



Managing Acquisition Risk by Applying Proven Best Practices

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Data analysis from recent acquisition program assessments has identified common characteristics of successful programs and supporting organizations. First and foremost, organizations with successful acquisition processes must embrace risk management throughout the entire product life cycle. While risk management is ingrained within their culture, these organizations take active measures to sustain effective implementation across programs by routinely conducting assessments to maintain currency, applying proven best practices to address specific risks, and using historical lessons learned to improve future performance. These assessment results also revealed characteristics of unsuccessful programs, primarily a lack of understanding and distinction between acquisition and development processes. This confusion resulted in an increase in interface issues as well as observable impacts on product cost, schedule, and quality. As a result of their analysis, the authors conclude that successful acquisition risk management is based on: (1) providing educated leadership and a supportive organizational culture, (2) adapting proven best practices in response to specific circumstances, and (3) emphasizing the program environment rather than process maturity.

During 2003, the American Systems Corporation (ASC) conducted nine program assessments of commercial and government organizations. These assessments evaluated 50 individual acquisition projects that were components of larger programs. Approximately half were acquisition programs with the remainder being programs to develop a product or provide a service.

The ASC assessment approach used a series of automated evaluation tools based on the revised Department of Defense (DoD) 5000 series of instructions, acquisition process models, a best practices-based

model, evaluation criteria similar to the current Class C Standard Capability Maturity Model® Integration (CMMI®) Assessment Method for Process Improvement-based model, and various specialized evaluation tools.

One of the major assessments was a program under a major Navy acquisition command responsible for acquiring hardware and software for afloat platforms. The ASC assessed the overall acquisition performance and associated risks within this program office by utilizing the assessment process described above in conjunction with the ASC Gap Analysis Profiling (GAP) tool.

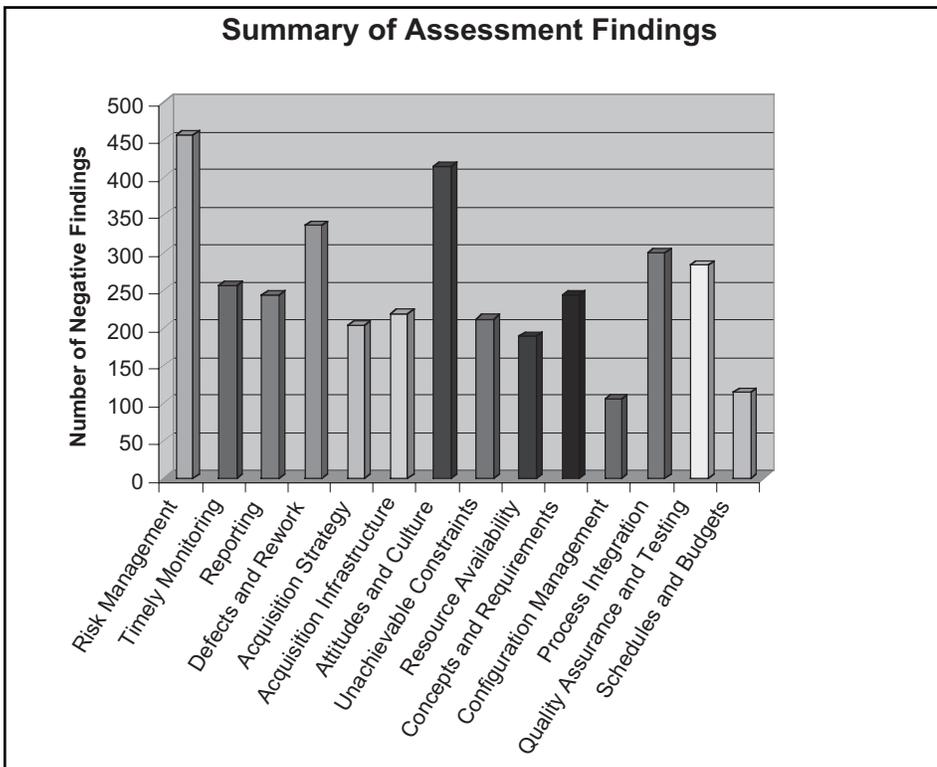
The ASC employs a consistent and repeatable process to conduct and analyze results for all assessments. The process begins with data collection and is accomplished by using a variety of questionnaires depending on the assessment model. Assessors conduct interviews, review documentation, and record their observations and document issues, which they then analyze manually using the automated GAP analysis tool.

