case Analyses are also useful outside DoD and the Executive Branch. To quote a recent report from the Legislative Branch concerning the F/A-22: "GAO recommends that DoD complete a new *business case* that determines the continued need for the F/A-22 and the number of aircraft required for its air-to-air and air-to-ground roles based on capabilities, need, alternatives, and constraints of future defense spending department wide" (GAO, emphasis added).

There is considerable help in the form of BCA templates and examples available both in the DoD and the commercial sector. There is, moreover, much in common among these sources. One of these guides provides the following template for constructing a BCA: Executive Summary, Boundaries of the Case, Discussion of Alternatives, Comparison of Alternatives, Conclusions, Recommendations & Issues (DUSD[Logistics]). A more detailed template follows in Table 3A1 below—which is a recommended table of contents for a BCA report.
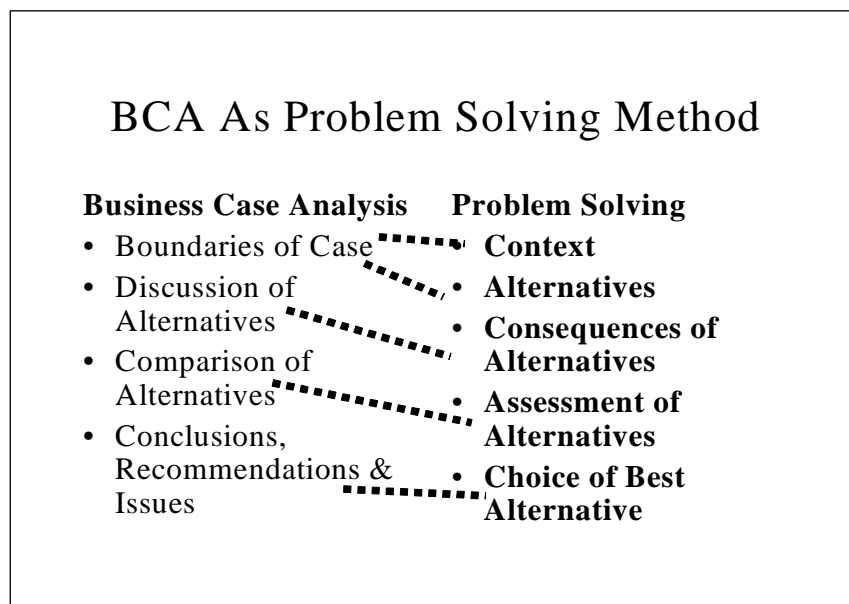
TABLE 3.A.1. A BCA Template

CHAPTER	SECTION	SUBSECTION
1. EXECUTIVE SUMMARY		
2. BOUNDARIES OF THE BUSINESS CASE		
	2.1. Goals and Vision	
	2.2. Context & Perspective	
	2.3. Functional Performance & Metrics	
	2.4. Initiatives Considered	
	2.5. Alternatives Considered	
	2.6. Key Assumptions	
	2.7. Status Quo Activity Model	
3. DISCUSSION OF ALTERNATIVES		
	3.1. Alternative 1	
		3.1.1. Functional Performance Description
		3.1.2. Performance Impact & Metrics
		3.1.3. Technical Architecture
		3.1.4. Cost Projections
		3.1.5. Risk Assessment
	3.2. Alternative 2 …	
4. COMPARISON OF ALTERNATIVES		
	4.1. Functional	
	4.2. Performance	
	4.3. Cost	
5. CONCLUSIONS, RECOMMENDATIONS & ISSUES		

What They Are Intended to Do

As current guidance makes plain, BCAs should provide a systematic analysis of management alternatives which is clearly communicated to the relevant stakeholders and decision-makers. Fundamentally, therefore, the BCA is a method for structuring and solving problems. BCAs are considered especially useful for formulation of change and modification strategies, as well for life-cycle management in general.

The nature and intention of BCA methodology is, in fact, simpler than the currently-fashionable mystique about its usefulness suggests. BCAs are, quite simply, a method for structuring and solving problems—no more and certainly no less. The BCA template in Table 3.A.1 above integrates well into the problem-solving outline provided in Section 2A above. This is indicated in Figure 3.A.1.

