SYM-AM-15-074

PROCEEDINGS
OF THE
TWELFTH ANNUAL ACQUISITION RESEARCH SYMPOSIUM

WEDNESDAY SESSIONS
VOLUME I

Engineering the Business of Defense Acquisition: An Analysis of Program Office Processes

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Published April 30, 2015

ACQUISITION RESEARCH PROGRAM
GRADUATE SCHOOL OF BUSINESS & PUBLIC POLICY
NAVAL POSTGRADUATE SCHOOL

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

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Engineering the Business of Defense Acquisition: An Analysis of Program Office Processes

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Abstract

The aim of this paper is to contribute to the ongoing discussion on defense acquisition reform by addressing acquisition reform at the project level—where projects are actually managed. Defense acquisition program management is designed to provide sustained, intensified, and integrated management of the complex technological development. It consists of applying resources to achieve a specific technical objective; managing and coordinating interdependent technical and social activities; and balancing severe constraints in cost, schedule, and performance. Defense acquisition reform must start at the project level, as it is here that resources are translated into results via work processes. The intent of this effort is to focus on the business process level of project management. Specifically, this research develops a system model of defense program management office (PMO) functions with the goal in later research to use the model to examine defense acquisition business processes. This research is the first part of a three-phase longitudinal study of program office processes and organizational interaction that affect the basic decision-making and outcomes for defense programs.

Introduction

The aim of this paper is to contribute to the ongoing discussion on defense acquisition reform by addressing acquisition reform at the project level—where projects are actually managed. Defense acquisition program management is designed to provide sustained, intensified, and integrated management of the complex technological development (Butler, 1973). It consists of applying resources to achieve a specific technical objective; managing and coordinating interdependent technical and social activities; and balancing severe constraints in cost, schedule, and performance (Butler, 1973). Defense acquisition reform must start at the project level, as it is here that resources are translated into results via work processes. The intent of this effort is to focus on the business process level of project management. Specifically, this research is designed to develop a system model of defense program management office (PMO) functions with the goal in later research to use the model to examine defense acquisition business processes.

Defense acquisition reform generally focuses on issues such as requirements creep, contractor inefficiency, and budget cuts. Apart from a recent Government Accountability Office (GAO) report that found the information requirements of higher headquarters can add as much as two years of work to a weapons systems development program, there is little academic research to examine potential root cause issues that may reside within the day to day interactions and decision-making processes within the PMO and stakeholder organizations (GAO, 2015). The reality is the practice of project management itself is an already complex process—even before the weapons system to be developed is introduced (Burgess, Byrne, & Kidd, 2003).

For the purposes of this paper, a process is defined as a network of activities that converts inputs to outputs—in other words, a system (Giachetti, 2010). The inputs vary and include hard management data such as budgets, technical updates, and production status. The inputs also take the form of inquiries for information from the technical disciplines, the acquisition hierarchy, and stakeholders. Outputs include both physical and mental products, (e.g., ultimately components of a weapons system) as well as decisions produced by the mechanics of the process. The process describes what goes on between input and output. Processes are further decomposed into activities and tasks (Giachetti, 2010). The focus of this study is at the process level. Outputs of processes lead to activities that potentially define decisions and directions of the PMO. Process measures include quality, efficiency, effectiveness, profitability and innovation.

In addition to defining the fundamental information requirements and processes in program environment, an examination of the model program managers (PMs) use to frame their decision-making is necessary. Department of Defense (DoD) program managers receive the same level of training as required by the Defense Acquisition Workforce Improvement Act (DAWIA) and have similar backgrounds and experiences when they assume the responsibilities of program management. In order to understand and influence program outcomes, not only must we characterize the formal and informal processes within a program, but we also need to understand the environment in which a program manager makes decisions. Asking PMs to be innovative and holding them more accountable, as articulated in Better Buying Power 3.0, requires us to understand the information-driven decision-making environment within which the program manager operates.

The requirements of project management have changed paralleling the exponential growth in technology since World War II, a corresponding increase in weapons systems complexity, and the vagaries of the acquisition system. Project management represents and is meant to manage change and assumes a structured and stable environment. While cost, schedule and performance are touted as the trinity of project management, cost, schedule and performance are metrics and constraints—the outputs of business processes—not project management activities. These traditional project management constraints are insufficient to enable and inform the management of complex, weapons/system-of-systems development programs.

Background

The DoD and the military services have wholeheartedly embraced various initiatives that are designed to improve overall program quality and efficiency (Office of the Under Secretary of Defense for Acquisition, Technology, & Logistics [OUSD(AT&L)], 2015). Many of these tools and processes, however, have had only marginal success, while actually increasing the overall process burden on program offices. Close examination of the overall program management process reveals that there has been fairly little change in the basic program management strategy and processes while significantly increasing the activity within these processes (Kwak et al., 2014). And the Project Management Institute has codified the defense acquisition program life-cycle model into a Project Managers Body of Knowledge (PMBOK), which further reinforces the status quo in the commercial industrial base. There seems to be little understanding, however, of the cause and effect relationship between the day-to-day decision-making driven by these processes and the successful outcome of programs.