Outputs include a matrix of risks associated with specific business processes that are weighted and sorted by various criteria, and a histogram that represents a compilation of all data points that identify high-risk areas and prioritize areas for process improvement. The assessors also correlate their observations and issues against proven best practices such as the Software Program Managers Network (SPMN) 16 Point Plan, CMMI criteria, DoD 5000 requirements, Operational Test readiness criteria, or customized evaluation points based on customer needs. The results are then documented in a final report with a consistent format and saved as a series of program-specific reports.

Assessment Observations

When we compiled all of the 2003 assessment results (government and commercial), we observed an interesting anomaly. The initial results of a commercial assessment composed of a series of 20 programs identified two areas of strengths: architecture development and interface development. Further analysis indicated that these programs had the largest cost and schedule growth of any in the information technology portfolio. This observation was inconsistent with what was originally expected.

Figure 1: Observation Summary



When we reanalyzed the results of our initial assessment, we identified several factors that explained these anomalies:

- Management had an unrealistic *can-do-at-all-cost* attitude that prevented an objective assessment of their actual capabilities to contain risk and control rework. This attitude prevented them from using available processes correctly, and it prevailed despite the fact that the technology being used in the programs appeared to be adequate. Such a *can-do* attitude introduces the risk that the program will continue on an unproductive path despite irrefutable evidence that it will not progress to the desired end state. For example, with this attitude, management would possibly dedicate more people and dollars to a problem that is related to ineffective processes rather than address the processes.
- Management failed to identify and remove defects that reduced product quality. They failed to manage and mitigate risks, which negatively affected cost, schedule, performance, and services provided.
- For many of these programs, management failed to distinguish adequately between development and acquisition practices.

When we reanalyzed the more than 900 observations that were collected during the initial assessments, we included a new categorization scheme that focused on the program environment. As shown in the histogram in Figure 1, the most significant issues regarding cost and schedule growth, which seemed to be more significant than process-related issues, were the attitude and culture of management and project personnel, and the project's ability to effectively manage risk. In addition, issues related to productivity and performing to a plan were far more prevalent than issues related to estimating cost or projecting schedules. Finally, program team members seemed to be more aware of process integration factors than specific shortfalls in individual processes. We concluded that, in terms of probability of success, this program was being affected more by the program environment than by process shortfalls.

During our reassessment, we observed that the client's employees consistently described practices in the wrong context. For example, individuals in acquisition organizations described the practices they were using to control development baselines, the methods they planned to use to develop the software architecture, or how they planned to use testing to resolve product quality issues.

When we evaluated this confusion of

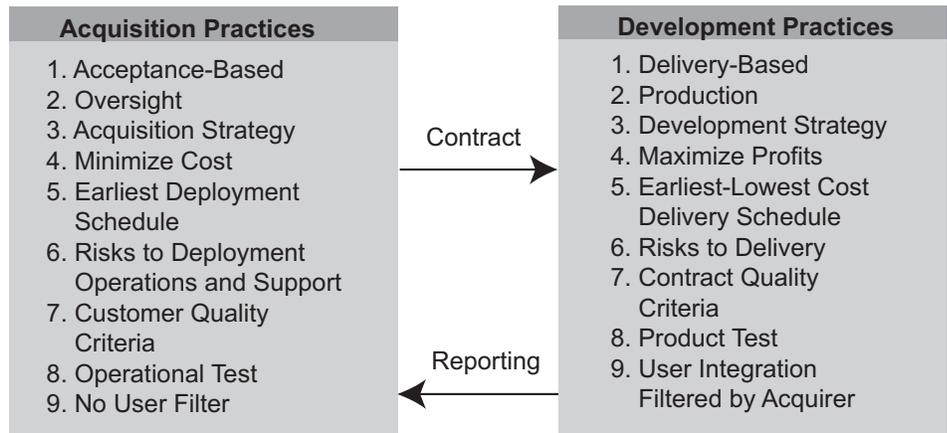


Figure 2: *Organizational Considerations*

practices, we determined that there was extensive definition of *development* best practices in the form of initiatives such as the 16 Point Plan, Practical Software and Systems Measurement (PSM), several Office of the Secretary of Defense (OSD) studies, and initiatives from the Software Engineering Institute and the Data and Analysis Center for Software. However, there were fewer initiatives related to proven best practices in the area of *acquisition*, with many of these practices blending into overarching models such as CMMI.