BCA As Problem Solving Method

Business Case Analysis
- Boundaries of Case
- Discussion of Alternatives
- Comparison of Alternatives
- Conclusions, Recommendations & Issues

Problem Solving
- Context
- Alternatives
- Consequences of Alternatives
- Assessment of Alternatives
- Choice of Best Alternative

Figure 3.A.1. Business Case Analysis Correspondence with Other Problem-Solving Methods. Sources: DUSD (Logistics) and Stokey.

As such valuable problem-solving techniques, high-quality BCAs can provide program managers with the following advantages:

1. credible assessment of alternative strategies,

2. clear rationale for decisions,

3. valid, transparent and persuasive analysis for reviewing agencies.

However, realization of that potential is much more likely with tools of analysis suitable for practical Business Case Analyses. It appears to this observer that Program Managers have much more guidance about BCA reports as *documents* than they have about BCAs as *analyses.* While it's easy to mandate BCAs and call for sound analyses, the task of developing the analytical foundations is explicitly left to the services (Wynne). This has the virtue of not requiring one analytical form to suit all users. But requiring BCAs without an assurance of sound analytical foundations poses the danger of BCAs that have the same depth as PowerPoint slides.

In short, Program Managers can consider BCAs as documents to be a settled matter. Moreover, the standard Table of Contents integrates nicely into the analytical processes needed to underpin a useful BCA. Guidance for doing the foundational analysis is much less complete. Therefore, Program Managers may well find it useful to devote significant attention to the analytical methods behind the submitted BCA report and the associated briefing charts. Chapter 2 discussed major theoretical foundations. The remainder of this chapter considers some of the practical foundations of the BCA as analysis.

3B. Input-Output Methods in DOD

3.B.1. DRM (QuickCost)

QUICK COST METHODOLOGY

One method of tracing relationships of various programs within the defense budget is the QUICK COST Defense Force Cost Model, based on the Defense Resource Management Model maintained by the Congressional Budget Office. QUICK COST features aggregated Budget Authority based on the budget projections. Actual budget details are kept in the Program Elements (PEs), which are classified. QUICK COST details are found in Aggregated Elements (AEs), which are unclassified aggregations of the PEs. This information is, however, still quite detailed.

The QUICK COST model directly estimates Operations and Support (O&S) costs associated with a given force structure. It does not provide direct estimates of changes in research and development, procurement and construction, or other funding not directly linked to force structure. However, the model's data base provides historical data for items in these categories.

The model's structure is based on Primary, Related and Support AEs. The model begins with the Primary AEs, which are directly associated with combat forces. Related AEs, in turn, are linked to associated Primary AEs. Support AEs are basically infrastructure, such as base operating support, central training activities, and logistics activities. The Support AEs (as the name implies) support the Primary and Related AEs within the model's hierarchy. Taken as an input-output model, QUICK COST involves "shipments" from Related AEs to Primary, and from Support AEs to Related and Direct.

The QUICKCOST scheme is summarized in the following table, readily seen as a simplified version of the military input-output model discussed above. The *P*, *R* and *S* subscripts represent the Primary, Related and Support classes, respectively, and the term *Operational Capability* replaces *Final Demand.*

Table 3.B.1. Notional Quick Cost Input-Output Table

AE Class	Primary	Related	Support	Operational Capability	Total Output
Primary	0	0	0	F_P	Q_P
Related	a_{RP}	a_{RR}	0	0	Q_R
Support	a_{SP}	a_{SR}	a_{SS}	0	Q_S

An important feature of the model is treatment of fixed and variable costs. Primary AEs vary directly with their associated forces, with all costs thus variable. Related and Support AEs are tied to the Primary AEs through proxy variables; changes in military pay within Primary AEs are taken to represent the change in the overall level

of activities. For the Related and Support AEs, the Model contains (a) fixed and variable costs based on "historical" experience and (b) all costs variable.[35] The historical fixed/variable factors are (not surprisingly) based on past experience—with changes in forces being, for the most part, relatively small in any given year and gradual over time. The all-costs-variable approach assumes all Related and Support AEs vary directly with associated combat forces. For purposes of Business Case Analysis of organic vs. contractor support, historical factors seem best. Such decisions taken individually will have only minor impacts on overall force and personnel structure.