Incremental changes in defense acquisition over the years as a result of major studies have done little to change the overall trend of the ever-increasing cost to benefit ratio of defense programs (Fox, 2012). The volume of regulations and corresponding reports has increased exponentially to the number of organizational interdependencies program offices must manage throughout the program life cycle. Unfortunately, this increase in oversight has not provided a real understanding of the performance value being realized. Additionally, many of the feedback mechanisms and management tools within the program management processes provide little knowledge of program performance. While the volume of data on programs is significant, the interdependency of these data is lacking and often dated. As a result, the program manager and the Title 10 oversight authorities spend countless hours making decisions on desynchronized data with limited understanding of the program interdependencies and relevance of the data. While the intent of such data is to improve the overall understanding of the program and help in predicting outcomes, the overall effect is quite limited and in many cases actually exacerbates the very problem they are trying to solve.

The Problem

Managing any formal project in today's world of complexity is challenging. Managing the development of a weapon system in the U.S. DoD can be a daunting task. The uncertainty associated with the maturation of the key technologies, combined with sometimes ambiguous and vague requirements and finding uncertainty add to the challenge. Structural aspects of the system, from the number of components to the detail of interfaces add to the task. Although the premise of project management is simple—execution is very difficult. This basic management challenge is captured in this quote from Morris and Hough in 1988:

> Curiously despite the enormous attention project management and analysis have received over the years, the track record of projects is fundamentally poor, particularly for the larger and more difficult ones. Overruns are common. Many projects appear as failures, particularly in the public view. … Why does the record so consistently show project overruns to be the norm? Is this the indictment of project management that it seems?

Almost 30 years later, the problems not only exist, they are becoming more commonplace. Although the projects examined by Morris and Hough were not exclusively defense projects, it seems appropriate to ask, why can't we get defense acquisition right? Are the problems to be resolved at the highest levels of acquisition policy, or should we also examine the problems at the level of the project? This research is about applying systems engineering and analysis and business process reengineering to the activities and processes of the PMO to discover what is driving the activities of the PMO in an attempt to discover efficiencies that could lead to better program management effectiveness.

The Approach

This study is the first phase of a three-phased, multi-year effort to examine the processes of a program management office for efficiencies and effectiveness. Phase 1 (this effort) is to review the literature, identify and codify the program office process categories, and develop a model.

This first phase defines the model by identifying categories of processes to frame the follow-on research. It is our goal to not only identify the fundamental formal and informal processes within which programs are managed but also to begin to understand the intellectual framework within which the PM makes decisions and draw conclusions and recommendations that may provide insight into how to change the way PMs and correspondingly the PMOs think and make decisions. End state is an understanding of the program office activities, as well as characterization of other activities both management and engineering that add to and take away from the efficiency of the program office.

Phase 2 will apply the model developed to pursue a mixed method (quantitative-qualitative) analysis of the business processes. Our method of inquiry is intended to investigate the challenges associated with managing a major defense program office in the execution of a program of record. We intend to draw directly upon the experiences of program office personnel as well as external stakeholders that have a role in the overall defense acquisition process as defined in DoD 5000.02. While it is important to better understand the interactions and decision-making that occurs within a program office, the dependent nature of external organizations as they relate to program decision-making is critical to the overall understanding and sense making of program performance.

This will be a longitudinal study in which we conduct surveys of leadership and program office personnel as well as stakeholder personnel within the DoD acquisition environment. We will also conduct interviews of a broad number of individuals, both at senior leadership and subordinate positions. Some potential questions will assess the relative efficiency of program office personnel and can be described by the following:

1. What percentage of time is spent on external rather than internal program issues?
2. What portion of that time is spent addressing programmatic issues as opposed to external stakeholder issues?
3. How much time is spent internally on managing the specifics of an individual program?
4. What is the direct value of the activities at the various program levels and can they be traced to program performance
5. How do the current program reporting and management and control requirements impact program performance and what is the overall value of these requirements to the Defense procurement enterprise.
6. How effective are the current business and systems engineering process in predicting the outcome of program performance.

At this point in the research, these are only sample areas of interest. A qualitative investigation will evolve following the grounded theory methods articulated by Glaser and Straus (Glaser, 1978). The inquiry will likely lead in various directions and will begin to become or be obvious once we begin our initial coding and category development. We intend to use the data to identify a logical path in which we will begin to observe patterns and themes from which we can begin developing theory that addresses the fundamental question.

