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**Examining the Institutional Factors
Affecting Cost Growth in Defense Acquisition
May Yield More Effective Policy Interventions**

30 July 2009

by

Philip J. Candreva, Senior Lecturer
Graduate School of Business & Public Policy
Naval Postgraduate School

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Prepared for: Naval Postgraduate School, Monterey, California 93943



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The research presented in this report was supported by the Acquisition Chair of the Graduate School of Business & Public Policy at the Naval Postgraduate School.

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Abstract

Existing studies of cost growth in defense acquisition have been predominantly descriptive rather than explanatory. While observers of defense acquisition acknowledge the role of cultural and institutional factors on program performance, few studies are focused there. However, recent studies have highlighted the importance of decision-making by government officials as a factor affecting cost growth. Informed by the literatures on cost growth, behavioral finance, group decision-making, and organizational failure, this report proposes a research stream to consider factors affecting cost growth beyond those traditionally studied. The study suggests that Ostrom's Institutional Analysis and Development framework can be the foundation of a research stream that includes both field studies and laboratory/computational experiments that can provide fresh insights into the cost growth phenomenon and—more importantly—aid in the design of more effective policy interventions to address the problem.

Keywords: cost growth, defense acquisition, program performance, behavioral finance, group decision-making, organizational failure, Ostrom's Institutional Analysis and Development framework



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Acknowledgements

This paper was made possible by a grant from the academic year 2009 Naval Postgraduate School Acquisition Research Program.

The contribution of graduate student assistant Lieutenant Commander Monica Agarwal is appreciated.



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About the Author

Philip J. Candreva, Senior Lecturer of Budgeting and Senior Associate, Center for Defense Management Research. Phil is a "pracademic" with over two decades of practical experience supporting several years of teaching and research. He is a retired naval officer who earned subspecialties in financial management, acquisition and information technology management. He is a 1996 graduate of NPS and he has been part of the school's budgeting faculty since 2002. He is a senior associate in the Center for Defense Management Research where his work focuses on the areas of budgeting and accounting reform, performance management, the role of the Chief Management Officer in DoD, and the recent presidential transition. His research sponsors have included the office of the Chief of Naval Operations and the Defense Business Transformation Agency. Phil has authored and published about two dozen articles, technical reports, and book chapters; his work has appeared in *Armed Forces & Society*, *International Public Management Review*, *Public Administration Review*, and *Public Budgeting & Finance* and other journals.

Philip J. Candreva
Graduate School of Business and Public Policy
Naval Postgraduate School
Monterey, CA 93943-5000
Tel: 831-656-2884
Fax: (831) 656-3407
E-mail: pjcandre@nps.edu



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Introduction

The US defense department suffers from persistent, but not certain, cost growth within major acquisition programs. Over the past few decades, scores of empirical studies have examined the causes and consequences of cost growth and have shed light on characteristics of programs that fail to meet cost performance goals. They have looked at factors such as the size of the program, its phase in the development cycle, the type of weapon being purchased and organizational structure. Other studies have taken a more qualitative view—considering the interplay of actions within a program office and between a program office and its environment. Both types of studies have provided countless recommendations to fix defense acquisition. Yet, problems persist. Twenty-first century shipbuilding, for example, suffers some of the same challenges described in Ian Toll's account of building the 18th century navy in his book, *Six Frigates*: rising material costs, labor shortages, inaccurate estimates, unproven technologies, requirements creep, decisions based on politics instead of economics or national security, reduced procurement quantities, sliding schedules, and occasional mismanagement. Those factors often result in cost growth. Given the materiality of the problem (i.e., hundreds of billions of dollars), the number of times it has been studied, the attention of the highest levels of government, and the myriad rules that have resulted in attempts to reform acquisition, two questions motivate the present study: Why does the problem persist? What have the studies and policy prescriptions missed?

In search of an answer, this study proposes a fresh line of research that combines field work with laboratory and computation experimentation employing a framework that considers variables beyond those traditionally used. Through a mutually supportive set of studies that combine the realism of field studies with the ability to rigorously test hypotheses through models in computational and laboratory experiments, considering new factors, policy makers may gain fresh insights on the problem with an eye toward more effective policy interventions.



Before describing that line of research, it is first necessary to examine its theoretical foundations. First, the cost growth literature is summarized. Two recent and important deviations from the norm of those studies will be examined in more detail as they focus less on the acquisition program and more on the decisions made by officials about the program. These deviations led to a review of the literature regarding individual and group decision-making, specifically as related to public budgeting and financial decision-making. Budgeting is central because cost growth is manifest by the allocation of financial resources to a program over time. This study was also informed by the literature on the dynamics of failure in large organizations. In sum, this is not simply a look at decision-making; it is a look at decision making about financial resources that persistently leads to undesirable outcomes.

After reviewing the literature, a framework for analysis is presented that will guide future research toward potentially explanatory factors that have not been explicitly considered in prior studies. Specifically, those factors relate to institutional and cultural forces that affect decision-making. The framework is then applied very broadly to the dynamics of defense acquisition in order to illustrate the framework and highlight additional factors. The paper concludes with a recommendation for a set of studies that would apply the framework at more appropriate levels to generate and test hypotheses that will lead to greater understanding of the dynamics within specific programs or decision contexts. It is through an increased understanding of the dynamics of this complex adaptive system that policy interventions can be conceived, designed, tested and refined before they are enacted. Better designed policy interventions should improve acquisition outcomes.



Toward a New Way to Study Defense Acquisition

Before the McCain-Levin “Weapons Systems Acquisition Reform Act of 2009” (S.454) was introduced in February of 2009, the Government Accountability Office (GAO) assessed the likely efficacy of the proposed reforms and concluded, “Our discussions with acquisition experts indicate that these changes may not achieve the desired improvement in acquisition outcomes unless they are accompanied by changes in the overall acquisition environment, its culture, and the incentives provided for success” (2009, p. 2). Two things are important to note: first, the environment, culture and incentives are salient moderating factors; second, acquisition experts already know about such factors. Interestingly, those factors have not been adequately addressed in cost growth studies.

Cost Growth

Scores of studies over the past two to three decades have sought to understand the causes and consequences of cost growth in defense acquisition programs. As a result, a great deal is known about aspects of the problem. Studies have examined whether the size of a program is germane (Coleman, Summerville, DuBois, & Myers, 2000; Dameron, Pullen, Summerville, Coleman, & Snead, 2001; Arena, Leonard, Murray, & Younossi, 2006). They have studied growth within Selected Acquisition Report categories and other taxonomies, such as estimating errors, inflation, and engineering changes (Eskew, 2000). Studies have looked at differences in cost growth across types of weapons systems, for example aircraft and missiles (Dameron et al, 2001) (Younossi, Arena, Leonard, Roll, Jain, & Sollinger, 2007). Other studies have looked at the point in the development cycle when cost growth tends to occur—whether it is more an R&D issue or a production issue (Coleman et al., 2000) (Tyson, Harmon, & Utech, 1994) (Younossi et al., 2007). Organizational structural issues such as reporting relationships (Kadish et al., 2006), centralization of authority (Dillard, 2004), and knowledge flows (GAO, 2008) have also been considered.



Extant cost studies have been overwhelmingly descriptive rather than explanatory. Knowing that more growth occurs during R&D than production is helpful but does not explain why. Knowing that aircraft programs suffer more growth than missile programs may suggest more management attention be placed there, yet that knowledge has not improved outcomes. With few exceptions, studies of cost growth in defense acquisition have adopted the foundational assumptions of economics or systems engineering. When the analyst approaches the political, institutional, social, or psychological dimensions of the problem, those issues are assumed away and left for further research or defined as outside the bounds of the study. When the social issues have a salient effect on the conclusions, they are addressed but not sufficiently analyzed. A notable example is the 2006 Defense Acquisition Performance Assessment (DAPA) Report, which asserts a “conspiracy of hope” among the actors in acquisition (Kadish et al., 2006). This “conspiracy” was a major influence on the present study: what is it, how does it work, why does it exist?

Two recent studies, however, have taken a slightly different approach to the cost growth phenomenon and offer new insights. RAND looked beyond the traditional cost categorization studies in an attempt to understand underlying causes (Bolten, Leonard, Arena, Younossi, & Sollinger, 2008). Using Selected Acquisition Reports (SAR) from 35 major weapons programs, the authors abandoned the SAR taxonomy and analyzed the supporting documentation to determine underlying causes of the cost growth. They found that two-thirds of cost growth could be attributed to decisions made by government officials. Those decisions concerned questions of affordability, and changes to resources, quantities, requirements, and schedules. Their report provides an important insight, but while the study identified the content of decisions, its design cannot answer the more important question, why were those decisions made? And, from that, under what conditions could better decisions be made?

The second study considered projects outside the defense establishment. Flyvbjerg and his colleagues examined cost growth in public works projects and



identified psychological and institutional biases in the estimates and decisions to fund the projects (Flyvbjerg, Holm, & Buhl, 2002; Flyvbjerg, Holm, & Buhl, 2004). They noted two forms of bias: psychological biases of the type explained in the work of Kahneman and Tversky (to be considered below), and political biases. Flyvbjerg charged that officials misrepresented project costs in an effort to seek approval of the projects. That is, they deliberately presented underestimates of the cost of the project. Flyvbjerg uses the term “strategic misrepresentation,” a term previously used in studies of public budgeting (Jones & Euske, 1991). Jones and Euske note that strategic misrepresentation “is a contingent strategy responsive to a system of rewards in a highly competitive game where resource constraints are present” (1991, p. 437). The word “strategic” is important to consider here. These officials are making a deliberate decision to lie because they believe it is an appropriate strategy given their context and perceived payoff. What is it about the context, the payoff, and the norms of the institutions these decision-makers find themselves in that result in such behavior?