There is difficulty in using this model directly for BCAs that assess organic vs. contractor support, however. The DRM model is designed to relate support and infrastructure expenditures to operational forces. That is, it's well structured to give reasonable estimates of the budgetary and manpower implications of changes in force structure. However, it's not well structured to consider the changes associated with substituting contractor for organic support. One of the major problems is insufficient "granularity" of the data structure.

In terms of providing insights into the issue at hand, QUICKCOST seems something of a dead end. This model generally lacks the precision ("granularity") to credibly capture the indirect savings from outsourcing support activities. It does, however, illustrate the feasibility of constructing a large-scale model of resource flows within DoD based on input-output principles.

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[35] One simple, but useful, explanation of variable and fixed costs is that there are (a) overhead costs associated with these AEs, and (b) resources associated directly with those AEs' "outputs." Thus, for example, a small change in end-strength would result in a change in training requirements. However, it would not result in a change in the base structure of the training commands. Therefore, it's reasonable to believe there are substantial overhead costs not affected by small changes in end-strength. However, if there are large percentage changes in end-strength, one would expect significant changes in the size of the training establishment and other personnel support commands.

3.B.2. Manpower Calculations

The Navy's manpower requirements system is laid out in OPNAV INST 1000.16J and related publications. Conceptually, this document looks quite similar to an input-output approach. The Instruction discusses the manpower requirements and authorization system, providing "guidance and procedures to develop, review, approve, and implement total force manpower requirements and authorizations for naval activities" (para. 1.a.).[36]

Manpower requirements for individual units (or activities) are based on the minimum manpower needed to satisfactorily perform the tasks required to accomplish the unit mission. Manpower requirements are stated in both quantitative and qualitative terms. The nature of the tasks determines manpower *quality*, generally specified in terms such as ratings, grades, subspecialties and classification codes. The nature of the tasks to be performed is determined by the unit's Missions, Functions and Tasks (MFT) or the Required Operational Capability/Projected Operational Environment (ROC/POE). The scale of those tasks (workload) determines the *quantity* of manpower required.

Workload determinations are based on Industrial Engineering methods, or some other "justifiable" technique (para. 4.a.). With each task is associated a justifiable number of work hours. With each type of unit is associated a standard work week (Appendix C). For example, a shore activity generally has a standard work week of 40 hours; standard work week for ships at sea (in the Instruction's specified conditions) is 81 hours. The standard "productive" work week ashore is 33.38 hours for planning purposes—the remaining 6.62 hours being assigned to training, service "diversion," leave and holidays. Suppose a shore activity must, for some reason, maintain a watch of three persons continuously (168 hours per week). The manpower required to accomplish this task is 15.10 (168*3/33.38= 15.10).

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[36] What follows is a somewhat oversimplified characterization of a complex process.

Thus, the manpower requirements of a naval activity are pieced together from a number of these building blocks. The activity's manpower requirement is recorded in the appropriate Activity Manpower Document (AMD), which is the sole authority for such requirements.[37] A change in a unit's workload or nature of tasks (among other things) necessitates determining the appropriate changes in the AMD (para. 5.b.) Total force requirements are tracked using the Total Force Manpower Management System (TFMMS), which is the "single, authoritative data base" for manpower requirements (para. 5.a.) The authorization process is done bottom-up (zero based), and the process is specifically untied from resource constraints—including end-strengths.

While the requirements process is relatively well specified, the authorization process is necessarily less so. Authorizations are specifically balanced against end-strength constraints (both quantitative and qualitative). Authorizations are also tracked with AMDs and the TFMMS. Having a validated manpower requirement is a necessary, but not sufficient, condition for a corresponding authorization. Thus, the requirements total constitutes an upper boundary for an activity's authorized total. Manpower authorizations, among other things, provide the foundation for personnel assignment. Therefore, as a practical matter, a manpower authorization is a necessary, but not a sufficient, condition for someone being assigned. Thus, authorized personnel is an upper boundary for assigned personnel; assigned personnel (except in unusual or temporary circumstances) cannot exceed authorized personnel