Survey of the Literature

> *The essence of ultimate decision remains impenetrable to the observer—often, indeed, to the decider himself. —John F. Kennedy (Allison, 1971)*

Decisions relating to resources and information are the outcomes of the project management processes. These decisions equate to the execution of a project. In defense project management, this Kennedy quote rings true, as decisions made often defy analysis, as they are opaque.

This survey explores project management decision-making and change through management science, project management science, and systems engineering and reengineering. Included in this section is a discussion of the project management environment and how the environment can influence process. This theoretical background provides the qualitative and quantitative basis for the research. This initial section is followed by a discussion of systems thinking, the systems approach, and ultimately the tie to systems engineering. An understanding of systems is essential to appreciate the activities of the business process, specifically the input and output relationships of the tasks and activities of that business process. The final step is a discussion of process modeling, followed by a proposed identification of process categories that will provide the framework for follow-on research.

While formal study of project management has accelerated over the past 30 years, some charge that the scholarly study of the broad field of project management has diverged from the realities of the practice of project management (Holmquist, 2007; Payne, 1995; Winter & Smith, 2006). In fact, recent studies note not only complaints from practitioners for lack of relevance, but also questions on the value of the PMBOK (Winter et al., 2006). A fundamental conviction of this research is that the defense project management environment has radically changed, and project management and decision science and practice has not kept pace (Winter et al., 2006).

Research in project management is ongoing. Study of public works projects, one of the first disciplines to adapt project management, is a good example. In many cases, research there seems to be more willing to consider breaking from the cost, schedule, and performance models by examining other variables. Specifically, government agencies dealing with the development of major infrastructure projects have found that a simple adherence to the principles of cost, schedule, and performance are insufficient to provide the necessary control of projects. For example, Owens et al. (2011) found that beyond cost schedule and performance, an appreciation of the details of financing, and the context of the project are essential elements for successful control.

Similarly, systems thinking and its application to management have received great attention. Early studies emphasized the importance of defining management as a systems activity (Jenkins & Youle, 1968; Johnson, Kast, & Rosenzweig, 1964; Snyder, 1987; Sterman, 1996). More recently, the continued development of systems engineering as discipline has fostered a renewed interest in applying systems thinking and systems engineering principles to management problems (Checkland, 1994; Jackson, 2000; Sage & Cuppan, 2001; Sage & Rouse, 2009). A systems approach to project management would complement the increased emphasis of systems engineering and weapon systems development. Key to this idea is that system engineering management of the technical aspects of development should be mirrored by a systems approach in the management of that technical effort (Feigenbaum & Sasieni, 1968).

The management science discipline has sought to quantify the activities of the various management disciplines, including project management. Tishler observed that in order to identify the managerial factors (and by extension the processes leading to those factors), success must be defined (Tishler et al., 1996). He further cited research by Pinto that definitions of success change during different phases of the lifecycle (Pinto & Slevin, 1998). This suggests that the rigid adherence to cost, schedule, and performance as indicators of success (and the hallmark of defense project management) alone does not reflect the totality of success in project management.

A constant theme in the management science literature is the criticality of addressing project complexity. We discuss project complexity below however, it is important to recognize that managerial and technical complexity, coupled with the limits of human capability, has resulted in managerial and technical specialization. The specialists are experts in their particular field, but that local, limited knowledge of the field precludes identifying potentially optimal solutions to interdependent program problems (Amaral & Uzzi, 2007). Specialization has a limiting function, in that the specialists in a PMO are measured by, and capable of addressing only those issues in their specific area. This suggests that requests for information or expertise outside specialist's area may have a debilitating effect on the efficiency and effectiveness of the PMO.

Decision-Making

Decision-making is the essence of project management. Effective decision-making varies depending on the nature of the internal formal and informal processes. Eisenhardt (1989) noted that more information, considered simultaneously and in an integrated manner, led to better more productive decisions. Lack of integration in the decision-making process tends to keep decision-making at an abstract level, creating anxiety among the decision-makers. Key differentiators between effective teams and less productive teams is the ability to stay focused on the decision outcome rather than procrastinate and wait for a time-dependent resolution.

Another critical aspect of Eisenhardt's (1989) research is the notion that teams that considered fewer options tended to overanalyze those options, thus wasting time with fewer permutations of potentially effective options. This bureaucratic approach resulted in the loss of valuable time and the inclusion of critical information in the decision-making process. Finally, the notion that conflict supports good and timely decision-making was deemed relevant only when the team instituted an effective issue resolution process. Conflict, left unmanaged, tended to result in further procrastination and less effective outcomes.

