Evaluating Risk in Competitive Procurements

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There is more to many competitive federal procurements than just automated systems; they involve the full range of services that constitute a government function, such as wholesale logistics. The winning vendor must perform a large part of the chosen function in addition to providing the actual systems. Since services are much less tangible, the government needs a reliable measure of process risk to determine the winning bidder. The Process Risk Evaluation (PRE) recently used by the Army is a flexible tool (based on the Capability Maturity Models®) that measures risk and helps agencies evaluate competing bids. This article discusses the development and application of the PRE and its utility for competitive procurements of major systems and service solutions.

As the name implies, the PRE is a new method for evaluating process risk, specifically in programs that require integration of multiple commercial off-the-shelf (COTS) packages or new systems.[1]

The Procurement

In April 1999, the U.S. Army Communications-Electronics Command (CECOM) issued a request for proposals (RFP) for the Army Wholesale Logistics Modernization Program (WLMP). The Army wanted to modernize the way it provides wholesale logistics services. The goal was not simply to enhance current processes, but to reengineer them by using commercial best practices and new technology.

The RFP required the chosen vendor to perform three major functions:
- Reengineer current wholesale logistics business processes.
- Sustain existing systems while in transition to new ones that support the reengineered processes.
- Manage the interfaces with external systems such as personnel or finance, which must communicate with existing and new systems.

The WLMP procurement—a 10-year contract—was significant in cost as well as scope. It did not procure a new *system*, but the full range of *services* that constitute the wholesale logistics function. The winning vendor would perform most aspects of the wholesale logistics function. Since services are much less tangible than a system, the Army's need for a reliable measure of process risk—how a service will be provided—was paramount.

Need for an Evaluation Method

As the RFP was being written, a dilemma arose. The evaluation team, three Army personnel and three contractors, recognized that the standard evaluation method—the Software Process Risk Evaluation (SPRE)—was inappropriate for measuring the process risk for this procurement.[2] It did not include all process risk areas covered in the RFP.

The SPRE was effective in evaluating many types of software development efforts but was not designed to evaluate areas outside of the traditional realm. The team could use the SPRE to evaluate some WLMP processes, including customization of COTS software and development of new software (for managing interfaces and other limited development). But it needed a new way to address other areas, including business process reengineering, sustainment of existing systems, and transition to new systems.

Consequently, the Army needed to augment the SPRE processes to achieve a more complex, robust risk evaluation method in the RFP. The evaluation team, using process areas selected from both the Capability Maturity Model for Software (SW-CMM) and the Systems Engineering Capability Maturity Model (SE-CMM), arrived at an alternative to the SPRE for measuring process risk—the PRE.

The WLMP procurement required a vendor to provide a range of logistics services including:
- Logistics modernization:
  - Business process reengineering and analysis.
  - Planning, to describe how the vendor's services will meet requirements and how new systems will be implemented.
  - Process trials to validate description and implementation plans.
  - Implementation of the wholesale logistics services.
- Sustainment:
  - Recurring services, including round-the-clock user support, controlled access to systems and data, corrective and adaptive maintenance, subject matter expertise for functional areas supported by the systems, integrity of software baselines, and requirements analysis services.
  - Additional functionality, in-process changes, and continuous process improvement.
- Transfer of the expertise, workload, software, and documentation associated with sustaining the functionality of the wholesale logistics legacy systems.
- Data processing services for transferred systems and modernized systems.
- Related logistics services to support other relevant logistics programs, including systems with which the WLMP must interface.

The Process Risk Evaluation

The following major phases of the WLMP procurement, which apply to other procurements of this type, provide the framework for discussing the PRE:
- RFP development.
- Vendor questions on the draft RFP.
- Evaluation of vendor proposals.
- Site visits to evaluate vendor processes.
- Source selection.

RFP Development

In developing the PRE, the team's objective was to incorporate in the RFP a method of evaluating the performance risk associated with each vendor's proposal. Since the Army would not be managing the day-to-day operations of the winning vendor, the RFP needed to provide a comprehensive method for identifying process risk beforehand.

To accomplish this objective, the team began by including all process areas from the SPRE in the PRE. Then it analyzed an early version of the Capability Maturity Model-Integrated[SM] (CMM-I) for additional process areas and associated goals relevant to the RFP. In all, the team developed a list of 21 process areas on which vendors would be evaluated. Since the CMM-I itself is a hybrid of other models, each process area could be traced back to its original source in either the SPRE (based on the SW-CMM) or systems engineering CMM (SE-CMM). Table 1 lists the 21 process areas and their sources.

Under the PRE, vendors are judged not by the maturity level they have achieved (as is customary in software related procurements), but by the overall risk rating achieved in the process areas. The evaluation team assigns a risk rating of low, medium, or high. No mention of maturity levels is included in the RFP.