Decision-making Behavior

There are two literatures regarding decision-making that pertain to the issue at hand. The first concerns the non-rational behavior commonly and consistently found when people make financial decisions. The works of Kahneman and Tversky (1979) and Thaler (1999) are germane. The second literature concerns group decision-making processes, and the works of Simon (1960), March (1994) and Jones (2001) are germane.

Kahneman and Tversky’s prospect theory (1979) provides a descriptive view of human decision-making that consistently and predictably deviates from the rational utility-maximizing assumptions of many economic models. In summary, people are more attentive to changes in wealth than its absolute value; they are more likely to accept risk in a potential financial gain than they are in potential losses. That is, at the same dollar amount, losses hurt more than gains please. Such



natural biases affect the manner in which problems are framed, which in turn affects decisions.

Thaler's mental accounting research (1999) demonstrates that people categorize and evaluate financial events in a manner that defies the assumption of fungibility of money. Financial events are believed to have both acquisition value (the value of the money involved) and transaction value (the emotional value of the event—the "good deal"). It is such mental accounting that results in non-rational behavior such as spending "found money" (i.e., the unexpected \$10 bill in a jacket pocket) more frivolously than \$10 deliberately withdrawn from a savings account.

From Kahneman and Tversky (1979) and Thaler (1999), we know that actual financial decision-making often defies the tidy logic of conventional economic studies. Since human nature is predictably non-rational, policy interventions can be designed to exploit those tendencies. Such is the point of Thaler and Sunstein's recent bestseller, *Nudge* (2008). There is no reason to believe decision-making related to defense acquisition is immune from such tendencies.

Not only are individuals prone to non-rational decisions regarding financial matters, they are also boundedly rational. That is, the assumption of perfect information common in economic models—all relevant information is available, there is infinite information processing capability, and decision-maker preferences are self-interested, known, and stable—are relaxed based on the knowledge that such assumptions simply are not true. Decision-makers do not have all available information: they have limited attention spans and processing capabilities, their desires are not necessarily stable, and they often act in the interest of others, even altruistically. Beach and Connolly (2005) demonstrate the effects of heuristics, framing, biases and emotions on decision-making. They find that within groups, individual limitations are not necessarily overcome and members of the group influence each other.



In his work on organizational decision-making, March (1994) advances the idea that in certain contexts a good decision is measured not by the outcome but by the appropriateness of the decision. Decisions are made not through a logic of rational choice or a logic of consequences but through rule-following and the pairing of an understanding of appropriateness to the specifics of the situation. Often in public administration, appropriateness is paramount. Means become ends in themselves. What others think about one's actions cannot be so easily dismissed, as evidenced by ethics rules concerning the "mere perception of impropriety." Appropriateness adds a moral dimension to decision-making that utility maximization does not thereby affecting the criteria by which decisions are made, the perceived payoffs of alternative decisions, and the information gathered and considered. In group decision-making situations, especially when members of the group represent different sets of values, there are inconsistencies in decision criteria, power struggles, coalitions, and compromises (March, 1994).

Bryan Jones (2001) applies these concepts of decision-making (along with evolutionary biology) to public policy. Humans, and the organizations in which they play a role, process information from their environments and take action. In order to act, they must attend to the information, interpret it, and devise a strategy on which to act on it. Attention is dichotomous—one either pays attention or does not—so the amount of information is limited and some form of selection or filtering must occur. Only the most salient information should be attended to. What is salient depends on the decision-makers, their experience, heuristics, and the role they play. The quality of the interpretation of the information is a function of the knowledge of people, their cognitive abilities, and the biases already noted. The strategy is affected cognitively by expected outcomes, but it is also shaped emotionally by institutional norms, rules, and customs. Strategies may include strategic misrepresentation, as noted earlier. Thus, any two individuals confronted with the same information, in the same context, will not necessarily arrive at the same decision. The differences are likely to be more pronounced when the volume of information increases, the complexity or uncertainty of means-ends causal chains increases, the various institutional forces are



ambiguous or contradictory, and if there are repeated decisions in a recurring process (Jones, 2001).

Where behavior tends to be more idiosyncratic, organizational rules, procedures and routines provide some consistency. Too much consistency can be problematic in a changing environment, so the paradox of organizations is that they must be routine based and flexible at the same time. A major source of flexibility is the adaptability and heterogeneity of its members.

At this point it is vital to ask whether defense acquisition is afflicted by boundedly rational, heterogeneous programs and could those contribute to cost growth? Apparently so. A recent GAO report concluded, “The uniqueness of each program, the lack of sufficient knowledge about system requirements, technology and design maturity, and the limited analytical tools available are often cited as factors that contribute to optimistic forecasts of development costs” (2009, p. 13).

Persistent Failure in Organizations

In addition to the limitations of past cost growth studies and the nature of group decision-making, a third major influence on this study is the literature regarding persistently failing organizations. By one definition, such organizations are those in which the official goals of sponsors or owners are not accomplished (Meyer & Zucker, 1989). Cost growth in defense acquisition meets that definition. Meyer and Zucker wondered how it could be that an organization survives for many years despite failing to meet those goals. Using a broad approach employing social movement theory, strategic management, agency theory, and transaction costs, they conclude that an organization’s performance need not determine its survival, provided there are sufficiently powerful actors whose interests are served more by the presence of the organization than its performance. It is reasonable to expect a similar dynamic affects some acquisition programs and the pattern of behaviors described by Meyer and Zucker may be present in troubled defense acquisition programs.



Bissell's (2008) study of public bureaucracy failure—not unlike past studies of defense acquisition—notes a tendency to overlook the socio-cultural elements of government work. His study cites a tendency to adopt technocratic and rationalist perspectives when debating policy, while “failing to consider the conflicts, contradictions, and counter-intuitive outcomes that are inherent in planning in complex situations” (2008).

Gailey and Lee (2007) studied the assignment of blame for deviance in organizations through a sociological perspective. They suggest that studying deviance (cost growth is a form of deviance) includes both an examination of the intent of actions and the selection of an appropriate level of analysis. Vaughn (2007) and Yeager (2007) note that culture is the mediating mechanism between macro levels (i.e., societal, constitutional), meso levels (i.e., organizational, policy) and micro levels (i.e., individual, operational) of analysis. That is, human behavior is situated among these forces and intent, or sense-making, is affected by considerations at all levels.¹ Cultural norms and beliefs determine appropriateness (using March's (1994) word) and may normalize deviant actions: “culture redefines deviance so that it appears to be conformity” (Gailey & Lee, 2007, p. 541). For example, examinations of the Challenger space shuttle disaster and the Tuskegee syphilis studies reveal cultural orientations of technical rationality and routinization of operations lead to a moral blindness in business decisions. In such situations, achieving a technical solution can become paramount, and the associated social costs are undervalued. Resolving deviance in an organizational context requires remedies that affect the culture and not solely the behavior (Gailey & Lee, 2007).

In an attempt to understand the multi-layered cultural influences on organizational failure, Collier (2002) drew on the Institutional Analysis and Development framework of Ostrom and her colleagues in a study of corruption. Like

¹ The techniques in the stream of research proposed in this paper are particularly well suited to analyzing the various levels of action affecting defense acquisition outcomes.



cost growth in acquisition, corruption is a form of organizational failure that diverts resources from more beneficial uses, distracts attention, and ultimately affects the security of the state. Like defense acquisition, corruption had been studied at length, without considering the interplay of economic, cultural and political forces. The IAD framework enabled Collier “to combine several seemingly unrelated theories of political, economic, and cultural behaviors into one interdisciplinary social theory” (2002, p. 25). He was able to offer a mid-level theoretical explanation of corruption and to identify several social phenomena that warrant further study on an individual and interactive basis. He also identified reasons why it is so difficult to uproot corruption. Inspired by Collier’s work, this paper suggests a similar path to understanding cost growth in defense acquisition.

Integrating these literatures, it is apparent that perfectly rational decision-makers who always seek to obtain the optimal outcome as decided by competent authority are lacking; rather, boundedly rational people making decisions that are sometimes goal-seeking and sometimes appropriate are prevalent. Decisions about financial matters are prone to known biases that very well may affect the quality of decisions about defense budget allocations. The decisions reflect strategies affected by explicitly understood organizational rules and implicitly understood institutional norms and customs. In certain contexts, those rules, norms and customs are well aligned and the organization (acquisition program) achieves a successful outcome. In other contexts, the rules, norms and customs may have created an environment in which cost growth becomes acceptable or inevitable. A conscious (or unconscious) “conspiracy of hope” ensues and the program fails to achieve a major goal. The remedy for such a problem cannot be found solely in rational, technical approaches but must attend to the institutional factors.