Eisenhardt's (1989) research established a model for strategic decision-making in high velocity environments. This model was derived from her categories and propositions that synthesized the relationship between information, process, speed, and performance in decision-making. Her model could be relevant to decision-making in a wide variety of disciplines and is consistent with the behavior observed and documented in the military decision-making process studied for many years. Decision-making in high stress combat environments or in the management of major defense acquisition programs has similar characteristics as those observed by Eisenhardt (1989) in her study of microelectronic companies and likely follow similar strategies in culminating in effective outcomes.

The notion that overanalysis of a problem, as is often the case in bureaucratic institutions such as the DoD, would be a useful basis to study the decision-making process within the DoD and its relationship to outcomes in areas such as defense procurement is intriguing in light of the most recent GAO (2015) report. Additional research, focusing on decision-making in complex environments, includes findings which argue that a high level of comprehensiveness slows the strategic decision process, advocate speed of decision-making is essential, and who argue that conflict in decision-making tends to slow the decision-making process (Fredrickson & Mitchell, 1984; Mintzberg, Raisinghani, & Theoret, 1976; Vroom & Yetton, 1973).

Systems

Systems engineering provides proven methodologies to analyze and define the management function. In fact, as analytical process, systems engineering decomposes system problems into component parts to provide for optimal solution. In the case of program business functions, these analytical steps include a quantitative evaluation of the relationships and interactions among and between the key variables in the program office, manpower, information systems, and stakeholders and their interdependencies.

The systems engineering principle of decomposition provides a methodological process to not only identify, but also measure the inputs, the time and cost associated with the process itself, and the outputs. For the same reason systems engineering uses requirements traceability to ensure adherence to system requirements, the analytical process provides a means of comparing business process outputs to both the inputs, as well as measuring those outputs in terms of efficiencies and effectiveness.

Systems engineering supports the development and maintenance of good design. That design leads to a design decision in weapon systems development. In this analysis of program office business processes, we anticipate that instead of a technical design decision we should be able to identify either an improved design for the flow of information, or a decision to ignore or request relief from the inputs—those requests for information whether ad hoc, or driven by regulation. The result of this analysis could be an improved design for the flow of information within the management function of the PMO. The emphasis of the management work needs to be on the management system, rather than the piece parts and daily responses typical of the PMO workday. In essence, we are suggesting that the PM become the chief systems engineer of the PMO.

Business Process Reengineering

Business processes came to popular attention with the Hammer and Champy book, *Reengineering the Corporation*, in 1993. Although seen as revolutionary in the 1990s, the idea of looking at business processes dates as far back as the 19th century. In fact, the concept of work improvement is an almost universal pursuit that can be traced to the current day management theorists from those original thinkers of the 19th century including Taylor (1974) and Fayol (1949). The knowledge intensive workplace of today requires understanding across functional areas (Tétard, 1999). Since the 1990s, process modeling has become a basic principle of organizing a business (Aguilar-Saven, 2004). Thus, in the PMO of today, the demand for data results in managers performing worker tasks to feed higher-level managers, while their own work of supervising weapons development suffers.

Reengineering focuses on responsiveness. Responsiveness, providing the correct and timely information and decisions needed for the effective management of a project, is achieved by the efficient and effective employment of knowledge, leadership, and empowered people to address everyday issues (Sage & Rouse, 2009).

From an engineering perspective, an organization functions on three levels, the systems management level, the process level, and the product level (Sage & Rouse, 2009). In defense acquisition, the systems management level is where the majority of research, and potential solutions have been focused. The second level, that of process, is where this research is focused. The product level focuses on manufacturing and technical engineering functions and is not addressed. A challenge with process modeling, to include business process reengineering, is that it is normally only considered when an organization is near disaster. Business processes are complex. The larger and the more technologically advanced the outputs of the organization, the more complex the processes.

In order to examine process, one must be able to decompose process into the essential elements. Decomposition allows us to look at not only the individual activities within the process, but also to examine the source of the inputs, and the destination of the outputs. In order to provide focus to the decomposition process, we are defining process categories associated with defense project management. These process categories provide the starting point for the analysis.

Change

Program offices are constantly responding to direction that requires either process or momentum change. Momentum change refers to those things that distract individuals and organizations from their preplanned strategy. The individual dynamics that evolve in these types of disruptions may have an impact on organizational synergy and could lead to various forms of conflict. Previous research was done in this area by Kellogg (2009) in her study of surgery residents and the conflicts that arose within the hospital when the government mandated less work hours for new interns.

Kellogg conducted a 15-month ethnographic study of two hospitals that were attempting to implement changes resulting from new regulations focused on reducing the amount of time an intern was required to work during the week. She argued that her observations led her to three key findings in the field of organizational movement that suggest that change can occur if those most interested in change are able to create an environment isolated from antagonists, in which they can form alliances and strategies necessary to realize the change. She created new terms for these findings such as relational spaces, relational efficacy, relational identity, and relational frames to characterize her findings.