We discovered that in many organizations we assessed, program team members often confused development practices with practices more relevant to acquisition. In an acquisition environment, practices related to development can be useful, but they must be adapted to the specific requirements of receiving a product rather than building it, and this adaptation does not always occur.

Figure 2 illustrates various practices that must be adapted to work within the

larger organization and to fill a specific role within the context of the overall program. As Tim Lister put it at the 1996 Software Technology Conference, “Could it be that adaptation of process is 90 percent of the problem, and the common processes are marginal?” [1]. This quote provides evidence that practitioners within the industry are concerned about successful implementation of best practices in a project environment.

As Figure 2 illustrates, similar practices must be substantially adapted to meet the differing needs of the acquirer and developer.

To facilitate effective adaptation of common practices, we developed the *Issues Grid* (Figure 3) to distinguish between acquirer and supplier functions as they relate to nine common issue areas. As the *Issues Grid* highlights, the risks that arise within these areas are specific to the role the organization plays in the project, and the response to these risks is driven by dif-

Figure 3: *Issues Grid*

Issues Grid		
Supplier Issues	Common Issues	Acquirer Issues
Delivery Integrity	Risk Management	Deployment and Support Integrity
Product Acceptance	Requirements	Operational Effectiveness and Support
Project Breakdown	Baseline Control	Product Integrity
Inflexible Project Change Delays Tradeoff Constraints	Contracting	Cost, Schedule and Product Exposure
Product Integrity, Acceptance and Delivery	Defect Identification and Tracking	Product Reliability, Performance and Operational Integrity
Product Demonstration Project Completion	Interfaces and Interoperability	Deployment, Operational Integrity and Support
Cost Overrun, Late Delivery, Profit, Impacts, and Excessive Constraints, Cost, Schedule, and Product Exposure	Estimation and Scheduling	Tradeoff Constraints, Change Delays, and Contingency Management, Cost Overrun, Late Delivery and Excessive Constraints
Constant Surprises and Project Chaos	Metrics and Reporting	Tradeoff Based on Incorrect Information
Staff Attrition	Staff Issues	Staff Consistency

firing organizational motivations and commitments.

From our observations in 2003, the attitudes of management and staff appeared to be a driver in program success. Typical comments were as follows:

- “I know there’s risk but the only contract type we have time to manage is FFP [firm fixed price], which shoves all risk to the contractor.”
- “The review is next week. We have to wing the estimate or we won’t get funded.”
- “Schedule? When do you need it?”
- “I don’t know what you’ll find when they start using it. It’ll be good enough.”
- “The staff will just have to ‘suck it up.’ I can’t afford the overtime.”
- “If I tell management that, they’ll fire me.”

These quotes not only indicate the frustration of the various project stakeholders, but also the divergence that can exist in how management, the customer, the staff, and the users understand the motivations and commitments of different organizations and individuals. In such an environment, a program has little chance of success either because individual commitments are unrealistic or morale is so poor.

The authors have observed many times that successful implementation of any practice, whether it can be considered a best practice or not, depends more on how the practice is accepted within the program’s culture and how specifically it is integrated rather than the value of the concept it provides. For example, in regard to risk management, we have observed that every organization we have assessed explicitly accepts the value of this practice. We often hear comments like, “We need to know what can impact our program early so that we can better manage it,” or “Risk management is essential to our success or failure since it provides us an early warning.”

However, very few of the organizations we assessed truly embrace the process: Very few managers are willing to completely

report negative risks to senior management for fear of negative reaction or unwanted help. Only an organization that culturally embraces risk management would assume the posture that management needs to be aware of the potential for good and bad outcomes.