A Promising Framework

How does one, then, seek to understand this relationship between the decision makers, the organization, its context, and institutional cultural concerns? As Frederickson and Smith (2003) stated, “in simplified form, institutionalism sees organizations as bounded social constructs of rules, roles, norms, and the expectations that constrain individual and group choice and behavior” (p. 71). After considering several views of institutionalism, the neoinstitutional work of Elinor Ostrom, fits best. Her Institutional Analysis and Development (IAD) framework (used by Collier (2002) in his study of corruption) is described in more detail later in the paper, but, in short, it considers “action arenas” composed of both an action situation and actors. The action situation involves “participants in positions who must decide among diverse actions in light of the information they possess about how actions are linked to potential outcomes and the costs and benefits assigned to actions and outcomes” (Ostrom, Gardner, & Walker, 1994, p. 29). While the model allows the actors to meet the criteria of self-interested agents who have stable and certain preferences and optimizes their utility using perfect information, the actors can also be acknowledged to have varying preferences, bounded information processing capabilities, and not entirely self-interested decision criteria that may even be altruistic—in addition to bringing unique resources to bear on the problem. These action arenas are not situated in a sterile context, but are affected by the attributes of the environment, attributes of the communities within which the actors identify, and institutional norms. Within the action area, patterns of interaction result in outcomes that can be evaluated based on some criteria (Ostrom et al., 1994). See Figure 1.



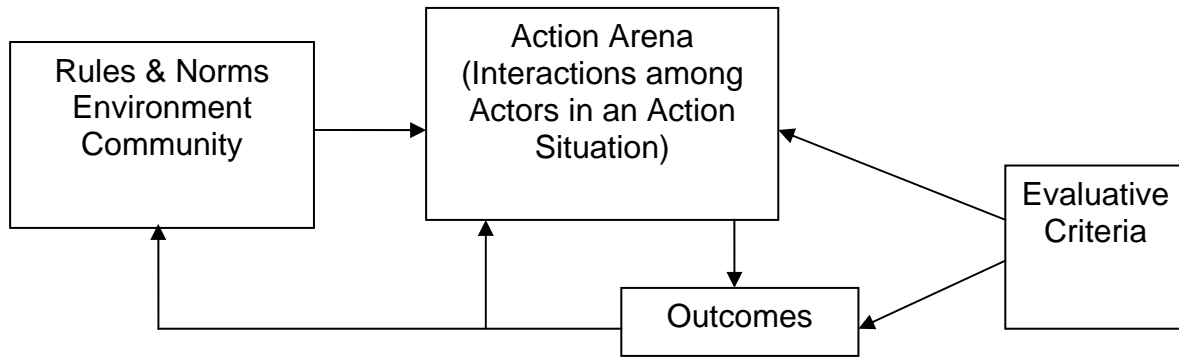


Figure 1. Overarching View of IAD

It is immediately apparent that the IAD framework considers factors that have not been a formal part of prior defense acquisition cost growth studies. But is the framework appropriate for defense? In the literature review of organizational failure, it has been successfully applied to one type of government failure. More commonly, the IAD framework has been used to explain the management of common pool resources. Appendix 1 makes the argument that the defense budget is a common pool resource. Since cost growth is fundamentally about comparing the amount of funding provided to an acquisition program at a minimum of two points in time, the allocation of funds from the pool of available dollars is the central concern.

Conclusion

In this paper, I argue that the application of Ostrom's IAD framework to the phenomenon of cost growth in the Department of Defense has the potential to yield recommendations for policy interventions that will improve acquisition outcomes. This is a conceptual paper, not an empirical one, and so I recommend the concepts be tested empirically. I recommend a campaign of empirical research and base that recommendation on an illustrative analysis of recent studies of defense acquisition employing the IAD framework.



The Institutional Analysis and Development Framework

Why a Framework?

There is no theory that explains cost growth in defense acquisition. A theory asserts an underlying reality concerning an observed class of phenomena. Kahneman and Tversky's (1979) prospect theory is an example, as is March's (1994) organizational decision-making. Theories help explain phenomena by telling why a condition came to be or what factors moderate that condition. To understand the causes or conditions that create cost growth in defense acquisition, a new theory may be created or the boundaries of existing theory may be addressed. To do so, the phenomenon must be approached in a structured manner that allows the researcher to isolate and observe the variables believed to be relevant. Here is where a framework is helpful. Frameworks are like maps in that they abstract reality with the purpose aiding navigation by means of a directive function (Shields & Tajalli, 2006). In the present case, a researcher will use a framework to ensure the necessary and sufficient elements of an institutional analysis are considered. The framework provides a list of variables (including interactions between variables) and can generate the required questions when an analysis is conducted. It allows the research to be categorized into individual, manageable sections.

Once the framework is populated with specific data, a model may be constructed. To illustrate, a framework of aircraft flight includes concepts like lift and gravity, drag and thrust, and the operation of elements such as wings and tails. The framework is based on theories of physics and fluid dynamics such as Bernoulli's principle. A model is a representation of a particular aircraft; the wings may be fixed or rotating depending on the particular arrangement of the variables. The values assigned to variables in the framework may be adjusted, guided by theories, on a specific model to predict (or verify) what is to occur. Engineers do this in computer-



aided design of mechanical systems. It is also possible to do with organizational design and social systems.

The last section of this paper describes how some organizational behavior and decision-making theories that were covered in the literature review could be tested for their ability to explain behaviors that affect cost growth in defense acquisition. Before getting there, this section will present the framework for analysis.

Institutional Analysis and Development Framework

The Institutional Analysis and Development (IAD) framework assumes that all social interactions can be viewed as composed of the same set of elements, whether they are economic markets, political organs, community or fraternal groups, hierarchical organizations, or sporting events. The IAD framework neatly mirrors the variables commonly used in game theory and organizational simulations (Ostrom et al., 1994), thereby allowing a researcher to perform structured exploratory and grounded research in the field and then to bring those findings into a laboratory or computational setting for hypothesis testing. Figure 2 (p.16) and Figure 1 (p. 12) summarize the elements of the framework.

The focal point of the framework is the action arena, which consists of actors who interact in an action situation, affected by exogenous factors. The action situation consists of seven elements: actors, roles, actions, outcomes, a production function that links actions to outcomes, information, and payoffs. Individual actors serve in roles. It should be noted that in a complex action situation, an actor may serve in more than one role, and actors normally serve in several roles across different action arenas. Within those roles, actors act and rules define the possible and appropriate actions. Depending on the level of analysis, the actors can be an individual, a group of individuals, or a social construct such as an organization or social system. There is a body of information available to all actors in the action arena, should they choose to access it. Actors are characterized, in part, by their individual ability to gather and process information. The interplay of actions by the



actors results in some outcome that has an associated payoff for each actor. The ex ante expectation of a payoff affects the strategies employed by actors; the ex post realization of payoffs is information that may influence strategies if there are subsequent occurrences of the action situation. The outcome is evaluated according to some criteria on an individual or collective basis. When dealing with common pool resources, the criteria may be related to economic efficiency, it may be related to distributional equity, it may be related to a moral imperative, it may be a question of accountability, or it may facilitate a desirable institutional attribute such as flexibility (Ostrom, 1999). Action situations may occur once, a defined number of times, or an indefinite number of times. Repeated situations have bearing on strategies employed by actors, information flows, outcomes and payoffs. An action situation is much like an N-player Prisoners' Dilemma game.



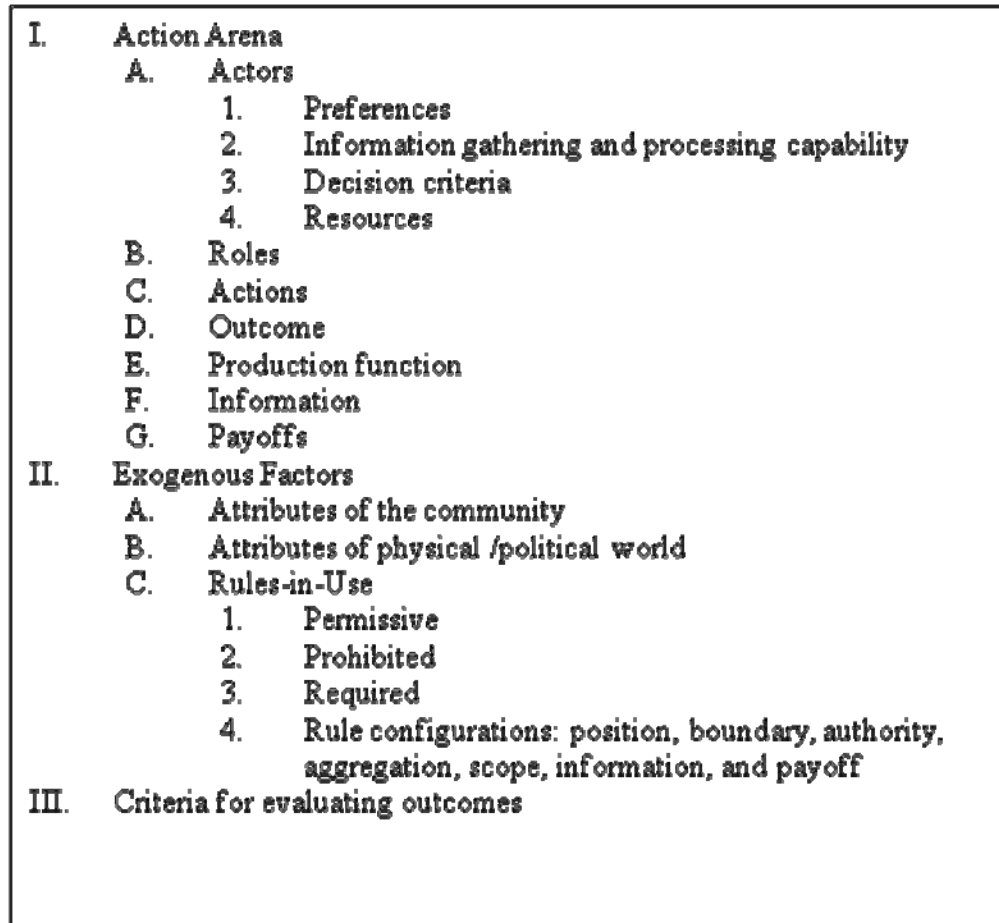


Figure 2. Elements of the Institutional Analysis and Development Framework

The actors in the action situation have four characteristics. First is their information gathering and processing capabilities, bound by their experience, expertise, and capacity. Depending on the actor, some information will be salient while other information is “noise.” Second, the actors are characterized by a set of preferences. They may be utility-maximizers or they may be satisficers; they may be risk-tolerant or risk-averse; they may prefer to cooperate or compete; they may value different outcomes in different ways. Third, actors employ decision criteria to select a course of action. Those decision criteria may vary in their degree of rationality or may be subject to some of the biases presented earlier. They may employ heuristics and simple frameworks or they may employ more sophisticated criteria. They may decide based on appropriateness or based on outcome. Finally, actors bring resources to a situation. In the common pool resource studies, the actors’ resources



may be fishing boats or groundwater wells; in a public policy arena, it may be empirical analysis or political leverage. The combination of the actor's characteristics and the characteristics of the action situation determine the actor's strategy at a given point in the scenario.

