A CMMI Case Study: 
Process Engineering vs. Culture and Leadership

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The success of a Capability Maturity Model® Integration™ (CMMI™) process improvement effort does not just depend on an understanding of the CMMI, a careful definition of the standard process, innovation in process engineering, a reasoned selection of cost effective engineering technologies, or even a focused and fully responsive training program. Success depends on the core culture of the company, and on the courage and ability of its leaders. The CMMI requires that real people in management, engineering, and infrastructure adopt new behaviors and beliefs. In this environment, two lessons have emerged: Core culture is a principal factor in achieving success, and “change leadership” is as important as “change management.”

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Unfortunately, the distributed PAT approach was fraught with participation and buy-in issues from the start (see Organizational Culture, page 13). Several solutions to the non-participation problem were tried, including tying individuals’ performance evaluations to support for the PATs, positive feedback systems, a newsletter, and intense training for the SEPG and PAT members. By the time CMMI Version 0.2 was published in August 1999, it was clear that the fully distributed approach was not going to work.

Then when it was introduced, the single process structure of the CMMI for Systems Engineering and Software Engineering (CMMI-SE/SW) Version 0.2 came as a surprise. We took advantage of this by making three important decisions. First, due to the nature of the organization’s business base, adopting the systems engineering model in conjunction with the software engineering model offered a major advantage because the organization now had the potential to develop a true single process for engineering from the start. Second, we decided to reorganize the distributed SEPG into an Engineering Performance Improvement Center (EPIC) with a core team of two people and field office leads from each of the seven major offices. Third, we decided to petition the Software Engineering Institute (SEI) to join the CMMI Version 1.0 product development team, primarily to avoid future surprises in the evolution of the CMMI family of models.

With a core team of process engineers and the support of field office leads from all the major offices, EPIC began the task of standard process definition in earnest. The first step EPIC took was to translate the CMMI-SE/SW product development team, primarily to avoid future surprises in the evolution of the CMMI family of models. We included infrastructure as a core process, i.e., a recognition that adoption of the CMMI will affect processes and technologies used by business development, human resources, training, information systems, and financial management. We ultimately found a life-cycle framework in ISO/IEC 12207 [1] that served as a starting point for our

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core process architecture. In addition to focusing our thinking, the core process architecture insulated us from all but the most severe changes to the CMMI-SE/SW as it evolved from Version 0.2.

**Process Engineering**

**Mechanisms and Innovations**

During the next two years, the organization defined the standard process in six major work products, each with its own primary focus and internal customers. These included the following:

- An integrated engineering handbook for project managers, engineers, and management.
- An engineering performance improvement program plan for the EPIC.
- A process and product quality assurance plan for quality assurance.
- A measurement and analysis plan for the entire organization.
- A purchasing manual for contract managers and project managers.
- A knowledge management plan.

For our purposes, we defined knowledge management as containing five specific stages in the learning process: knowledge needs assessment, knowledge assimilation or creation, knowledge codification, knowledge transfer, and assessment of both assimilation and the knowledge-management process itself. The concept and practice of knowledge management creates alternative training solutions, and allows us to start activities like identification of knowledge domains and development of knowledge base experts.

The organization also adopted several mechanisms and (at least to us) innovations that have proven or are starting to prove their value. Among these are the following:

- A life cycle that is both flexible and recursive, allowing tailoring to support the needs of the project and the customer.
- A repeatable tailoring approach that accommodates services, systems, and hardware and software development for small to large project sizes.
- The use of principal managers and leaders in the organization to teach critical courses.
- The early development of an automated measurement database.
- The development (later than we wanted) of a distributed work environment to support process engineering and information sharing.

Several of these innovations and mechanisms have been the subject of conference panels and the SEI’s working group efforts [2, 3, 4].

We understood and have reaffirmed the value of frequent external assessments as a means of refreshing our approach, clarifying issues, and evolving the process culture. We had an external SEI-authorized lead assessor conduct four profiles, or low-end assessment requirements for CMMI (ARC) Class B assessments. We have also conducted one ARC Class B assessment that was nearly a full Level 3 Standard CMMI Assessment Method for Process Improvement.

The results of our ARC Class B were that our standard process was nearly complete, but project buy-in and institutionalization was found to be lacking. The assessment caused us to refocus our knowledge management program, and to add activities to gain buy-in at the project and organizational-unit manager level. We also had an epiphany as a direct result of the assessment: Our service thread in the standard process was not as complete as it needed to be.

In all cases, we have found clarifying realizations that catapulted our understanding and insight rapidly forward. The opportunity for organizational delusion (potentially humorous when seen in other
In general, no organization-wide measures were being collected or analyzed on a routine basis, except for customer satisfaction ratings and certain financial performance measures.