For each process area the team develops a description, goals, and set of questions that it would ask to evaluate a vendor's capability. Developing the goals and questions is an important effort because fleshing out the topics in each area provides the basis for evaluating each vendor's ability. If the goals or questions are incomplete, important functions or services might not be accurately evaluated. The team derives the goals in each process area from the relevant maturity model.[3]

Because of the nature of this type of procurement—for services, not just for a new system—and the limited amount of process control that the government can exercise over the vendor, the risk evaluation method is all the more important in protecting the government's interests and ensuring that the vendor can perform as expected. The sponsoring agency needs confidence in the risk evaluation method.

Vendor Questions

After completing and publishing the draft WLMP RFP, the team made it available on an Army Web site. Interested vendors responded with comments and questions. Judging from their responses, the concerns were more procedural than content oriented. For example, they requested clarification on the requirement for documentation on past projects.

Table 1. PRE Process Areas and Sources

Process no.	Process area name	Source
1	Analyze candidate systems	SE-CMM
2	Configuration management	SW-CMM
3	Coordinate with suppliers	SE-CMM
4	Evolve systems architecture	SE-CMM
5	Integrate disciplines	SE-CMM
6	Integrated project management	SW-CMM
7	Integrate system	SE-CMM
8	Manage product line evolution	SE-CMM
9	Manage risk	SE-CMM
10	Organization process definition	SW-CMM
11	Organization process focus	SW-CMM
12	Peer reviews	SW-CMM
13	Process change management	SW-CMM
14	Project planning	SW-CMM
15	Project tracking and oversight	SW-CMM
16	Quality assurance	SW-CMM
17	Requirements management	SW-CMM
18	Software product engineering	SW-CMM
19	Technology change management	SW-CMM
20	Training program	SW-CMM
21	Understand customer needs and expectations	SE-CMM

The participating vendors were accustomed to a requirement for CMM certification at a specified maturity level, but not to the PRE—a method including process areas on which the vendors had not been previously rated. In spite of this vendors had minimal uneasiness with the PRE as an evaluation method, and they believed that no important process areas had been omitted. On the basis of vendor comments the team made minor editorial changes to a few process areas, but did not add to or delete from the original list (Table 1). It then issued the final RFP.

Evaluation of Vendor Proposals

In their proposals vendors should describe how they will perform the PRE processes and submit documentation to show their ability to do so. In the case of the WLMP, the vendors discussed the 21 PRE processes listed in Table 1 and submitted documentation on six previous projects to demonstrate their ability to perform those processes.[4]

All evaluation team members review the risk section of all vendor proposals.

Site Visits

The evaluation team visits the vendors whose proposals pass the written evaluation (for WLMP, two prime contractors and one major subcontractor). During the visits vendors provide all relevant documentation for previous projects and make project and management personnel available for interviews. The evaluation team selects the projects that provide the most insight into the vendor's process maturity. The vendor's project documentation should be available for the entire site visit.

On the first day of a site visit the vendors describe the processes they used. Next, the team and vendors discuss the selected projects. These discussions also center on the vendor's processes for accomplishing the PRE areas. Vendors are required to ensure the availability of specified personnel, from senior management to team leaders, who are familiar with either the project's management or with specific processes in use. (For WLMP, the team also interviews members of the vendor's Software Engineering Process Group.)

All evaluation team members review vendor documentation before the interview to determine which areas need additional clarification. The interviews are also an opportunity to ask questions that arise during the proposal review. All evaluation team members also attend each vendor interview. However, two team members (one primary and one secondary) oversee each area and ensure that the evaluation is thorough and accurate.

The documentation for review should be cross-indexed by process area for easy access by the evaluation team. When vendors who passed the written evaluation have all achieved at least CMM Level 3, the documentation they provide directly relates to the evaluation team's requirements.[5] In competitions involving vendors of lower maturity, the team's job could be more burdensome because the documentation might not clearly indicate a vendor's use of CMM processes. The lower the vendor's maturity, the more likely the evaluation team is to uncover shortcomings.

On the basis of the interviews and project document review, each team member rates the vendors in the process areas and develops a list of vendor strengths and weaknesses. Then the team discusses its findings and agrees on a single rating for

each area. A vendor is assigned one of three risk ratings: low, medium, or high. Low risk, for example, indicates that "little doubt exists, based on the vendor's performance record, that the vendor can perform the proposed effort." In addition to assigning a rating for each process, the team consolidates and summarizes the list of strengths and weaknesses.

The team bases the vendor ratings on the information gathered in three venues: evaluation of proposals, interviews and review of project documentation during site visits, and vendors' written responses to final questions raised by the team. Because the information gathered during the site visits validates the information provided in the proposals, it is at least as important as that provided in the proposals.[6]

Source Selection

After deciding each vendor's rating the team prepares its results for submission to the source selection evaluation board (SSEB). The SSEB prepares and presents a report for the source selection authority (SSA), which makes the final procurement decision. The evaluation team provides the SSEB with the overall risk rating for each vendor, as well as a summary of the vendors' strengths and weaknesses. The SSA used this information to make its WLMP award decision, which was announced in Dec. 1999.