It was noted earlier that there are external factors affecting the action arena. Those include rules-in-use, the attributes of the community, and the attributes of the physical world. Rules-in-use or "working rules" are those that are actually considered when taking action. Ostrom describes them as "the set of rules to which participants would make reference if asked to explain and justify their actions to fellow participants" (1999, p. 51). Thus, rules-in-use may not conform to the formal standard operating procedures, regulations, and laws that are supposed to drive behavior; instead, they are the rules informed by such formal prescriptions, but modified by the norms of the community or communities the actor represents. In an acquisition context, rules-in-use capture not what the regulations say a program manager should do, but what CAPT John Doe—a naval officer, an aviator, a member of a particular systems command and PEO, who happens to be a program manager—thinks ought to be done. The actor's assessment of the expected payoff of an action includes any rewards for following rules and sanctions for violating them.

Rules come in three basic forms: those that prohibit action, those that require action and those that permit action. There are also seven types of rules, according to Ostrom (1999): rules for exit and entry, position, scope, authority, aggregation, information, and payoffs (1999, pp. 52-53). As the aim of this paper is to improve acquisition outcomes through effective policy interventions, policy-makers would be well-served to understand the various types of rules and how they impact the choices of actors.

Further affecting the action arena are the characteristics of the physical world in which, and about which, the actions take place. These attributes determine what actions and outcomes are even possible. For a study of the actions within



government, it may be helpful to re-label this the characteristics of the political world. Defense budgets, for example, are not solely the creation of the Defense Department, but are heavily influenced by external actors and events such as congressional budget processes and military operational contingencies.

Lastly, the action arena is influenced by the attributes of the community. It was already noted that the rules-in-use are affected by the community but so too are the strategies, preferences, and desired outcomes. The response of the community determines what behaviors are acceptable. They determine the degree of homogeneity of preferences and values among the actors (Ostrom, 1999).

A final attribute of the framework is that action arenas are interconnected. For instance, there may be a set of serially connected arenas of incremental decisions where the output of one arena becomes information available to another, changes the payoffs in another, or establishes new rules for another. The latter example is common in hierarchical organizations, such as the DoD. An action arena at a high level of the organization that determines questions of process or provides guidance on organizational objectives establishes a condition for an action arena at a lower level. Ostrom (1999) describes three levels of rule-making: *operational* rules that directly affect routine decisions, *collective-choice* rules that affect operational activities by determining who is eligible to participate and the rules for changing operational rules, and *constitutional-choice* rules that affect who and how collective-choice rules are made (p. 44). As Gailey and Lee (2007) noted, culture was a mediating mechanism between layers; the IAD framework permits such layered analysis.

The Value of the Framework

The framework is quite powerful in that it permits the application or testing of individual and group behavior theories. It permits the analysis of action scenarios across multiple layers. The interconnectedness of action arenas and rules makes the IAD framework useful to designing, testing, and studying the effects of policy



prescriptions since those prescriptions normally take the form of new collective-choice or operational rules. How does it do that? The framework facilitates the prediction of outcomes by either modeling structured, predictable situations, or by inferring outcomes from lessons learned in field research.

The framework has been successfully employed to study the management of common pool resources and, as explained in Appendix 1, the defense budget has many of the same characteristics as common pool resources. It has been used in other government applications such as the study of corruption, mentioned earlier, and to examine the allocation of health resources in state governments. There is ample evidence to suggest it should also apply to defense acquisition.

In a public budgeting context, possible research questions the framework can address include:

- Are resource allocation decisions affected by the presence of non-rational biases, such as those prospect theory would lead one to expect?
- Are resource re-allocation decisions affected by Thaler's "mental accounting"?
- What heuristics and frames are used by resource allocation decision-makers?
- What preferences do the decision-makers bring to the action arena? Do they seek increasing budgets, sufficient budgets, or balanced budgets? How do they differ among roles?
- What rules-in-use exist that contravene the prescribed rules? How is deviant behavior, such as "strategic misrepresentation," justified?
- What action arenas determine the rules for the resource allocation arena?
- What changes in strategy occur in successive rounds as knowledge of program performance increases? Does that differ if the program is successful or unsuccessful?

Given the answers to such "what" questions, researchers may explore the "how" questions, seeking to understand the underlying processes. With that knowledge policy interventions can be designed and tested. Given the knowledge of "how"



decisions are made given a set of “what,” changes to a particular “what” should affect strategies and behaviors and, ultimately, outcomes.



Applying the IAD Framework to Defense Acquisition

In practice, however, these processes and practitioners often operate independent of one another. Uncoordinated changes in each of the processes often cause unintended negative consequences that magnify the effects of disruptions in any one area. Incompatible behaviors often result because organizational values differ among process owners and participants. DAPA Report (2006, p. 5)

Introduction and Methodology

In that short passage from the DAPA Report, many of the elements of the IAD framework are present: actors, roles, interactions, payoffs, outcomes, strategies, etc. This section of the paper illustrates the framework by applying it to defense acquisition at a summary level. The actors in this illustration are not individuals; rather, they are systems: the PPBE system, the defense acquisition system, and the JCIDS (requirements) system. The action arena is the interaction of those actors and others as they determine the allocation of resources for a portfolio of acquisition programs. The arena is not a particular meeting or decision forum; rather, the process as it exists broadly.

The model is populated from the results of a content analysis of recent studies of the cost growth problem in defense acquisition. The data set included reports from the Government Accountability Office and Congressional Research Service, the 2006 Defense Acquisition Program Assessment Report, CSIS and RAND cost growth studies, the USD(AT&L) Acquisition Transformation Report, and work from Acquisition Research Quarterly. Using a content analysis software



program (QSR NVivo®), the diagnostic portions of the studies² were coded according to the elements of the IAD framework by two researchers. Coding reports were run for each element of the framework and a narrative developed from those reports. What follows is that narrative.

The Actors

Budgeting and resource allocation decisions for a given program or portfolio of programs involves interactions among several actors. This section describes those actors and, in the process, illuminates the elements of the framework associated with actors and roles: their preferences, information gathering and processing capabilities, decision criteria, and the resources they bring to bear on the actions in the action arena.

The first actor is the Planning, Programming, Budgeting, and Execution (PPBE) System. PPBE seeks to create a balanced budget; one that best meets the needs of those who define military requirements in a fashion that strategically balances current and future readiness, while conforming to fiscal guidance and appropriation law, while remaining politically viable. Consistency is an overarching virtue in budgeting and the tendency is to make incremental, not dramatic, changes from year to year. A common refrain among programmers is that “money in motion is money at risk,” implying a preference that recognizes political rather than economic bases or reallocation.

PPBE relies on many disparate and sometimes conflicting information sources. Strategy documentation and operational plans dictate the desired force structure that must be tempered with technological feasibility, programmatic executability, and funding limits. Information is considered in a multi-dimensional

² Only the portions of the studies that described or diagnosed defense acquisition were coded. Recommendations, forecasts, or policy prescriptions, were not. The intent was to gather descriptive statements that could be analyzed within the IAD framework, not to question recommendations.



space defined by military department, major force program, mission capability area/capability portfolio, appropriation, and fiscal year. Balance is sought among all dimensions, and all dimensions have dedicated sponsors or advocates except the fiscal year. Thus, there is only a diffused resistance to defer plans, move expenses, create outyear “wedges,” and draw out schedules. The DAPA Report found,

Those who hold the budget purse strings reduce annual Research Development Testing and Evaluation, Procurement, and Operations and Maintenance for Program budgets to ensure that all the acquisition funding accounts fit within the “top-line” President’s Budget. This results in causing some programs to be “un-executable” at the expense of others, essentially borrowing from one to pay for another. (2006, p. 23)

While GAO notes, “With too many programs underway for the available resources [...] DoD must make up for the funding shortfalls by shifting funds from one program to pay for another, reducing system capabilities, cutting procurement quantities, stretching out programs” (Francis, 2009, p. 6).

PPBE is calendar-driven. A timely bad decision is better than a tardy good decision. Phases overlap within a given fiscal year cycle and fiscal year cycles overlap. Preliminary work began on POM-12 before the fiscal year 2010 budget was completed, both of which affected the work of program review 2011 and the associated Quadrennial Defense Review. Because multiple budgets are in progress at varying stages of development, funding issues may be resolved in any one of them, not necessarily the one that best matches the needs of the particular program. Those engaged in the process know that mistakes may be corrected in either the next cycle or during subsequent steps of the current cycle. No budget is ever cast in iron: programs evolve into budgets into appropriations into apportionments into allocations and reallocations that are sometimes even reprogrammed.