Conceptually, the manpower requirements process looks very much like the input-output perspective discussed in Section 2B above—especially in the quantitative dimension. Some activities' missions are directly related to providing operational capability (a good analog of "final demand"). Other activities support the operational units. A portion of that support overall is related more or less directly to the operational units' mission; depot-level maintenance is one example. Another portion involves

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[37] Source documents for the AMD, in turn, include the SMD, SQMD, FMD and SMR, as appropriate. These acronyms are defined in App. A to Encl. 1 of the Instruction.

support of the personnel assigned to the operational unit. Suppose, for example, an F-18 squadron changes the number of aircraft assigned.[38] As a result, the AMD would be recalculated, based (in all likelihood) on the change in the scale of tasks to be performed. At the same time, the supporting units would recalculate their AMDs, since the scale of tasks in the operational unit (quite likely) changes the scale of tasks for all the supporting units. If, as is generally the case, those supporting units are, in turn, supported by other units, then still more units would recalculate. (This is the "multiplier" property of input-output models discussed in 2B above.)

Likewise, if that same F-18 squadron were to outsource some of its functions to contractor personnel, then manpower requirements for the squadron would be recalculated for the AMD. For supporting units, tasks directly associated with the squadron's operational tasks would remain the same. However, supporting activities' tasks associated with the F-18 military personnel levels would be recalculated. Thus, the military manpower reductions associated with outsourced support functions are not limited to the unit in question.

It is possible to visualize a version of TFMMS (tied to AMDs) that allow such calculations to be done quickly, cheaply and accurately. However, it is unlikely that the manpower data bases can provide such services. The extent to which the AMDs of operational units are explicitly tied to the AMDs of their supporting units is not clear. Likewise, it is not clear the extent to which changes in AMDs are explicitly tied to the TFMMS. (Determining the current state of such linkages would be an interesting topic for further research, but is beyond the scope of this particular project.) Moreover, data bases as MIS support tools are no better than the raw data given them. Unless capabilities are exercised, it is likely the necessary information is either inaccurate (not having been checked through actual use) or simply missing. An expert source

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[38] Some suspension of disbelief is requested. It's unlikely that current Navy policies or existing legislation would permit outsourcing in this form. The example is chosen for expository clarity. It's possible to choose an example further from the tip of the proverbial spear and make the same point, but with perhaps less clarity.

characterizes this process as a sort of "trickle down" effect from one activity to another, even with major changes, and a process that does not take place automatically.[39]

What is clear is that the TFMMS, AMDs and related data sources are not intended for the purpose of "what if" excursions based on changes in the scale of unit missions. As the Instruction makes clear, they are specifically designed to track unit manpower requirements bottom-up; they are also intended to reflect the top-down allocation of resource constraints (such as end-strengths) against those requirements. As such, they are well designed for purposes such as supporting inputs to resource allocation processes (in the case of PPBES) and providing data for reports requested by the Congress.

3C. Outsourcing Methods

3C.1. A-76 Process

OMB Circular A-76 documents policies of the US Government for the "performance of commercial activities."[40] It requires activities which government personnel perform to be classified as "commercial" or "inherently-governmental." All activities in the latter category are to be performed with government personnel (organic assets). Activities in the former category are "subject to the forces of competition."

A sorting between the commercial and inherently-governmental activities is detailed in Attachment A (Inventory Process). Attachment B specifies (to a fair level of detail) the process for competition (Public-Private Competition).[41] Attachment C contains rules and procedures for calculating costs (Calculating Public-Private Competition Costs).

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[39] Based on conversations with CDR William Hatch, USN (now retired).

[40] This discussion borrows heavily from the Circular, version of 29 May 2003, and the Powell thesis.

[41] Actually, at least two competition processes—the streamlined process is discussed in Attachment B, Section C; the standard process in Section D.

The Process in Brief

The standard competition process consists of a number of stages, which can be summarized as the following:[42]

1. Inventory agency activities, classify them as commercial or governmental, and determine how the competition(s) are organized ("bundled").

2. Announce intention to undertake an outsourcing study, both to the affected government work force and to potential commercial sources.

3. Develop and announce the terms of the competition to include expectations (Performance Work Statement, PWS), various study teams, and a quality assurance plan (QASP). Criteria for source selection are also specified.