There also existed a set of organizational core values that were propagated and institutionalized through leadership example, training, and evaluation of office and personal performance. These core values were assimilated throughout the organization, and provided a foundational starting point for process improvement. These core values were comprised of the following statements: "We are relationship-based," "People are our greatest asset," and "Growth is an imperative."

The values were adhered to and considered in normal operations at each level of the organization. This resulted in a common culture that exhibited a consistent focus. The underlying message was that commonly held values (processes), if strictly adhered to, offered real potential for organizational and personal success.

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technology. It was important to rely on the leadership’s knowledge of the CMMI, of the principles of process improvement, and trust in the seminal abilities of the change manager in dealing with such issues.

The change manager (EPIC technical director) developed a close and continuous relationship with the senior leadership. An early effort was made to understand how the business environment would evolve, that information would be shared across all levels of the organization, and that standard processes would normally have to be followed, even by the leadership. The problem is, these words just did not mean much to an organization that was just starting down its quality path.

So our leadership was pretty much left to discover for itself how real the CMMI is. The discovery process had several layers, each rising into view as the one before was successfully negotiated. Discovery levels included the following:

• The CMMI really does change the way every part of the organization operates.
• The costs associated with adoption of the CMMI are real and cannot be avoided.
• Routine actions have to be conducted in accordance with the standard process, as well as corrective and near-crisis actions.
• A CMMI process improvement effort is not just another project, where the work products are the most important output.
• Some of the people you have worked with and trusted for years will resist the improvement effort for various well-intentioned reasons.
• Assessments cannot be used to provide feedback and evaluate the performance of individual elements of the organization.
• The CMMI process improvement effort must be carefully aligned with the goals of the organization to make it worthwhile.
• The management and leadership style that has served to bring leaders this far in the organization now must be negotiated with the unseen authors of a complex model they are just beginning to appreciate.

The business instincts, trust, and core values of the leadership are challenged in this environment, and rightfully so.

**Conclusion**

So what combination of elements does it take to succeed in adopting the CMMI? Competent process improvement strategies and activities are certainly necessary, but not sufficient. Innovation may provide considerable additional value to the organization, but not if the process improvement effort is terminated while the process group is busy innovating. Organizational culture and core values have a considerable effect on the probability of success of the CMMI effort. And, because the CMMI intrudes on the infrastructure of an organization, the potential impact of culture on the process improvement effort is magnified.

There will be bumps in the road. Some heroes in the organization will probably leave. It will take longer and cost more than anyone wants. Management and leadership will be exposed to a series of discoveries that will be somewhat uncomfortable, and even be asked to continuously re-examine the values, beliefs, and management/leadership techniques with which they have succeeded so well in the past. New management techniques will have to be adopted, and the discipline with which engineers conduct business will be made significantly more rigorous. The amount and detail of continuous information sharing will increase considerably at all levels of the organization.

The substantive issues that threaten the success of a CMMI process improvement effort stem from a single source: the need for every engineer, manager, and leader in the organization to evolve in a very prescribed manner of conducting business. The professional, hard-working people who make up the organization have to be led to believe that the new way will work. They need to believe it will not threaten their careers, will not ultimately make their jobs more difficult, and will allow them to succeed within a new framework that they are just beginning to understand. This task, while difficult, is critical to success. It requires business leaders who are committed to the fundamental improvement of their organization, who know and trust their people, and who have the skills and character to lead people through change.

**References**


**Note**

1. This article is a follow-up to the example in the book by Ahern, Dennis, et. al. CMMI Distilled. Addison-Wesley, 2001: Chapter 2.
2. Jacobs Sverdrup Inc. is a wholly owned subsidiary of Jacobs Engineering.

**About the Author**

Jeffrey L. Dutton is the technical director of the Engineering Performance Improvement Center (EPIC) at Jacobs Sverdrup. He provides leadership solutions and management of process and technology improvements to the business of conducting and managing engineering programs. EPIC’s principal focus is on adoption and institutionalization of the Capability Maturity Model Integration™ for Systems and Software Engineering (CMMI™-SE/SW). Dutton was a member of the Software Engineering Institute’s Product Development Team for Version 1.0 of the CMMI-SE/SW. He has led systems engineering and software process improvement efforts for more than six years. Previously, he was an authorized software capability evaluator. He was also assigned to the Office of the Secretary of the Air Force (Research and Development), and Headquarters Air Force Operational Test and Evaluation Center. He has a bachelor’s of science degree in aerospace engineering from the University of Arizona and a master’s of science degree in operations research from the Air Force Institute of Technology.

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