The phases are not neatly sequential and, in many cases, are organizationally disjointed with planners, programmers, and budgeters residing in different organizations. Those planners, programmers and budgeters analyze issues in different ways, use different tools, find different information salient, and employ



different decision-making heuristics (Havens, 1983). This inhibits the quality of information flow, understanding, and integrity of the process, while increasing conflict.

To the PPBE system, success is defined by both outcomes and process. A successful outcome is a reasonably well-balanced budget that seems to meet the needs of the most salient stakeholders and one that has a high likelihood of being approved by Congress. The process is successful if the salient stakeholders' voices are heard and considered. There is a bias to support the warfighter and "rather than limit the number and size of programs or adjust requirements, the funding process attempts to accommodate programs" (Francis, 2009, p. 6).

The second actor is the Defense Acquisition System (DAS). The DAS seeks to deliver defined military capability, ideally within reasonable cost and schedule parameters. The program office is at the nexus of demands by the military requirements process, contractual relationships with the commercial sector, and resources obtained through PPBE and legislative processes.

Programs are routinely managed by individuals who have practical experience with systems similar to the one being acquired. Programs are often grouped with like programs, with oversight by senior executives familiar with those types of systems. For example, fighter aircraft programs are often managed by pilots and within program executive offices comprised of other tactical aircraft programs. Thus, a particular military department warfighter subculture influences a given program management office.

The DAS is an event-driven system, characterized by phases, milestones, and gates. The program moves to the next phase only after having demonstrated an acceptable level of progress in the last phase and only after scrutiny by a series of reviewers. Significant program leadership attention is drawn to the process of obtaining financial resources. Further attention is drawn to the external demands of



the gate or milestone process. Both come at the expense of attention paid to direct program management.

DAS programs have significant technical considerations. Many programs exist in order to obtain or maintain a competitive advantage over the nation's adversaries. Technologies are rarely mature at program initiation—posing a challenge for planners and estimators. Over time, as technology matures and desires evolve, plans adjust accordingly (Chadwick, 2007).

The program office relies on the commercial sector as their agent in developing those technologies: creating the plans, and bringing everything together into effective systems. This is a classic agency situation with conflicting goals and asymmetric information. Some of the information held by the contractor is vitally important to the program manager's efforts to obtain resources and other support.

Depending on the materiality of defense acquisition programs, they may have significant political support, divided support, or surprisingly little support. Program managers view their role as advocates and seek to maximize political support while minimizing intrusive oversight. The nation's choice to invest in an acquisition system is subject to policy analysis like any other public policy decision. In the requirements process inside the DoD, costs and benefits are measured largely in military terms; in a political setting, the calculus necessarily includes other variables and constituencies beyond the warfighter matter. In an effort to obtain requisite support, the program office becomes sensitive to those concerns.

Managing the range of costs in pursuit of the range of benefits is at the heart of program management. But, program managers also find themselves in a situation where accountability is sketchy; the link between rewards and performance is attenuated, and authorities and responsibilities are not aligned. "Program managers cannot be held accountable when the programs they are handed already have a low probability of success. In addition, they are not empowered to make go or no-go



decisions since they have little control over funding, cannot veto new requirements, and they have little authority over staffing” (Sullivan, 2008, pp. 8-9).

The third actor within the DoD is the requirements generation and validation process: the Joint Capabilities Integration and Development System (JCIDS). Unlike PPBE and the DAS, JCIDS is relatively unconstrained by financial resources. Analyses of alternatives are based more on effectiveness than efficiency. When efficiency is considered, the costs of inputs measured in time, manpower, weight, distance, lethality, survivability, reliability, reach and other military factors are far more important than costs measured in dollars or budget authority. Indeed, the functional solutions analysis phase of the process considers the combination of doctrine, organization, training, materiel, leadership and education, personnel and facilities (DOTMLPF). Conspicuously absent is consideration of financial impact.

The JCIDS is focused on the gaps between existing capabilities and those desired by the combatant commanders. There is an inherent bias in the system to acquire more things to fill in those gaps. The nature of a military is that it desires to always be more capable and more ready. The requirements are generated by portions of the DoD organization that do not have responsibility for either budgeting or acquisition management, thus exacerbating the desire for more. Therefore, desires tend to stress the capacity of the PPBE and DAS.

The JCIDS generally interfaces with the DAS with an initial capabilities document at milestone A, a capability development document at milestone B, and a capability production document at milestone C. These documents provide validation of the military essentiality of the system and the thresholds and objectives of technical performance for the system. The JCIDS interfaces with PPBE through the issuance of planning and programming guidance before the POM and budget are built and through various review processes after they are built but before they are approved.



With respect to resources and information, the JCIDS represents the voice of the “warfighter.” This role is most influential regarding the military utility and value of the requirement. This is the supported role where the DAS and PPBE are the supporting roles. The DAS and PPBE feel a responsibility to support the requirements defined by the JCIDS, sometimes too much so: “Program teams allow requirements to escalate without discipline, thereby driving costs beyond baseline budget and schedule” (Kadish et al., 2006, p. 5).

Finally, other actors in this action arena that will eventually determine the level of funding for various programs include the Congress and the portion of the for-profit commercial sector that will build and support the systems. “The primary mechanism for which Congress has exercised its legislative powers to improve the performance of the defense acquisition structure on a recurring basis has generally been the annual National Defense Authorization Acts (NDAAs), though annual Appropriations Acts still exert significant influence via Congress’ power of the purse” (Chadwick, 2007, p. 29). Program quantities and funding levels are reviewed, approved or modified on an annual basis, between cycles of internal defense budgeting. Oversight is maintained by legislative staffs and support agencies. Congress is interested in seeing a capable and affordable military on a collective level and in supporting constituent interests on a local level. Serving the former can come at a cost to the latter and vice-versa. Similar to the trade-offs, compromise, and risk management inherent inside the DoD’s resource allocation decision system, there are trade-offs, compromise, and risk management in the legislature. Congress also weighs the defense program against the other 80% of federal spending, a consideration not present inside the DoD. Thus, the decision process for Congress must attend to matters that are both local and national, as well as matters inside and outside the DoD.

Among the constituent interests of Congress are the businesses and employees of the businesses they represent. Those businesses that are defense contractors are other actors in this action arena. They, too, are in a uniquely



powerful position in that they hold the capability to design, manufacture and support the desired systems. That information is necessary to the process of estimating costs and budgeting based on those estimates. These corporations may be motivated by any combination of factors: market share, cash flow, profit margin, technological leadership, or technology transition to non-military lines of business. The relationship between the DoD and the contractors is more arms-length when competition is present and more cooperative in a sole-source setting. Actor strategies are affected by the allocation of risks and rewards by contract type. Many corporations hire managers and executives with military backgrounds, but the DoD has very few with corporate experience, other than the occasional political appointee. These corporations also have a relationship with members of Congress as do their subcontractors. The corporations are free to approach and lobby Congress in ways the DoD is not.

In sum, the values of the actors clearly differ. As the DAPA report summarized:

Organizations providing oversight and coordination of “little a” acquisition activities value compliance, consistency of approach and control of program activities. The budget process values how much and when to buy and focuses on control and oversight to balance the instability that advocacy creates. The requirements process values the “why” and “what to buy,” focusing on obtaining the ability to achieve mission success and to protecting the life of the warfighter. The “little a” acquisition process values “how to buy,” striving to balance cost, schedule and performance. For industry, the critical issue is survival, followed by predictability in the defense market segment and achieving stockholder confidence. (Kadish et al., 2006, p. 5)

When these values collide, there may be cooperation or there may be competition; there may be understanding or dismissal; there will certainly be different strategies employed by the various actors in the action situation. Kadish et al., found

That the budget, requirements and acquisition processes function in a framework that is bound by process practitioners and stakeholders [...] In this framework, divergent bureaucratic goals and values have resulted in



behaviors that drive the budget, acquisition and requirements processes apart—processes that need to be in harmony for the System to work. (2006, p. 23)

The Action Situation

The process of allocating resources for a given program or portfolio of programs involves interactions among all the actors described above. This section describes those interactions and, in the process, illuminates the elements of the action situation: production functions, payoffs, information, actions, and outcomes.

Over time, multiple interactions of subsets of actors share information, strategize, or make preliminary decisions. These interactions result in an allocation of funds to a program at a point in time and further (re)allocations at subsequent points in time. There is not one decision, rather a series of decisions that occur on a regularly recurring basis.³

While funding decisions occur on a regular, annual cycle, the requirements for the military systems persist and evolve on no set schedule, and acquisition programs are event driven. As adversaries develop capabilities, and as technologies mature or are discovered, requirements continually evolve. Given the inherent bias towards more capability and more readiness, there is increasing demand for program output and the associated demand for funds. The calendar-driven budgeting cycle must not only attempt to forecast the changes in requirements, it must also forecast the timing of programmatic milestones.