4. Issue a solicitation, or Request for Proposal, seeking bids from the commercial sector.

5. Develop the in-house alternative (Most Efficient Organization). This consists of a management plan, cost estimate, performance plan, and transition plan. This alternative is one of the finalists.

6. Compare the Most Efficient Organization (in-house) with the qualified commercial proposals (outsourced) generally in terms of cost of meeting the terms of the PWS.[43] (However, the contractor's proposal must meet a minimum cost differential: 10 percent, or $10 million (whichever is less).)

7. Award the contract (issuing agreement), after appeal if applicable.

8. Transition to the in-house organization (if applicable) or to the winning commercial source.

9. Conduct post-award contract administration (if applicable) and quality assurance.

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[42] Stated in A-76, Attachment B, displayed visually in Figure B2. Stevens provides an excellent comparison of the current version of A-76 with its predecessors.

[43] There are provisions in A-76 for possibly not selecting the lowest-cost alternative ("tradeoff" source selection). This section is based on discussions in the Circular, and the Powell thesis.

The Essentials of the Process

The provisions of A-76 are not formulated with organic vs. contractor support of new systems in mind. However, the essentials of the process provide useful benchmarks, regardless of the outsourcing decision at hand. These essentials are listed below:

1. Fully understand the context of the decision. The performance of the activity in question affects capability (perhaps directly) and the performance of other organizations. Performance categories and impacts of that performance should be carefully and specifically noted. In the A-76 process, this is embodied in the Performance Work Statement.

2. Fully develop the relevant alternatives.

3. Specify the consequences of selecting each of them. In particular, A-76 provides guidance for determining full costs of the alternatives.

4. Assess the consequences. The A-76 base case for comparison and assessment is cost of meeting the standards of the PWS.

5. Make a decision and implement it. This phase includes awarding the contract or issuing an agreement. It also includes any appeals, and actions associated with executing the PWS with the chosen provider.

3C.2. An Outsourcing Risk Assessment Method

The Powell thesis proposes a method for managers to assess the risks associated with a proposed outsourcing action. Basically, aspects of the new relationship are related with a stoplight scheme. For example, if there is a high degree of asset specificity involved, there would be a red light in that category, and a higher degree of risk is indicated. Powell intended the light scheme to increase visibility of areas where management attention is important, and where managers ought to focus their risk-reduction efforts.

That application is certainly valid, but there's another wrinkle. The study of Transactions Cost Economics indicates that risk-reduction measures (even if highly effective) are not risk-elimination panaceas. Accordingly, one can expect an overall

outsourcing action with a large number of assessed red and yellow lights will be more costly and risky during its execution, even with due diligence in risk reduction.

What follows is a variation of Powell's stoplight scheme.

a. ***Asset Specificity.***

RED. Source becomes specialized, with no close substitutes or competitors readily available. Example: only qualified supplier for a specific, highly-specialized task—such as suppliers of spare parts for aging weapon systems.

GREEN. Routine (non-specialized) goods or tasks; competitors or close substitutes readily available. Example: purchase of standard commercial items, such as paper clips and other office supplies.

b. ***Complexity.***

RED. A large-scale task covering a large geographic area. Complexity of task severely limits qualified bidders. Example: large-scale, complex IT support; such as NMCI.

GREEN. A simple, routine task or standard product. A large number of qualified bidders. Example: office supplies.

c. ***Length of Relationship.***

RED. A long-term relationship, which strains ability to foresee problems during original contract negotiations. Complexity and asset specificity exacerbate this problem. Example: IT support, such as NMCI.

GREEN. Outsourcing is a one-time transaction, or can be structured as a series of one-time transactions. Example: purchase of office supplies.

d.   *Frequency.*

RED. Specialized, complex task or service from which there is significant learning-by-doing. Incumbent contractor has significant competitive advantage over potential competitors. Example: contract maintenance for specialized aircraft, such as E-4s.

GREEN. Routine, standard task, service or product, in which a number of firms have significant expertise. Example: copy machine repair.

e.   *Time Sensitivity.* (added)

RED. Quick performance of task or delivery of product is essential for satisfactory performance. Example: repair of combat aircraft, or warship subsystems.