Kellogg studied the behavior of staff and interns at two seemingly similar teaching hospitals as the hospital directors attempted to implement work hour change for the interns. The motivation of the directors was twofold. First was their concern of maintaining accreditation, and second was their desire to attract a larger body of candidates for their program. There appeared to be both defenders and resisters to the change, who she referred to as Defenders and Reformers. Not surprisingly, the Defenders tended to include the more senior residents and the institutional staff, and the reformers tended to include the interns who comprised the brunt of the long workweeks and tended to have the most to gain from the change.

The relevant nature of this study suggests that similar conflicts could be resident in program offices by the continually changing nature of the program environment. This may lead to similar behaviors identified by Kellogg and could perhaps lead to potential strategies to improve the outcomes of an environment that is plagued with change as an inherent result of the acquisition process.

PMO Process Classification

To effectively manage a program, an understanding of the details of the business processes is essential. A central effort of this research is to identify the details of these business processes. In order to do that, and business processes need to be decomposed into their essential elements.

A system is a set of interacting components that have a relationship (Marca & McGowan, 1988). We consider a business process a system, as it is a self-contained activity that converts inputs to outputs. Identifying the characteristics of the business process system used in the PMO is essential to understand the processes. System modeling provides a means to develop an accurate description of a system (Marca & McGowan, 1988). We use IDEF (integrated computer aided manufacturing DEFinition) methodology in this study to model the business processes in the PMO.

IDEF0 is a modeling technique that captures relationships, interdependencies, functions and interfaces methodology for modeling (Presley, 1995). IDEF is used to create activity models and establish interrelationships among inputs, controls outputs, and mechanisms (ICOM) of the business processes (Vernadat, 1996). Arrows represent inputs (I), controls (C), outputs (O), and mechanisms (M). Figure 1 shows the “IDEF Box” and the functions that are captured, and the ICOM taxonomy.

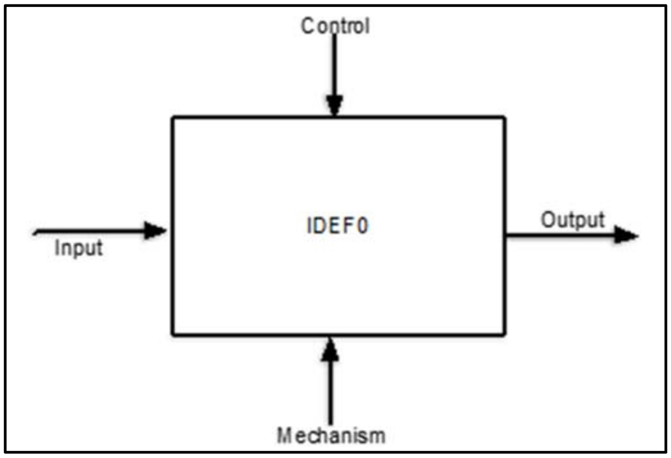

Figure 1. IDEF Methodology

Process Elements

Using an enterprise systems engineering model developed by Saenz (2005), we have identified three major process classes, organized into a hierarchy. Organized from lower to higher, the first process class is the process element level. The process element level consists of work, resources, information, and decisions.

The second level moves beyond the actual work performed and includes process categories that impact on the business processes. The process categories include capacity, conflict, context, and complexity. These categories are more difficult to measure in an engineering sense; therefore, a combination of quantitative and qualitative research must be used.

The top level of the hierarchy is where the metrics are defined. This top level includes measures of cost, schedule, quality, and a measure of the benefit that the processes as well as the outputs the processes bring to the organization.

The first, process element is the lowest level and is where the actual work is accomplished. The process element level includes work, resources, and information that lead to the decisions that impact the management of the program. In the PMO model, inputs are the activities that require an action from the PMO. Those activities include reports, information, and decisions that must be addressed. Controls regulate the function and include constraints such as time and budget. Outputs represent the result of the combination of inputs controls and the mechanism that represent the resources that actually do the work. In the PMO, outputs include decisions, as well as materials including budget and engineering reports, and replies to requests from stakeholders for information. In many cases the outputs of one process become inputs to another. Mechanisms are the physical resources needed to perform the work, and for purposes of this research include PMO personnel, and the resources they need to accomplish their mission. Figure 2 shows the IDEF methodology applied to the process element level, where the work is actually being performed.

