Factors Affecting Process Improvement Initiatives

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When starting a process improvement initiative, it is imperative to determine the appropriate tasking and the scope of the process improvement program. It is tempting for an organization to try to take on too much too fast, especially if it feels that it must catch up to its competition. While it is natural to want to initiate a program quickly, it is important for an organization trying to get a process improvement initiative started to be as realistic as possible in these beginning stages. This paper will identify the critical factors to consider that have helped the authors' clients.

This paper is based on the authors' previously published, "Entry Strategies Into the Process Improvement Initiative," *Software Process Improvement and Practice Journal,* Vol. 4, Issue 2, pp.73-88, June 1998.

The Critical Factors Identified

When an organization is trying to establish its organizational process, there are many factors that must be taken into consideration. We have identified the following factors that we believe are critical for organizations that have started their process improvement programs in the past 10 years, and will discuss them throughout the remainder of this paper.

- History of previous process improvement programs or quality improvement programs.
- Financial resources to fund the process improvement initiative.
- Human resources that can be dedicated to process improvement.
- Software engineering capability of the developers.
- Technology support available.
- Contractual obligations.
- Scope.
- Customs and culture of the organization.
- Standards (industry, corporate, organizational, project, customer).
- Understanding and support from all levels of management and practitioners.
- Corporate political pressure.
- Business objectives.
- Vision.

History

Knowing the history of previous process improvement or quality improvement programs can help the process improvement initiative an organization is about to undertake. After one or two intitiatives associated with quality management or process improvement have failed, an organization becomes disinterested and cynical. Existing process improvement attempts, perhaps scattered throughout the organization, should be examined to determine if they could be used as a good starting base for this new organizational process improvement effort. Looking at what went right and what went wrong with past process and quality improvement attempts can be very useful. If an approach or part of an approach was successful, perhaps following that approach will be successful again. If an approach was not successful, then understanding what caused the failure could help avoid those problems and negative feelings the next time. Understanding history can help ensure future success.

Financial Resources

Most organizations that get involved with process improvement are in business to make a profit. Process improvement is not free; it takes money, computer resources, human resources, tools and techniques, training, and consulting support. It is important to determine how much process improvement an organization can afford. Regardless of what standard or model is followed or what external pressure may be exerted on the organization, there is a real probability that it can only afford so much process improvement. Even if the managers and practitioners of the organization wanted to improve in multiple areas at one time, they may be financially restricted to focus on a few key areas and add others as they begin to show a measurable return on investment.

Human Resources

When we speak of human resources, we must also state that we are talking about qualified human resources. A process improvement initiative that will be successful must be able to assign or find qualified process improvement agents. Some of the best candidates for the support of process improvement may also be the key players in development or project management. Senior, especially middle, management normally is not happy to move these people out of their perceived strategic positions and into process improvement. Finding qualified process improvement agents to join an organization, to come up to speed on its products and services, and to adapt to its culture is also a difficult task. Process improvement requires strong process improvement or change agents who can coach and mentor others, allowing them to become comfortable with the changes and even more productive. The process improvement agents or Software Engineering Process Group members need to understand senior management's strategic direction, the organizational structure, software support activities such as Software Quality Assurance and Software Configuration Management, modern software engineering techniques and methods, and basic project management practices in order to increase the likelihood of success. They also must be able to work within the organizational culture, know how to manage technology change, be able to apply team-building concepts, and utilize collaborative consulting skills.

Understanding Software Engineering Principles

It is worth taking the time to understand the organization's comprehension of basic software engineering principles and deciding how much training, coaching, and mentoring will be necessary to support the process improvement initiative. It might be wise to provide some basic software engineering training and follow up with coaching and action planning as the organizational members realize what it is that they need to do to improve.

The Capability Maturity Model (CMM®) and the associated process improvement aids that the Software Engineering Institute (SEI) supports assume that the organization has a sound understanding of software engineering principles but does not apply them very well. CMM Level 2 Key Process Areas focus on project management practices to remind managers and developers that they need to adhere to these project management practices to properly manage and control their projects. The CMM is not a Software Engineering Handbook. It does not describe the underlying software engineering principles, but assumes that they are understood. Asking for an assessment and assuming the organization can accept the assessment results, develop an action plan, and start to implement it with positive measurable results can be very risky! It is useful to determine the level of understanding of software engineering at all levels of management, as well as to determine the software developers' level of experience and understanding of software engineering principles.