Individual service members rotate between roles within the PPBE, DAS, and JCIDS processes. Former warfighters become budgeters or program managers; today's budgeter may become tomorrow's warfighter. Because of this, the actors

³ Certainly one could look at each of these interactions as separate action arenas, and a detailed study of defense acquisition should do that. For this illustration, they are merged.



within the PPBE and DAS roles feel an obligation to support the general warfighter or a particular internal sub-culture. CSIS reported such intra-service tension: “Much of the Air Force’s prioritization is also due to organizational politics and the secondary importance of unmanned space vehicles in the Air Force that results from it. There are few incentives for advocates of such programs in an organization that is run by fighter pilots and exhibits a reward structure strongly biased towards the latter career track” (Kaiser & Cordesman, 2008, p. 13). Frequent turnover of personnel also limits their experience and expertise:

Key Department of Defense acquisition personnel who are responsible for requirements, budget and acquisition do not have sufficient experience, tenure and training to meet current acquisition challenges. Personnel stability in these key positions is not sufficient to develop or maintain adequate understanding of programs and program issues. (Kadish et al., 2006, p. 29)

There is a bias toward short-term objectives. The risk of promising more in the short run at the expense of long-range stability is not personally significant since these decisions affect events years in the future. Resource allocation decision cycles are lengthy and a decision during the building of a POM occurs one to two years before the funds are appropriated and allocated to the program and effects manifest even later, quite likely after individual actors have changed roles. Because of the perceived high reward for supporting the requirement and the low cost of assuming the risk of underfunding, there is a tendency to underfund one program in order to make another program possible. The assumed risk carries less cost than the perceived benefit of supporting the marginal requirement.

In the case of a system that has lukewarm political support, but strong military support, incentives exist to under-represent the cost. All things being equal, a program is more attractive politically if it appears to cost less. “A new weapon system is not likely to be approved unless it promises the best capability and appears affordable within forecasted available funding levels” (Sullivan, 2008, p. 8). Gaining initial approval is relatively more difficult than adjusting the price of the program once it has been started; there are sunk costs, and stakeholders have a



vested interest. “It is one challenge to defend the continuation of an ongoing program in the annual defense budget; it is quite another to add such controversial and costly programs to a budget already under pressure” (Kaiser & Cordesman, 2008, p. 14).

Exacerbating this bias is the tendency among industry partners to underestimate the cost of the program to either ensure its political viability or to secure the winning contract—or both. Early in a program’s lifecycle, when there is relatively more uncertainty, a lower estimate will generate support and is difficult to refute. The risk of a low estimate is mitigated in the presence of a cost-plus contract, the fact that budgets are revisited annually, and the degree of legislative support for the program or the company.

The DAPA report referred to the reinforcing pressures to underestimate costs that exist both inside and outside the DoD the “conspiracy of hope” (Kadish et al., 2006, p. 102). Moderating this behavior is the goal within PPBE to balance the budget and to deliver an executable program that is politically viable. Gross misstatements of cost will be met with hostility by Congress and will create a bow wave of problems that future budgets must resolve. The professionalism of the actors within PPBE moderates the risk but does not eliminate it. The frequent presence of “budget wedges” attests to the fact that such bow waves are knowingly created and allocation problems are intentionally deferred to future cycles. When budgets are stressed, schedules are stretched out and quantities are reduced, driving up per unit costs of systems.

Program managers refer to the triple constraint of cost, schedule and technical performance. Sometimes a little performance is sacrificed in a context of tight budgets and underestimation takes a different form.

Requirements are occasionally scaled back without associated cost avoidance (or savings) being reported. This typically occurs at the time of a program rebaseline, during the major development phase, or when some maturing system components are not providing the required capability. If the



anticipated performance of such components is close to that originally specified, a decision is often made to slightly relax the original requirement rather than incur additional cost and schedule slippage to achieve the original specification. The effect of relaxing requirements without reporting associated cost avoidance is the underestimation of the cost to meet the original requirement. (Bolten et al., 2008, p. 18)

Such decisions drive up the cost per unit of capability but are rarely recorded as cost growth since no additional budget authority was requested.

Further moderating the underestimating behavior is the desire within the DAS to fully resource a program to ease the challenge of managing the program to its desired outcome. Program managers usually prefer more funds to fewer for a given project as a tool to mitigate programmatic risk. The program manager's estimate, however, is largely based on the input from the corporate partner who is likely to estimate low at the beginning of a program to ensure contract award and political support and is incented to estimate high later in production when they are the sole source in order to improve cash flow and profitability. The program manager, in an asymmetric information environment and not in control of his own resource stream, is at a disadvantage and is not fully capable of avoiding the seemingly inevitable cost growth.

Supporting the DAS is the independent, cost-estimating community. They attempt to moderate the effect of the biases to under-represent cost by not having a vested interest in the outcome. Their goal is to provide as honest and independent an assessment as possible, but that is not without risk. Their estimates are information that is available to all actors in the action arena, but no actor is required to exactly follow the estimate. Further, estimates may be stochastic, providing considerable room for debate regarding the appropriate level of funding and risk. "Department requirements to budget programs to the most probable cost are routinely interpreted to apply only to the budget years" (Kadish et al., 2006, p. 53). Still, a decision to fund a program at a level that deviates significantly from the estimate invites scrutiny. Limiting the moderating effect of the independent cost estimate is the quality of information about the program: "Because the government



often does not perform the proper up-front analysis to determine whether its needs can be met, significant contract cost increases can occur as the scope of the requirements change or become better understood by the government and contractor” (Sullivan, 2008, p. 7). Some argue that the incomplete knowledge is biased optimistically: “programs are started without knowing what resources will truly be needed and are managed with lower levels of product knowledge at critical junctures than expected under best practices standards. In the absence of such knowledge, managers rely heavily on assumptions about system requirements, technology, and design maturity, which are consistently too optimistic” (Sullivan, 2008, p. 2). Finally, the cost-estimating community prides itself on its independence but “enormous pressure can be placed on the cost analysts to create optimistic estimates so that the proposed program will not be viewed as too expensive to move forward as currently specified” (Bolten et al., 2008, p. 17).

Once Congress is engaged in the process, their additional considerations may affect the economics of a program. For example, building limited quantities of ships in multiple shipyards appeals to wider constituencies and may be the most politically expedient and locally responsible thing to do, but it dampens the rate of progress along learning curves and increases transaction and overhead costs which drives up per unit acquisition costs. To certain members of Congress the local payoff exceeds the national cost.

The action arena, as noted, is a series of incremental decisions. After the budget is built and after Congress appropriates the funds, there is still a question of execution. It is common for programs to receive less than their full allocations from the appropriation because of legislative provisions that are assessed against all programs, and for local “taxes” to create management reserves or discretionary accounts. Such actions reduce the funding available to a program that was already budgeted at a risky level. “Variability between annual budget predictions and the ultimate budget authority makes program planning difficult” (Kadish et al., 2006, p. 32). Other decisions are made about quantities: “Changes in quantity occur when



the government decides that the proposed quantity is too expensive and must therefore be cut, that more system units are required, or that the initial or current quantity is no longer justifiable, for any number of reasons” (Bolten et al., 2008, p. 18). Among the series of incremental decisions are those to rebaseline programs, which reduce the visibility of cost performance.

The action arena also consists of repeated reviews of budgets and programs, many of which are perceived to have little value or may even conflict with other reviews. “According to 97 percent of the input that we received, the current oversight and leadership process is deficient. Existing oversight relies upon overlapping layers of reviews and reviewers at the expense of quality and focus” (Kadish et al., 2006, p. 25). An abundance of rules causes confusion and raises the overhead program costs, and it raises the cost of information for overseers. Many of the review bodies are also organizationally distinct from the budgeting and program management processes leading to a situation where “responsibility and accountability are blurred since none of these review bodies are accountable for the impact of the imposed changes” (p. 25).

By way of summary of the action arena, the GAO reported,

DoD largely continues to define war fighting needs and make investment decisions on a service-by-service basis, and assess these requirements and their funding implications under separate decision-making processes. While DoD’s requirements process provides a framework for reviewing and validating needs, it does not adequately prioritize those needs and is not agile enough to meet changing warfighter demands. Ultimately, the process produces more demand for new programs than available resources can support. This imbalance promotes an unhealthy competition for funds that encourages programs to pursue overly ambitious capabilities, develop unrealistically low cost estimates and optimistic schedules, and to suppress bad news. (Sullivan, 2008, p. 6)



Exogenous Factors

Among the most important elements outside the action arena are the rules that govern it. It is here that the value of such a framework for policy prescriptions is apparent. Laws, policies, regulations, instructions and memos litter the acquisition landscape. There is no shortage of guidance on how to manage an acquisition program. On close inspection, much of the guidance permits flexibility and encourages programs to adapt to their unique circumstances. Other guidance is more constraining and limits program and budget actions. “While the former Department of Defense Directive 5000.2R has been reissued as a ‘guidebook’, it effectively remains a compliance document, forcing all programs to adopt a similar architecture and comply with a similar set of processes” (Kadish et al., 2006, p. 49).

The set of rules is constantly changing. The JCIDS instruction alone went from version “C” in 2003 to version “G” in 2009; nearly one major change per year. In the face of persistent change, actors may become confused, weary, nonconformist, or they may waste effort attempting to keep up. “Changes in acquisition instructions, policies and mandates are applied to programs that are already baselined, without consideration for cost or schedule impact” (p. 49).

Some rules are ineffective: “numerous reports of cost, schedule and/or performance failures in acquisition programs and practices [...] occurred despite efforts to mitigate them, such as revisions to DOD’s defense acquisition policy documents, reports and recommendations of numerous Commissions, Studies and/or Panels, and efforts to simplify and streamline defense acquisition processes” (Chadwick, 2007, p. 2). CSIS observed that “the Nunn-McCurdy Act has been applied anything but rigorously to current and recent procurement programs” (Kaiser & Cordesman, 2008, p. 10).