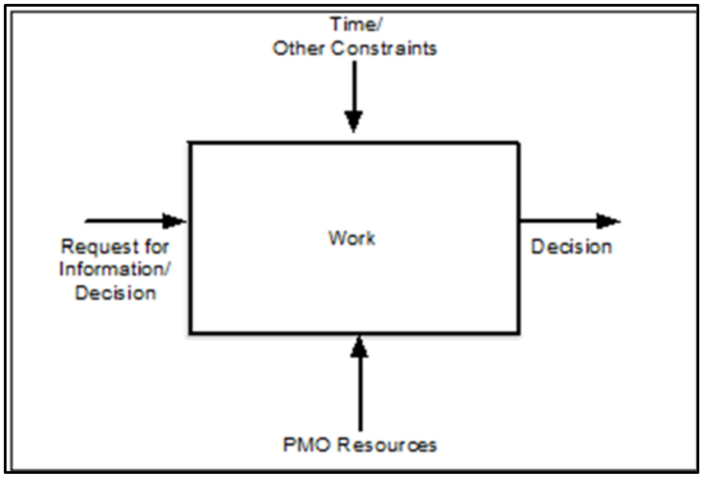

Figure 2. IDEF Applied to the PMO Process Element Level

Process Categories

The second level of the proposed hierarchy is that of process categories. Process categories influence the accomplishment of the work and are essential to understand the efficiencies of the process. Payne (1995) suggested project management activities can be divided into categories including capacity, complexity, conflict, and context. Payne developed these categories in the context of managing multiple simultaneous projects. However, these categories are appropriate for measuring PMO processes as they cover the range of activities in any PMO. Figure 3 shows the process categories and their relationship to the element level.

Capacity/Scope

Capacity (or scope) is a measure of the amount of work that can be performed by the PMO. In the PMO, the number of people times their available work time represents capacity. In industry, capacity and the necessary scaling (elasticity) is addressed through hiring, reassigning, and releasing people, as well as using tools like overtime. In the government, hiring and firing to meet capacity needs is not feasible. And for the most part, the personnel needed to address increases in PMO scope are not eligible for overtime. Therefore, in any PMO, attaining required capacity is met either by providing capacity organically or subcontracting training activities to a commercial provider. The degree of subcontracting will be another process measure. Over a specific time period, capacity refers to the amount and type of work to be done, decisions to be made, resources needed to perform productive and managerial work; and the amount and types of information required (Saenz, 2005, p. 104).

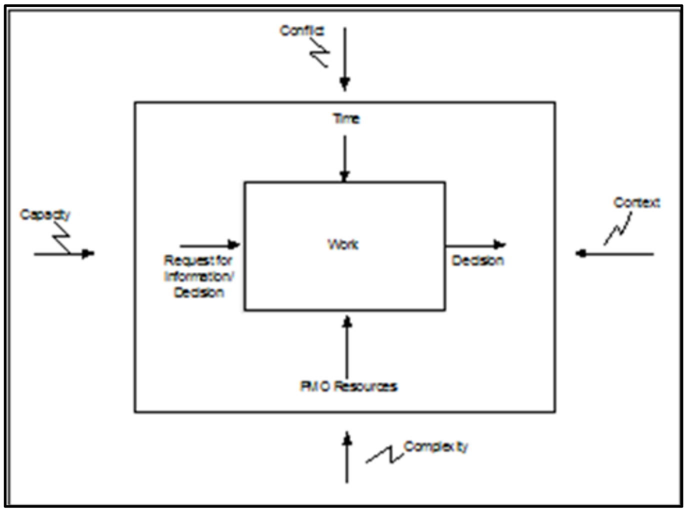

Figure 3. PMO Process Categories in an IDEF Model of PMO Process Elements

Capacity is measured in terms of the numbers of actions, processes, activities, and tasks of the PMO and is applied across resources and information. The output of capacity is an inventory of process capability measured at the PMO level. Capacity is a measure of system potential. As in weapons systems engineering, capacity must be measured and managed, and provides the framework to identify the elasticity necessary to address downsizing and surging. Capacity and the elasticity necessary to address surging is a critical, but often-unaddressed process factor.

Capacity/Scope is also a measure of the capacity or magnitude of the PMO activities necessary for success. In resource constrained environments, the details of scope provide the necessary information at the PMO level to make appropriate decisions on what can and cannot be addressed. Similar to systems engineering, including scope adds realism to the specification process.

This research approach to the project management environment is critical because while a project may appear to be operating in an efficient manner and may even be at less than full capacity with regard to level of effort, it is the process by which the team makes decisions at the various levels of capacity that will have an impact on the overall program performance outcomes. Capacity is a central process category.

Conflict

Conflict describes the actual management of the development of the system and is related to the balances and choices made. Conflict is divided into three parts, people, system, and organization (Payne, 1995). By far, the most important part of project management conflict is that associated with people.

The people aspect of conflict starts at the PM level. The PM is assigned a group of people on a temporary basis—a matrix organization. PMOs are purpose-built temporary organizations that consist of people with different loyalties and different masters. The first element of conflict is the fact the PM for the most part has limited control of the entire PMO. A second major element of conflict is change. Projects are about change, but change is anathema to most people.