GREEN. Quick delivery of products or accomplishment of task is not essential for satisfactory performance. Satisfactory performance can include some delays. Example: copy machine repairs.

f.   *Operational Significance.* (added)

RED. Unsatisfactory performance significantly degrades operational capability or compromises safety. Example: repair of combat aircraft or warship subsystems.

GREEN. Unsatisfactory performance involves, at most, administrative inconvenience and longer time to accomplish routine tasks. No compromise of operational readiness or safety. Examples: delays in copy machine repairs and temporary lack of office supplies.

Chapter 4. Recommendations for Program Mangers

As noted, one significant problem facing the Services and Program Managers is the mandate to develop analytical methodology for Business Case Analyses. This essay has discussed some of those foundations—starting with theoretical methods and proceeding to the practical manifestations in a defense environment.

Overall, the analytical tool box is certainly not empty. However, it's also not full and probably not stocked to minimum essential levels. Basically, it appears theoretical methods have not yet been translated into practical methods suitable for defense managers and the acquisition work force. There is good reason to believe that fulfilling the analytical methods mandate will entail additional work.

Interim Thoughts on Assessing Organic vs. Contractor Support

Waiting for analytical study completion can result in long program delays. Waiting for a fully-satisfactory analytical foundation for those studies can similarly result in eternal program delays. This report, therefore, offers some recommendations for BCAs done in the interim.

A useful starting point for assessing contractor vs. organic support alternatives is the framework contained in OMB Circular A-76. A-76 and supplementing directives arguably do not apply to development of Product Support Strategies. [44] However, they do contain a useful framework for this particular variation of the outsourcing decision. That is, even if A-76 is not an applicable directive for Product Support Strategies, Product Managers can likely profit from considering the provisions of A-76 as a source of advice. Accordingly, the following suggestions are offered.

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[44] To quote an old saying, however, determination is above this observer's pay grade.

1. Get the objectives straight. If in doubt, over-invest in the Performance Work Statement, or whatever analog is used.[45]

2. Thoroughly develop the alternatives. This includes careful consideration of the following questions:

   a. What's the best process for developing a contractor-based support function?

   b. Will the organic alternative be based on business-as-usual, perhaps using existing manpower requirements? Or will it be some variation of the Most Efficient Organization?

3. Carefully assess the alternatives. For organic vs. contractor support, this includes the following considerations:

   a. How will the manpower effects for activities supporting the outsourced functions be considered? It appears the current manpower data system is not designed to compute these "what if" estimates in reasonable amounts of time or at reasonable degrees of accuracy. It's recommended instead that BCAs include some rule of thumb, such as a 15% overhead rule.[46]

   b. In assessing organic manpower costs, what percentage of manpower requirements will be supported with an authorization?[47] If there's no authorization, there's no fill and no expenditure of resources.

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[45] Term from A-76.

[46] From discussions with Commander Hatch.

[47] For example, about 93% of at-sea surface warfare requirements are supported with authorizations. There's a seemingly separate, but related, issue for outsourcing actions that affect at-sea military personnel authorizations. What happens to the associated shore authorizations maintained to provide a rotation base? Should their functions also be outsourced?

c. Be sure to consider transactions costs and risks associated with the contractor-support alternative. One reasonable approach to assessing both costs and risks is using Powell's stoplight scheme.

Proposal for Consideration

As stated above, there's considerable reason to believe the analytical framework for BCAs is incomplete, due more to the availability of practical rather than theoretical foundations for that analysis. Therefore, the following proposal is worth some consideration.

First, assemble an interdisciplinary team with knowledge of underlying theoretical foundations, DoD institutions, and Navy needs. Obvious places to look for such individuals include AFIT, CNA, IDA, LMI, NPS and RAND. Second, involve these researchers as consultants in actual BCAs in order to improve the BCAs themselves, but also to advance needs analyses for the analytical foundation. Third, assemble a case study and lessons-learned literature based on this experience. Fourth, identify and fund research into applications of basic theory to BCAs, with a view to developing analytical templates. Finally, translate those templates into practical instructions for acquisition professionals.[48]

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[48] The Powell thesis discussed in Chapter 3 above is one useful example of translating theory into a significant part of a template useful for outsourcing and PSS decisions.

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