Analysis and Conclusions

Based on our reassessment of our 2003 observations, we reached certain conclusions. First, for an acquisition program to be successful, the program must be planned and adequately staffed and resourced. It also must be consistently executed and follow acquisition strategies that are aligned with enterprise and organizational guidelines. The processes used must be documented and, most importantly, they must be adapted to the specific role of the organization using them; the culture of that organization; and the realities of staff, schedule, and resources. Additionally, those processes that are critical to acquisition success must be cultural imperatives, and they cannot outpace the skills, training, and experience of the individuals who must apply them. Finally, an acquisition organization must do more than simply define the process. A primary task must also be to identify, tailor, acquire, integrate, apply, and monitor the effectiveness of the individual practices, methods, and tools that are used to implement the process. Understanding what to do (process) is important, but understanding how to do it (practice) is critical.

Because this observation is common knowledge, the question becomes, “Why don’t we deal with it?” Impediments to the implementation of a process often are not inherent to the process itself, but rather they arise from the organizational culture. The CROSSTALK article “Seven Characteristics of Dysfunctional Software Projects” [2] indicates some causes of poor organizational culture. It identifies seven specific project characteristics that preclude an organized application of effective practices to a project:

1. Unwarranted optimism and the unrealistic expectations of executive management.
2. Late decision-making.
3. Inappropriate use of the standard software process.
4. Missing or inadequately implemented program activities.
5. Lack of leadership.
6. Early declarations of victory.
7. Absence of risk management.

When these characteristics exist on an acquisition project, an attitude develops that is extremely detrimental to success. The question then arises, “If these issues are so apparent, why don’t projects address them?” As indicated in [2], the two primary reasons most likely are denial and culture. Denial becomes an issue when, in the day-to-day execution of an acquisition project, an attitude develops that can be characterized this way: “The indicators of disaster are probably wrong, and we won’t be impacted the way the other 12 projects were.” Such an attitude can lead acquisition managers, or any manager for that matter, to do risky things.

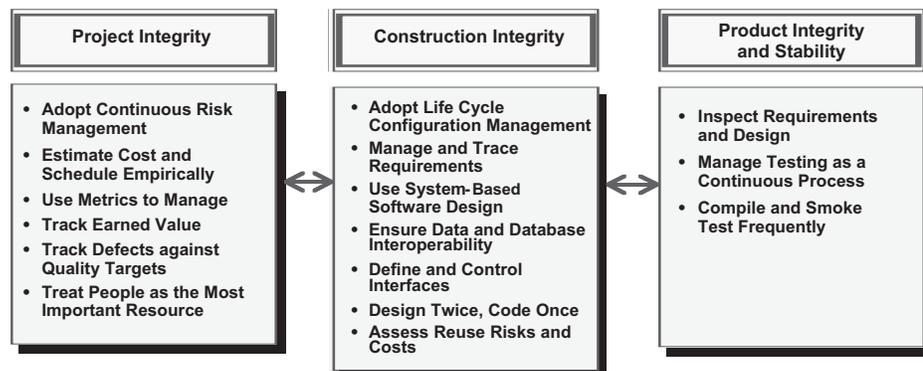
Second, each of the seven factors listed above relates to cultural rather than technical issues, which as previously noted, “Cultural problems are harder to solve than technical problems ...” [3]. To address these problems adequately, a manager must understand what makes his or her project function effectively. That is, the manager must answer questions such as, “How do all the project stakeholders interact? What motivates them? Why don’t they address important issues even though they are essential to project success?” Only after obtaining the answers to these questions can a manager understand how these seven factors affect the project and then effectively minimize them. For an untrained manager, or a manager under pressure, this is a difficult prospect that often provides more reality than they or their executive management are prepared to deal with.

Critical Practices

As part of our reassessment of our 2003 observations, we identified several practices that can help mitigate the risks and issues discussed above. The practices we identify here are based on industry standards and have been proven as success criteria in all sizes of programs and projects. These recommended practices would provide a starting point for programs to regain the health of their overall program and provide a high-level road map as a starting point.