System conflict is expressed as the balance of priority. At the PMO level, priority is established by stakeholders and decided by the PM. However, as in any activity, priority shifts based on actual events. At the process level, priority is expressed as what activities get done in what sequence. For this analysis, examination of priorities is central to understanding the outputs of the process as different management levels have different impacts on the establishment and the execution of priorities.

Organization conflicts arise from the stakeholder approach to project management. Higher-level organizations set priorities that may or may not match those of the PMO. Similarly, the matrix support organizations (i.e., engineering) are tasked with providing support to different projects. How those leaders decide to allocate their resources impacts the success of the project, as well as the execution of the process.

Context

Context is the ecosystem of the PMO and the project. From a systems perspective, context needs to be viewed from the perspective of all stakeholders (Owens et al., 2011). Context includes the politics of the stakeholder community, the political environment, resource availability, and *force majeure*.

Context includes those PMO activities that are essential to administer programs, but are not directly related to the management of the development/ or manufacture. Context ranges from tracking budget requests through the bureaucracy to responding to legislative branch oversight, as well as the myriad non-program training requirements dictated by DoD and the U.S. government. A recurring theme in this category is the necessity of interorganizational and interpersonal communication. While a known factor, this communication causes considerable work not directly related to managing technical development.

The politics of the stakeholder community is by far the most powerful factor in the category of context. Whenever people are put in an organization and asked to function as a team, there is an inevitable use of power and political behavior (Pinto, 2000). Notwithstanding a general distaste for political behavior in DoD activities, the reality is the practice of politics is a prime force in defense acquisition. Political behavior is the process by which individuals and groups seek, acquire, and maintain power (Pinto, 2000).

Complexity

Complexity refers to those activities concerned with the interfaces between the project management organization, the technical staff, stakeholders, and others. Complexity as a measure of military weapons systems has been detailed by Sapolsky (1972), Hughes (2011), Gholz, and others (Sage & Rouse, 2009). Systems engineering was developed in part to address the engineering aspects of complexity in the development of weapons systems (Kossiakoff et al., 2011). While continuing to evolve, systems engineering has for the most part been able to address that technical complexity—indeed, a hallmark of systems engineering is its ability to provide a mechanism to address complexity (Hall, 1962).

Complexity has a direct effect on the ability of the PMO to deal with management and decision issues as the more complex the system, the potentially more complex the management and decisions necessary. Moreover, the mixture of human-socio-political complexity found in program management offices demands a closer look at how systems engineering and the behavior and management sciences can together address these problems.

Definitions and explanations of complexity abound, from Williams (2008) to Gell-Mann (1995), to Holland (1993), to Hughes (2011). Rather than select a specific definition, and to allow for a more complete analysis, the complexity framework developed by Sheard and Mostashari (2009) is adapted to illustrate project management complexity. The framework includes a topology of different kinds of structural complexity, two kinds of dynamic complexity and socio-political complexity (Sheard & Mostashari, 2009). Table 1 captures the framework and provides examples of its application to defense program management.

Structural complexity includes the size of the acquisition system while focusing on the connectivity of the parts of the system and its hierarchy (Williams, 2008). For purposes of the defense project management system, structural complexity also includes the civilian and military hierarchy and the connectivity between higher and lower level commands, and program offices. The number staff actions between these organizations is significant and includes both issues relating to managing ongoing development, as well as issues discussed above of conflict, context, and capacity.

Beyond the hierarchies, PMOs are major business entities directly controlling budgeting, spending, and in most cases the award of fee to defense companies. PMOs are spread throughout the United States and overseas, and organized into military-type hierarchical organizations. The architecture aspect of structural complexity is also influenced by the nature of defense acquisition. Since the technology development infrastructure (i.e., laboratories, R&D centers, and manufacturing) is for most part privately owned, structural complexity also describes the network connectivity necessary for the system to function.

Table 1. Project Management Complexity

Type	Sub-type	PMO/ Acquisition Example
Structural	Size	DoD/Services/Separate Agency PEO/PMOs/Budget
	Connectivity	5–7 levels of command/staff structure drive actions and approvals. Bureaucratic structure requires different level of approvals
	Architecture	Boundaries/different commands/different agencies offices with each command/Executive Branch/Congress
Dynamic	Short-Term	Daily problems/Personnel changeover/engineer shortage/materials failures/short requirement dynamics
	Long-Term	New weapons development/changing pol-mil-budget environment
Socio-Political	Social-Political-Policy-Technical Issues	Personnel changeover/"the new PEO/PM"/change and change management/Regulations/Policy changes/
Interdependence	Emergence	Unanticipated actions and consequences a result of incomplete appreciation

Sheard and Mostashari (2009) divided dynamic complexity into short and long term. In the case of project management, unpredictability and uncertainty is common. Whether it is a tactical response to a development problem, or an administrative response to directives, the project management system is in constant flux.