Other rules are too strictly applied, forfeiting their intended effect. For example, oversight varies depending on cost estimate of program, not program risk. There is more oversight on a \$5 billion program going smoothly than on a \$500



million program out of control. “The rigidity of the Acquisition Category designation process and its single focus on program cost results in an excessive number of programs requiring Defense Acquisition Board review” (Kadish et al., 2006, p. 24).

Along with the formal, written rules are the multitudes of rules-in-use that are implicit. Not as much is said about those since they have not been the subject of much research⁴. We see some hints of those rules in the preferences and biases described in the action arena. There is ample anecdotal evidence that promotions for senior officers and executives are based more on having experienced acquisition rather than having done it well. Some program managers of major acquisition programs who have suffered significant cost growth and schedule slips have been promoted to flag and general officer rank. Budget officers who reprogram dollars and insert “wedges” are viewed as problem solvers rather than problem creators when only the primary impact is considered.

Such personnel policies are largely driven by the fact that the budgeting and acquisition communities generally do not promote, the warfighter subcultures do. It is a situation where aviators promote aviators who happen to be program managers, thereby getting a good aviator who knows something about acquisition on the team. It is not a situation in which program managers promote program managers who happen to be aviators to ensure good program managers are on the team who have some knowledge of aviation. Thus, an actor’s community norms will impact the decision processes and strategies in the action arena.

Evaluation of Outcomes

This study is primarily concerned with cost growth, yet we find that not all programs suffer cost growth. A statistically improbable number of programs come in on schedule and at cost. “The data are clearly skewed positively, i.e., the majority of

⁴ This is one area especially ripe for the kind of research proposed here.



programs stretch [...] This was to be expected, knowing the conventional wisdom [...] It was unusual, however, that so many programs finished precisely on time. [suggesting] that finishing on time may be so important that programs are tempted to declare completion and rely upon follow-on work to fix errors in the ‘shipped product’” (Coleman, Summerville, & Dameron, 2003, pp. 118-119).

Outcomes are not neutral; they are subject to scrutiny and interpretation, and reflect on the actors involved. Self-reflection by the systems involved is common. “For nearly 60 years, the Department of Defense has been engaged in a continuous process of self assessment to identify and improve the way it acquires weapons systems” (Kadish et al., 2006, p. 1). Unfortunately, “poor outcomes—delays, cost growth, and reduced quantities—have been persistent for decades” (Francis, 2009, p. 12) leading one to question the efficacy of the evaluations and the feedback mechanisms.

While this paper is focused on problems, defense acquisition has hardly been a failure. The U.S. military has assembled a tremendously potent fighting force and can claim military superiority in nearly any conceived situation. For the warfighter, acquisition processes have been successful; slow sometimes, but largely successful. Outcomes can be assessed along several performance parameters (e.g., lethality, survivability, reliability, in addition to cost and schedule) and because the performance record is mixed across those measures, the signals fed back into the action arenas are mixed. Given the complexity of the environment for acquisition, it is difficult to isolate blame if something goes wrong, thus “DoD officials are rarely held accountable for these poor outcomes and the acquisition environment does not provide the appropriate incentives for contractors to stay within cost and schedule targets” (Sullivan, 2008, p. 2).

In the public arena, when signs of disorder are present, there is a bias to “do something”. We find “all levels react by becoming more involved, applying more oversight and often making budget, schedule or adjustment of requirements that significantly lengthen development and production cycles and add cost” (Kadish et



al., 2006, p. 23). These actions can create a reinforcing loop that exacerbates problems. Within that loop actors have learned through experience and the norms of the institution “that DoD’s implied definition of success is to attract funds for new programs and to keep funds for ongoing programs, no matter what the impact” (Sullivan, 2008, p. 14).

Summary

As this is being written, the newly confirmed Undersecretary of Defense (Acquisition, Technology & Logistics) is proposing new rules. A Defense Science Board report suggests new rules. The House Armed Services Committee has created a Panel on Defense Acquisition Reform that will report recommendations for possible legislation to improve outcomes. All of the new rules are based on the same type of analysis that has been conducted for decades. There is no more reason to expect these new rules to affect outcomes any more than the last few dozen rule changes have affected outcomes. Most of these rules are based in the legal-rational authority of bureaucracies; few, if any, are based in the value-rational perspective of professional organizations with strong cultures. The next section proposes a research agenda that takes a different tack that may lead to better rule-making.



A Suggested Research Agenda

In December 2007, the Undersecretary of Defense (Acquisition, Technology, and Logistics) tasked the Defense Science Board to look at human dynamics in warfare. The tasking memo created a Task Force on Understanding Adversaries because the DoD “needs to understand the adversary and host population social structure, culture, motivations, beliefs and interests that contribute to behavioral actions and responses. This understanding is necessary to recognize behavioral patterns and gain influence in interactions” (DSB, 2009, p. 117). If it is necessary to understand such factors to predict and influence behavior and response among the U.S.’s adversaries, does it not stand to reason that such factors must also be explored to understand and influence behavior among the actors in other contexts, such as defense acquisition?

Just as the DSB noted the insufficiency of the DoD’s capabilities with respect to human dynamics—“outdated and insufficient training of military personnel and key advisors [...] with respect to cultural studies, dynamic network analysis, and human dynamic models and simulations” (2009, p. xiv) —gaps remain in the body of knowledge concerning the management of defense acquisition. A significant gap is an understanding of the institutional forces that affect acquisition outcomes. To create that understanding, a new approach to studying the problems of defense is needed that considers these additional factors. The USD(AT&L) should create a parallel task force for the understanding of human dynamics in defense acquisition that specifically maps cultural forces and rules-in-use, using computational and laboratory tools to analyze the dynamics of the processes that define, fund, and manage acquisition programs. Without such understanding, effective policy interventions will remain elusive. If the DSB is correct in stating that “cultural insensitivity is militarily dysfunctional” (2009, p. xii) then it is not too far a leap to suggest that cultural insensitivity is also managerially dysfunctional. The field of



organizational behavior has long linked the understanding of organizational culture to performance (Quinn & Rohrbaugh, 1981; Denison, 1990; Schein, 2004).

What follows is the outline of a research agenda that should begin to fill the gap in knowledge. The agenda consists of both field work and computational/laboratory experimentation through models. The field work consists of qualitative research to increase understanding of institutional factors such as rules-in-use and community norms. Such understanding is then used to create models that represent current environments and behavior. Those models are then taken to the field for validation. Upon validation, models are used to assess the likely impact of changes to exogenous factors, *viz.* new rules. Such experimentation allows the policy-setters to test the efficacy and to assess the secondary effects of policy options.

Field Research

Field research is necessary for three reasons. First, while there are extant studies on the culture of the military, there are not studies (to the author's knowledge) on the culture of defense requirements generation and validation, defense acquisition, or defense programming and budgeting. Employing the IAD framework can generate research questions about the institution of defense acquisition in manageable segments of work. Data can be collected about defense acquisition and analyzed within the elements of the IAD framework. Research questions to be answered by field work may include:

- According to the actors, what action arenas are most salient in affecting cost growth? (E.g., are the compromises inherent in building the POM more influential than the stature of an independent cost estimate?)
- What are the rules-in-use for a given action arena? (E.g., if decisions are made to underfund or underestimate a program, how is that justified?)



- To what communities are the actors beholden? (E.g., does a military department affect a person's decisions on joint programs?)
- What incentives, rewards, or sanctions do the various communities use to enforce the rules? (E.g., are future promotions based on the prestige of programs, the mere fact that a person has acquired program management experience, or the performance of the program?)
- How are decision-makers affected by the multiple roles in which they serve? (E.g., what does it mean to be a program manager or resource sponsor who is also an aviator or submariner?)

Second, field work is necessary in collecting data to test hypotheses about defense acquisition that stem from theories of individual and group behavior that originated in different contexts:

- From behavioral finance, do budget reallocation decisions by resource managers in the DoD typify the mental accounting behaviors theorized by Thayer? Is the tendency to accept risk in some areas and not others consistent with Kahneman and Tversky's (1979) prospect theory?
- From group decision-making, are decisions affecting cost and funding based on their appropriateness, as March (1994) suggests, or based on expectations of utility-maximizing outcomes? What are the mental models and heuristics that guide information search, interpretation, and decisions?
- From organizational failure, do particular programs exhibit the factors associated with permanent failure that Meyer and Zucker (1989) documented, and, if so, do they follow a similar process? Does strategic misrepresentation occur in defense acquisition like it does in municipal public works projects, as demonstrated by Flyvbjerg's studies)?

Both the first and second reasons for field work generate a level of external validity as the research moves into the laboratory and computational environments. The actual behaviors and rules-in-use uncovered in the field should be used to construct models of organizational behavior. The laboratory and computational experimentation is described in the next section, but it is in that environment where alternative policy prescriptions can be assessed for their likely impact.

The third reason for field research is to validate the predictions that result from computational and laboratory experimentation. As promising policies are



developed in the laboratory, they should be taken back to the field for validation. This can occur prospectively by surveying actors associated with defense acquisition to gauge the policies' face validity. This can also occur retrospectively after policies are enacted to assess whether the model accurately predicted the outcomes. Depending upon the materiality of the policy change, the models may need to be updated.

Experimental and Computational Research

Earlier in this paper, a comparison was made between the IAD framework as applied to common pool resource decision-making and an N-player, multi-round, Prisoners' Dilemma (PD) game. PD games have long been studied in laboratory settings and one strength of the IAD framework is that it, too, lends itself to such modeling, simulation, and gaming. In the book, *Rules, Games & Common-Pool Resources*, Ostrom et al. (1994) show how gaming can be used to understand actor strategies and institutional forces. They further show how gaming can be used to hypothesize and test the effects of rule changes on the structure and outcomes of action situations.