Technology Support

Another critical element is to determine the organization's attitude toward technology. It is important to ascertain whether technology is sought after as the "silver bullet" or if it used to support the process and make the developers more productive. Where does the technology support come from now? Does an in-house group provide it or is it provided by an outside vendor with a long-term contract that is difficult to break or get around? What budget is available for technology?

If management views technology as a quick answer for the organization to get on with its important work, or sees technology as a way to increase the developers' productivity by 15 percent to 20 percent without any other support, then it is important to help management understand process improvement concepts. However, if management's attitude is that appropriate technology should be used to support the process improvement initiative and that both process and technology are needed to allow workers to be as creative and productive as they can be, then an emphasis on technology is desired.

Technology is necessary to support the managers and developers working on today's complex systems. A quick glance at the CMM might give one the impression that technology is not thought about until Level 5, but of course that is not true. Technology is required to support the managers and developers at every level; however, the technology must complement the process, not drive it. Any entry strategy into software process improvement must take past, present, and future technology into consideration.

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Contractual Obligations

The talk about process improvement seems to indicate that an organization needs merely to decide that it will undertake a process improvement initiative and all other factors are incidental. However, some of the organization's major projects may have long-term contracts that can be viewed as blocking factors to process improvement. Some or many of the process improvement ideas may not be allowed to be implemented on those projects without first obtaining permission from the customer. This implies that either an understanding or an agreement must be made with the customer for that existing contract or the organization may be restricted in what it can realistically implement on such a project.

Scope

The term *scope* is most appropriately used when preparing for an assessment or evaluation (audit). You must decide whether the entire organization is to be examined or just a department or even a project or two. It is entirely appropriate to think about the scope when preparing for a process improvement initiative. Each process improvement initiative must have a clearly defined scope. Is it the intent to institutionalize the management practices of Level 2 throughout the organization? From a political or strategic point of view, is it more appropriate to focus on a product line? What departments should be included in the process improvement initiative? Are there specific projects that should spearhead the process improvement effort and then gradually expand successful concepts to the rest of the organization? The scope of the process improvement initiative will also determine how many resources are needed to support this effort. Resources include people, money, equipment, tools, methods and techniques, training, and potentially outside support from consultants.

Customs and Culture

Culture may seem obvious to us, but it is subtle and can have an enormous influence on the way that we think and go about our daily lives. Organizational culture not only affects the development and maintenance of software but also everyday morale of the work force. Culture may come from the region of the country or world that we are living and working in. The culture of the European countries of France, Spain, and Italy is very different from that of Germany, the Netherlands, and Scandinavia. The culture of the southwest region of the United States is vastly different from that of the East Coast. Some cultures conduct meetings only to tell the participants what decisions have been made, and others are so team oriented that an answer given to an outsider is almost always the result of team thinking. Some cultures are open and accept challenges and innovations, whereas other cultures are closed and decisions must come from the top.

Much of the process improvement thinking today seems to support the idea that a strong process focus should transcend the personalities of the top management of an organization. In the authors' experience it is more often that the senior management team's attitude toward quality and process improvement has a strong influence in determining what the organization's culture will be. The organizational process improvement initiative must

take into consideration the organization's culture, if this initiative is to have any chance of success.

Standards

The various standards established for software development around the world have their own special effects on a process improvement initiative. Department of Defense (DoD) standards such as MIL-STD-498 and previously MIL-STD-2167 and MIL-STD-2168 directed ways of approaching problem solving, prescribed formats of documentation, and dictated software life-cycle approaches that influenced many software support activities such as configuration management and software quality assurance [1], [2], [3]. International Organization for Standardization (ISO) standards such as ISO 9001, ISO 9004, and ISO 9000-3 (TickIT) are a set of commonly talked about international standards. They were intended to allow countries to trade with one another and be able to expect a certain level of quality [4], [5], [6], [7]. Instead, the pressure to be ISO certified pushed organizations to develop pages of documented processes that were rarely known or used throughout the organization. Institute of Electrical and Electronics Engineers (IEEE) standards provide templates and guidelines for organizations to adapt to support their software development efforts [8]. The Capability Maturity Model, developed at the SEI in Pittsburgh, has become a de facto standard in the world [9], [10], [11]. Many companies, however, try to apply the CMM as an absolute model rather than the roadmap or guide that it is.

Your organization's requirements to adhere to a standard and/or its reaction to standards can have a profound influence on your process improvement initiative.