Lessons Learned

On the basis of the WLMP procurement, the team reached the following conclusions concerning the PRE:

(1) The PRE was effective in covering all key process areas of a very complex program. Because CECOM normally conducts its procurement according to a sanctioned methodology (SPRE) and a single process model (SW-CMM), there were initial concerns about adopting an alternative unsanctioned method. However, after using PRE to determine process risk, the team was confident that it had identified all key processes and collected sufficient information from the vendors to provide accurate input to the SSEB.

(2) Much of PRE's effectiveness is due to its basis on processes of the CMMI and predecessor models. The PRE was built on a firm foundation and offers many of the same benefits as CMM, including the increased likelihood of success for projects using it. The PRE is also a means of using CMM processes when a procurement does not fit neatly within a single maturity model.

(3) The PRE method is resource intense. To be useful, it must be scaled to the size of a specific procurement. For procurements smaller than WLMP, the number of process areas evaluated can be decreased. One team member was recently involved in a procurement for system maintenance services. For that procurement only six of the 21 process areas were necessary for determining process risk. Alternatively, the size of the evaluation team could be scaled down. The WLMP team consisted of six members; smaller teams are appropriate for simpler procurements.[7]

(4) The PRE works best when evaluation team members understand the CMM models and the PRE process. The WLMP site visits were accomplished in one week because the team knew the types of information to collect from vendors. This understanding allowed team members to ask the right questions in interviews and to recognize relevant documentation

in the ocean of paper that each vendor provided. Knowledge of CMM also helped the team compare vendor statements about their processes with what the vendor documented on past projects. Without this knowledge, the site visits and evaluation period would have been significantly longer, and valuable information might have been overlooked.

(5) Similarly, the PRE consumes more resources in procurements involving vendors of low CMM maturity. Vendors in the WLMP competition were well grounded in CMM methods and provided documentation that demonstrated the use of CMM-compliant methods in conducting projects. Without this experience the evaluation period would have been longer and more expensive.

(6) After a few initial misgivings, the PRE gave rise to little organizational resistance. As it is based on CMM processes, it is no more burdensome than a classic Software Capability Evaluation; since the PRE can be modified to fit a given procurement, it applies to many organizations. The WLMP program manager considered the PRE a useful means of collecting the information necessary for selecting the best vendor. He was very receptive to the PRE, and said that it evaluated many areas that would matter to him during implementation. As the customer of this procurement, his satisfaction with the method was critical to its adoption.

Additional Information

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Notes

1. "Integration" can be internally focused (e.g., running modules of a legacy system while modernizing it) or externally focused (e.g., developing interfaces with external systems while the legacy system is being modernized). The WLMP procurement required both types.
2. The SPRE is the Army's implementation of the Software Capability Evaluation 3.0 method. It evaluates the performance of the key process areas (similar to the processes listed in Table 1) of the SW-CMM and is the Army's basis for rating vendors bidding on procurements involving software development.
3. In the case of the WLMP, the team derived the questions for process areas in the SW-CMM from the SPRE; for processes not covered by the SW-CMM, as well as for business process reengineering topics, the team developed its own questions.
4. For vendors bidding as teams, at least one principal had to have worked on each past project in order to bid for the WLMP.
5. For the WLMP, the documentation provided by each vendor filled 50 to 100 boxes per project.
6. The Army considers site visits so important that its SPRE method relies much more heavily on information gathered from site visits than on evaluation of vendor proposals. The Army prefers to judge a vendor by the processes in use rather than by the proposed execution of future projects.
7. The six team members made three week-long site visits, spent one to two weeks evaluating vendor proposals, and spent a few days on miscellaneous tasks such as following up with vendors on final questions and preparing consolidated ratings.

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Coming Events

November 10
Infomation Outlook 2000 (Australian Computer Society)
www.acs.org.au/act/events/io2000/index.html

November 16-17
ACM Conference on Universal Usability
www.acm.org/sigchi/cuu

December 4-7
International Conference on Power System Technology
www.ee.uwa.edu.au/~aips/powercon

December 11-13
Global Development Network Conference
www.gdnet.org

January 18-19
2001 Measurement Science Conference
www.msc-conf.com/findex.html#cfp2001.html

January 25-27
Ryerson 2001: A Software Approach
www.ryerson.ca/~csie/2001

January 30-February 2
CIEC 2001 Odyssey: Industry & Education Engineering
www.asee.org/conferences/html/ciec2001.htm

February 7-9
Network and Distributed System Security Symposium
www.isoc.org/ndss01/
call-for-papers.html

March 5-8
Mensch and Computer 2001
http://mc2001.informatik.uni-hamburg.de

March 31-April 5
Conference on Human Factors in Computing Systems
www.acm.org/sigs/sigchi/chi2001

April 29-May 3
Software Technology Conference (STC 2001)
www.stc-online.org

May 1-3
IEEE Radar Conference
www.atlaessgrss.org/radarcon2001

May 6-9
IEEE International Symposium on Circuits and Systems
www.elec.mq.edu.au/iscas01

May 12-19
23rd International Conference on Software Engineering/International Workshop on Program Comprehension
www.csr.uvic.ca/icse2001