Such modeling and gaming is not unique to the IAD framework and has become widely accepted in related domains. In the seminal issue of the journal *Computational and Mathematical Organization Theory*, Carley (1995) describes such work as focusing "on developing and testing organizational theory using formal models. The community shares a theoretical view of organizations as collections of processes and intelligent adaptive agents that are task oriented, socially situated, technologically bound, and continuously changing" (p. 39). Defense acquisition can be similarly described and insights should be gained by building computation or mathematical models.

Carley (2009) summarized the state-of-the-art use of computational modeling for understanding social behavior and concluded that there are "a plethora of tools with impressive interfaces but little theoretical power" (p. 47). It is important that any



model created to support defense acquisition first begin with a solid theoretical foundation to inform its design. Carley provides a set of model design considerations that are beyond the scope of this paper but would be invaluable to one who would pursue this line of research. She also emphasizes the utility of such models for decision support and assessing the potential impacts of policy decisions in a cost-effective and timely manner.

Other applications of computational tools and techniques for understanding organizational behavior are relevant to a study of defense acquisition. The Virtual Design Team model created at Stanford University models complex engineering projects, not unlike defense acquisition projects. The model is based in contingency theory and adopts an information processing view of the actors and their interactions in a complex, multidisciplinary series of tasks (Jin & Levitt, 1996). The Stanford team has begun to explore the effects of culture on project performance (Horii, Jin, & Levitt, 2005).

The Virtual Design Team model has already been adapted to military use by the Center for Edge Power (CEP). The CEP has adapted the models to increase understanding of network-centric command and control structures (Nissen & Buettner, 2004; Leweling & Nissen, 2007; Gateau, Leweling, Looney, & Nissen, 2007).



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Conclusion

Tools of computational modeling currently exist to create a new level of understanding of the dynamics of defense acquisition. This paper outlines an agenda for research that would employ such tools in conjunction with a proven framework that incorporates variables that have been omitted in past studies and are grounded in the theories of behavioral science. The goal is to understand the institutional and cultural factors that lead to the types of decisions that too-often result in cost growth in defense acquisition projects. New policy prescriptions based on existing knowledge have not solved the problem; perhaps taking a rigorous look at additional factors will yield fresh insights into an old problem.

With greater understanding through field work, new rule sets can be hypothesized and tested in a computational or laboratory setting to see how behaviors, and ultimately outcomes, are affected. Such tests can be done in a timely and cost-effective manner without creating churn, confusion, or change-weariness within the acquisition workforce. Prospective rules that are found to reinforce the status quo in an experiment should be abandoned; those that offer the greatest promise of successful reform should be enacted. Understanding the behaviors of the actors in defense acquisition, and—more importantly—how those behaviors would change in the face of new rules, should make policy-making more effective. Effective in this case means a portfolio of programs that with increasing frequency meet warfighter requirements within cost and schedule parameters.



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Appendix 1. The Defense Budget as a Common Pool Resource

The IAD framework has been successfully used to explain the management of common pool resources. A common pool resource (CPR) is characterized by two factors, it is difficult to exclude someone from using the resource, and the use of the resource by one consumer denies its use to another (subtractability). The resource is normally renewable, so management of the stocks and flows affected by rates of production and consumption is vital.

Subtractability		
Low	High	
Public Goods	Common-Pool Resources	Difficult
Toll (or Club) Goods	Private Goods	Exclusion
		Easy

One example of a common pool resource is a maritime habitat designated as a fishing zone. When open to fishing one might expect fishermen to take as much as possible, eventually depleting the stock of fish. Economics theory says that the interplay of such rational self-interested parties in this situation will result in externalities and the Tragedy of the Commons (Harden, 1968).

I argue that the defense budget (specifically, the allocation of financial resources within the Program Objectives Memorandum (POM)) is a common pool resource. Since cost growth is fundamentally about comparing the amount of funding provided to an acquisition program at a minimum of two points in time, the allocation of funds from the pool of available dollars is the central concern. Studies



of defense acquisition are replete with comments that programs are underfunded, projections are optimistic, decisions are deferred, growth displaces other investment, estimates are low in order to “buy in,” and program managers spend too much time acquiring and protecting budgetary resources, all of which suggest that funding allocation decisions are a vital concern and actors involved in funding decisions employ strategies to affect the outcomes of the decisions. Just because funding is critical, though, does not make it a common pool resource. Look at the definition of a CPR, and compare it to the defense budget.

Clearly, the characteristic of subtractability is present. Within a given year’s top line, a dollar allocated to one program is a dollar no longer available to another. The resource is characterized by stocks and flows: given an appropriation by the Congress, there is a stock of budget authority that is spent according to the prescribed allocation. Those allocations can change within a budget cycle through reprogramming. The stock can be reduced with rescissions or expanded with supplemental appropriations. The cycle repeats on roughly an annual basis and the claimants on the subsequent year’s flow will change as will the total amount available. These characteristics are quite similar to what one would find if looking at a managed forest, groundwater supply, or fishing area—things widely considered to be CPRs and the focus of previous studies employing the IAD framework.

Of concern when describing the defense budget as a CPR is the notion of excludability. Ostrom, Gardner, and Walker (2004) define this characteristic as “how easy or costly it is to exclude or limit potential beneficiaries (users) from consuming them once they are provided by nature or through the activities of other individuals” (p. 6). It is helpful to note that man-made items qualify as CPRs, such as computer processing time or parking garages. It is also important to note that it is not necessary for a CPR to be available to *any* user; reasonable barriers to entry may exist. For example, a fishing area is not susceptible to being overfished by everyone, only those with sufficient capital to buy a fishing vessel and the requisite knowledge to use it. Groundwater, another common pool resource, will only be consumed by



those who have dug a well to capture it. Thus, it is only necessary to state that it is difficult to exclude any potential users *who have access* to the resource. Not everyone has access to the defense budget, but approximately 5,000 program elements define the budget and those program elements are represented by hundreds of advocates, all of whom are participants in the PPBE system, thereby giving them access to, and a legitimate claim on, the budget.

While there are processes for fishing or pumping groundwater, the characteristics of the fisherman or pumping station—along with the rules and institutional framework within which they operate—affect the amount of the resource they can possibly obtain. Likewise, the attributes of a claimant on the defense budget—along with the rules, processes, and institutional factors—affect how much one can claim. Granted, not all the claimants for defense resources are infinitely greedy and prone to take as much as they can get; likewise, users of a parking garage normally only take one (sometimes two!) spaces at a time, computer users are not using CPU time perpetually, and fishing boats and water tanks have a capacity limit. Different actors will seek to consume differing amounts based on their individual needs. All that is necessary to have a CPR situation is that the different actors who have access to a resource may stake a claim against that resource and that the size of those claims will be based on individual preferences and strategies. Ostrom (1994) notes that CPRs are often heterogeneously distributed in “a patchy environment in which patches may differ dramatically in yield” (p. 11). Internal DoD budget “controls” create a patchiness to the defense budget.

Further, CPR situations are characterized by both the provision of the resource and the allocation of it to users; allocating the flow effectively is the central concern. Of defense acquisition, the GAO recently commented, “DoD’s ability to allocate funding effectively to programs is largely driven by its acceptance of unrealistic cost estimates and a failure to balance needs based on available resources” (2009, p. 13). This is highly indicative of a CPR: claimants competing for



a finite, but renewable, resource employing strategies in an environment defined by institutional norms.

The idea of a budget as a CPR is not a new. In the *Concise Encyclopedia of Economics*, John Cogan makes the argument that the federal budget deficit is an example of the tragedy of the commons (Cogan, 1993). If the defense budget is a CPR, then there should be evidence of the ill effects that CPRs tend to produce. Has the defense budget been “overfished”? By some accounts, yes. From 1998 to 2008, the Department of the Navy budget grew by almost 50% in real terms, yet the number of ships, aircraft and personnel fell by about 15%. DoD-wide, procurement and R&D spending has grown from \$95 billion (33% of defense outlays) in 2001 to \$205 billion (35% of defense outlays) in 2008, yet the services complain of insufficient reinvestment. As the provision of resources has expanded, the demand has grown even faster. The GAO reported that in 2001 there were 75 major defense acquisition programs (MDAP) with total planned commitments of \$790 billion. By 2007, that portfolio grew to 95 programs valued at \$1.6 trillion (GAO, 2008). Not only did the overall size of the portfolio grow in that time, the rate of cost growth for the average program also increased. Whether the provision of resources fueled claimants’ appetites or the provision of resources has been insufficient given demand is not important at this stage, it is important that those data seem to characterize a dynamic often associated with a CPR. To some, the defense program is underfunded, to others it is oversubscribed, but to everyone it is a problem of financial stocks and flows. CSIS recently reported one military department’s explanation of a troubled program as

missteps of changing requirements and chronic underfunding in the past as the reasons for the pause in the program, but budget pressures make it clear that the organization can simply not afford to fund the entire program [...] It is clear that block-building will delay the program further, and expose an already trimmed budget over a protracted period of time to increased budgetary pressure and competition from other [service] priorities. (Kaiser & Cordesman, 2008, p. 12)



The interesting thing about the management of common pool resources is that ill effects do not always happen. Ostrom et al (1994) found several cases in which the action arena resulted in quite cooperative and successful outcomes. And we know defense acquisition has its share of successes.



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