Understanding and Support from All Levels of Management and Practitioners

From Dr. Edward Deming's ideas on Total Quality Management to the texts that are found today on quality management and process improvement, it is clear that management understanding and cascading management support is critical for the success of any process improvement initiative [12]. Without senior management sponsorship, process improvement change is slow at best. However, it is most frequently the middle managers who become the blocking factors in any quality management or process improvement effort. Middle managers today are under tremendous pressure from multiple sources: they feel pressure from the senior management team to produce products better, faster, and cheaper; and they feel pressure from the developers and first-line managers to provide the latest in computers, languages, methods, and techniques. Many of the middle managers are not aware of the processes that their developers are following. As a result, they often resist process improvement initiatives due to this lack of awareness and to the pressures just noted. Therefore, any process improvement initiative must take these factors into consideration. The senior management team must encourage, train, and support middle managers in process improvement principles so they know what is in it for them and, in turn, provide the necessary support from their level.

Although the CMM puts tremendous emphasis on management practices, a successful process improvement initiative must also have the practitioners' support. Groups, managers, and practitioners must be trained, mentored, and coached.

Corporate Political Pressure

While there may be companies that are unaware of the CMM or do not care to use it as a guide for their process improvement initiative, the political pressure to be CMM Level 2 or CMM Level 3 by a certain time is at epidemic proportions throughout the world. Many large international companies have edicts from corporate offices indicating that each business unit must achieve SEI CMM Level 2 or SEI CMM Level 3 in 12 months or 18 months. The idea of process improvement frequently gets lost. With at least a few of the large clients that the authors are aware of, a vice president is offered an incentive of $10,000 to $20,000 if his/her business unit achieves the CMM level number. Some of these vice presidents have issued orders to their process improvement managers to do whatever it takes to get the certification of the needed level—process improvement is secondary.

One European client felt this corporate pressure so badly that the client abandoned its systematic approach of process improvement and resorted to developing processes in isolation from those who would use them, providing a two-hour overview training, and declaring the practice to be institutionalized. The resentment to the process improvement effort and to the CMM was the highest these authors have seen in 10 years. The individual managers and practitioners could not see what benefit they were getting if the only goal was to achieve a level. Eventually the management team took a stand against the corporate directive and backed a process improvement initiative that would support the business and eventually result in a higher maturity level rating. Political pressure must be taken seriously when starting a process improvement initiative.

Business Objectives

For a process improvement initiative to be successful, it is imperative that it is tied to the organization's business objectives. Typical business objectives have included reducing time to market, improving delivery-time accuracy, increasing the quality of products, and increasing market share. It is important to determine the organization's highest priorities; the consequences to business resulting from weak or ineffective processes, and the action taken to correct the cause. You need to identify how the process improvement initiative is seen to support the organization's business objectives, and how the process improvement initiative will tie in to the organization's overall focus on Quality Management. Only then can the management practices at CMM Level 2 and the technical practices at CMM Level 3 take on real meaning. For example, if a business objective is, "Find and fix each problem once," it can be shown that applying the management practices of Software Configuration Management will support this business objective.

By getting management to define the business objectives, the process improvement initiative can be adapted to support those business objectives. By using the CMM as a

roadmap, an organization can accomplish process maturity and use this maturity to support the business objectives; otherwise maturity levels are often useless. Be careful not to lose sight of the business goals, thinking that you are going through the process only to attain a certain level regardless as to whether the process works for your organization.

Vision

Understanding senior management's vision is a critical step in establishing an organization's process improvement initiative, one whose value cannot be emphasized enough. In the past three years, assessments have revealed that a lack of understanding of the senior management's vision has caused measurable lack of motivation and productivity.

Where senior management thinks the organization will be in the next year, and in the next two to five years, must be identified. Competitors and strategic alliance partners need to be recognized. The technology changes that are expected and/or will be required to support the vision should be addressed. Determine the necessary organizational structure to support this vision, as well as what the organizational culture must be. Only then can you determine how a Process Improvement Initiative will support this vision.

Conclusions

Getting involved with process improvement is essential for companies that develop software today. However, deciding on how to get started, how many resources to dedicate to this effort, understanding how it supports the organization's business objectives, and many other factors, is not an easy task.

The factors that may affect a process improvement initiative must be determined and used to guide the organization into choosing the right entry strategy for it. One size does not fit all and an assessment may not even be the right place to start! The first step toward a successful improvement program is to choose the appropriate process improvement entry strategy.◆

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✐Letters to the Editor✐

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—Delores J Harralson, Hughes Space and Communications

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—Cathy Ricketts, NAVSEA