The unpredictability arises from the diverse and always changing aspects of ongoing development. Each individual (the human element) will interpret and emphasize different aspects of the problem and how to address that problem. This has potentially significant impact on the management system unless this unpredictability can be mitigated. In other words, the interdependency is severed, and PMO are reduced to experience-driven survival skills rather than the approved PMO processes.

Uncertainty also stems for the military rotation policy where senior leaders change jobs approximately every two to three years. Most new leaders are driven to make a mark on the organization and may be therefore unwittingly contributing to the uncertainty of the staff. This constant change has two main effects. The first is a focus on the short-term. What can one do in the next 12 to 24 months that will make a difference and further a career? This constant change also affects the technical staff. Uncertainty is reflected in another complexity factor, socio-political (Maier, 1995). It is this area where the nexus between management, and the non-engineering human factors of policy, process, and practice of the system is most critical.

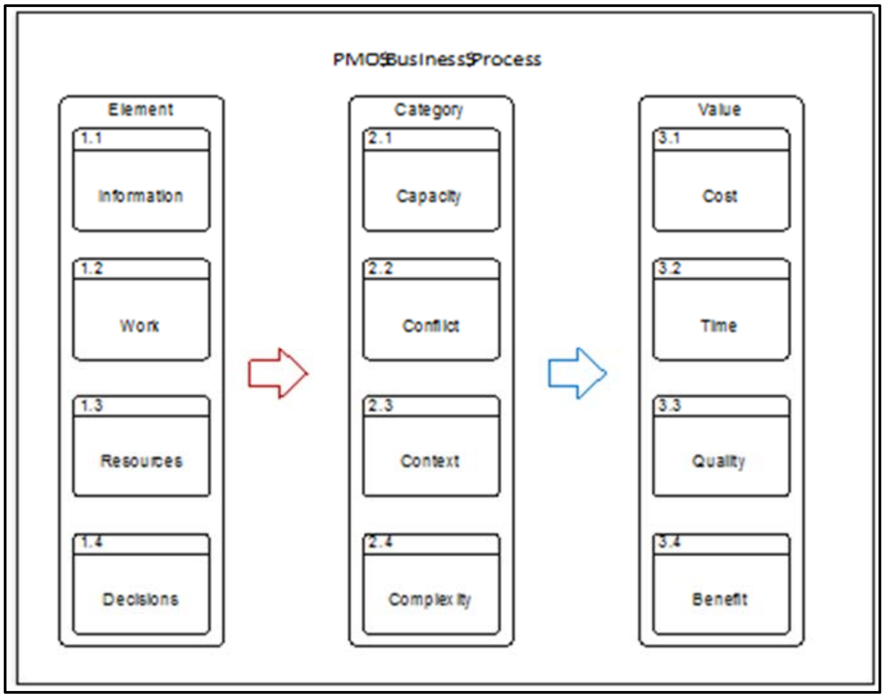

Figure 4. PMO Process Model

The last aspect of complexity in the context of program management is interdependence. When different systems interact, there are two results. The first is the cumulative effect of the interaction (Rebovich, 2008). For the PMO, the interdependencies between those managing the development and those executing the development should result in repeatable, consistent results—continued progress in system development. However, when the link between those managing and those executing is broken, or as can happen, ignored, the interdependency is broken. Consideration and appreciation of the effects of complexity is critical for any examination of the defense PMO. Complexity drives the necessity for a systems approach to project management.

Value

The final process category is Value. Value includes the well-known measures of cost and schedule, but adds measures of quality and benefit. Each process consists of a flow of mental and physical activity and information. These flows include the resources, equipment, people, and the decision essential for success. These flows drive decision-making both for execution and to inform future decisions on resource allocation. Figure 4 shows the complete model.

These flows also define the core competency of the PMO as demonstrated at the element level. The result of this process implementation is alignment of the work processes of the PMO. Those processes are then reconciled with the support elements of the enterprise (HR, Finance, Engineering, Quality, etc.).

Conclusion

This paper develops a process model to identify and define the PMO processes to model the activities of a program management office. The process model described in this paper provides the framework for the phase of this research that is to perform a field study of PMO processes. The model depicted in Figure 4 is the model that will be used in the Phase 2 research using both quantitative and qualitative techniques. This research will be a multi-phased longitudinal study of program office processes and organizational interaction that affect the basic decision-making and outcomes for defense programs.

The mixed methods approach may provide novel insight into underlying issues that impact the overall program performance. This unique study combines both systems engineering rigor and humanistic behavior as it relates to program outcomes and ultimately may provide a perspective on the how value is derived from defense programs.

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