One evaluation model is the SPMN 16 Point Plan (Figure 4), which focuses on evaluating critical practices that address

Figure 4: SPMN 16 Point Plan



Practice	Source ¹
Acquisition Best Practices	
Risk management is embraced by the acquisition organization as a cultural imperative and supported and sustained by management.	16 Point Plan [4]
Contract types must match program risk irrespective of administrative load or overhead.	OSD Study [5]
A metrics-based reporting structure based on PSM and the SPMN metrics process is defined and written into the contract with severe penalties for misreporting.	COTS Acquisition Study [6]
Award fee payments are based on the timely identification and correction of issues rather than the accurate reporting of their existence.	COTS Acquisition Study [6]
Acquisition Characteristics and Infrastructure	
Independent estimation organizations use a calibrated model to evaluate and validate cost and schedule baselines based on worst-case scenarios prior to every acquisition review.	16 Point Plan [4]
Acquisition programs have an active user program that involves the customers and users from the start of the program through deployment and shares the real state of the program, risks, and issues that could preclude success.	Governance Practices [7]
Acquisition organizations require structured inspections involving their products and require and pay for contractors/developers to inspect and report metrics concerning defects in requirements, architecture code and other product related components. The acquirer should inspect acquisition products released to developers, as the developer should inspect development products released to the acquirer. The acquisition inspections will find defects in acquirer's products such as concept, user requirements, interfaces, etc. Finding and fixing these defects prior to their use by a developer will have a significant effect at lower rework cost late in the program.	16 Point Plan [4]
A defect profile is negotiated as part of the contract and meeting it is a key part of award fee calculation (with appropriate safeguards).	PSM [8]
Attitudes and Culture	
Practices required by the acquisition organization are planned, executed, and managed by the acquisition organization and not relegated to the supplier.	16 Point Plan [4]
Specific requirements to ensure conformance with enterprise data and process models, including content as well as structure are included in the Contract and Statement of Work.	16 Point Plan [4]
Management and acquisition culture is reality-based, rewarding openness and anticipation of problems and heavily penalizing burying or not seeing risks, issues, or problems that impede success.	COTS Acquisition Study [6], 16 Point Plan [4], OSD Study [5], Governance Practices [7]
Managers are rewarded or penalized based on how they address risk and reality during acquisition.	COTS Acquisition Study [6], 16 Point Plan [4], OSD Study [5], Governance Practices [7]
The acquisition organization pays for, and requires payment to contractor staff, incentives relating to teambuilding, performance, product completion, and tenure on project.	16 Point Plan [4]

Table 1: *Best Practices Matrix*

key, high-leverage areas practiced by successful commercial software developers. These practices pertain to management and control the software development aspects of the work so that the government's requirements are met and high-quality software is delivered on schedule, on time, and within cost.

The 16 Point Plan addresses three primary areas of product management: project integrity, construction integrity, and product integrity and stability. Project integrity encompasses those practices that result in identification of basic project constraints, expectations, and metrics as well as practices used to plan and implement a project environment to predictably satisfy those constraints, expectations, and metrics. Construction integrity encompasses those activities that specify the basic product requirements; maintain traceability to these basic requirements; and control the content, change, and use of the many artifacts and deliverable products that are produced to satisfy user and customer requirements and expectations. The third area, product integrity and stability, ensures that defects (which are inserted in products as part of the software process) are identified and

removed in a timely fashion, and that testing is complete and effective and results in the right product consistent with agreed-to requirements and actual expectations.

Acquisition best practices are different than those used for product development, and it is not enough to simply implement a practice that development organizations use such as the SPMN 16 Point Plan. The practices described in Table 1 enable the organization to monitor the developer and receive a product rather than directly monitoring the developing organization that is producing a product. Practices such as integrated risk management, which are critical and must be addressed, should be based on metrics, should maintain visibility into contractor processes, and should evaluate requirements from the acquirer's rather than the developer's perspective.

The practices listed in Table 1 can be misused or misapplied in regard to acquisition practices. For example, the type of contract selected has a bearing on the type of practices to be used and on how they must be adapted. We observed in several assessments during 2003 that the contracting organization was overworked and did not have time to construct or administer a cost-

plus fixed-fee (CPFF) contract, despite the fact that a CPFF contract was more suitable to the risk. This situation came about because the contracting professionals did not have a stake in the success of the program but only in the successful award and administration of the contract.

Constrained by the terms and conditions of the contract, the development organization is thus forced to perform high-risk activities such as requirements analysis, architecture development, and defect analysis under an inappropriate contract type. These activities are considered to be high risk because they are difficult and expensive to accomplish late in the program, the findings may result in unanticipated rework not considered under the contract type and necessitate corrective actions that are difficult to complete within the current process, and they are subject to schedule constraints. Correcting these problems would have been much easier had the contract type enabled or supported the flexible process definition. Thus, the wrong contract type can lead to shortcuts, tradeoffs, and decisions based on the cost of the contract rather than the quality of the product.

Summary

The application of proven best practices by acquisition organizations is a powerful risk reducer. Not all managers and stakeholders who acquire software products have the expertise, training, or incentives to deal with the day-to-day realities of a major acquisition program. As Watts Humphrey put it, "Poor project management will defeat good engineering, and is the most frequent cause of project failure [9]." Managers who use proven best practices that are adapted to the quirks, commitments, and realities of their acquisition program have an advantage that will allow them to anticipate and address the real problems they will invariably face. Rather than rely on *silver bullets* to resolve crises, organizations must establish a culture, based on practices that have been used successfully in the past that anticipates acquisition risks rather than reacts to them. "Enterprises that succumb to the silver bullet syndrome tend to never improve at all, and indeed often go backwards [3]."

Improving acquisition processes works to a point. Most programs have processes, even though their execution is often pro forma. The most effective best practices for acquisition take into consideration the organizational culture. Effective acquisition strategies embrace the uncertainty and risk associated with changing established processes. Acquisition organizations must

make the often-significant investment necessary to implement and support the practice (which entails planning, tailoring, practice documentation, method and tool selection, training, productivity impacts, artifact conversion, etc.). Managers must also realize that the new practice may not provide the promised improvement in productivity in the short term. The promise is long term. ♦

References

1. Lister, Tim. "Software Management For Adults." Software Technology Conference, Salt Lake City, UT, 1996.
2. Evans, Michael, Alex Abela, and Tom Beltz. "Seven Characteristics of Dysfunctional Software Projects." CROSS-TALK Apr. 2002: 16-20 <www.stsc.hill.af.mil/crosstalk/2002/04/evans.html>.
3. Jones, Capers T. Assessment and Control of Software Risks. New Jersey: Prentice Hall, Feb. 1994: 241.
4. Software Program Managers Network. "16 Critical Software Practices for Implementing Performance-Based Management." Vers. 3.0. Arlington, VA: Integrated Computer Engineering, Inc., 2 Aug 2000 <www.spmn.com/16CSP.html>.
5. Adams, R., S. Eslinger, K. Owens, and M. Rich. "Software Acquisition Best Practices: 2004 Edition." Third Annual Conference on the Acquisition of Software Intensive Systems, Arlington,

VA, 26-28 Jan. 2004 <www.sei.cmu.edu/products/events/acquisition/2004-presentations/adams-eslinger/adams-eslinger.pdf>.

6. Adams, R., and S. Eslinger. "Best Practices for the Acquisition of COTS-Based Software Systems (CBSS): Experiences from the Space System Domain." Ground System Architectures Workshop, Manhattan Beach, CA, Mar. 30 - Apr. 1 2004 <http://sunset.usc.edu/gsaaw/gsaaw2004/s12/adams_eslinger.pdf>.
7. Dragoon, Alice. "More Governance Best Practices." CIO Aug. 2003 <www.cio.com/archive/081503/factors_sidebar_1.html>.
8. Buys, Ruth T. "DoD Software Core Measures." Fifth Annual PSM Users' Group Conference, Aspen, CO, 23-27 July 2001 <www.psmc.com/UG2001/Presentations/08OSDSoftwareManagementMetrics.pdf>.
9. Humphrey, Watts S. "Three Dimensions of Process Improvement Part I: Process Maturity." CROSS-TALK Feb. 1998: 14-17 <www.stsc.hill.af.mil/crosstalk/frames.asp?uri=1998/02/processimp.asp>.

Notes

1. The practices have been modified from the original to reflect the results of the study.

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