KPA
Insights through analytics

The Israel ESPINODE

Software Process Improvement Series

Part VI

Planning for Software Process Improvement[1]

[1] Adapted from the book by Kenett and Baker: **SOFTWARE PROCESS QUALITY: Management and control**, M. Dekker Inc., 1999

In Part IV, we discussed how to organize for quality management, in Part V we introduced software process improvements, CMM, SPICE and ISO9000. In Part VI we introduce a planning strategy for software process improvement in the context of quality management initiatives, which includes assessments based on CMM, SPICE or ISO9000 methodologies. The first step of any improvement is problem recognition. This may be accomplished by performing an assessment, as described above. An assessment of the current state of the practice leads to a set of findings and a corresponding set of recommendations for process improvement. These become the basis for selecting process improvement projects (the second step) and developing the action plan for process improvement (see Figure 1).

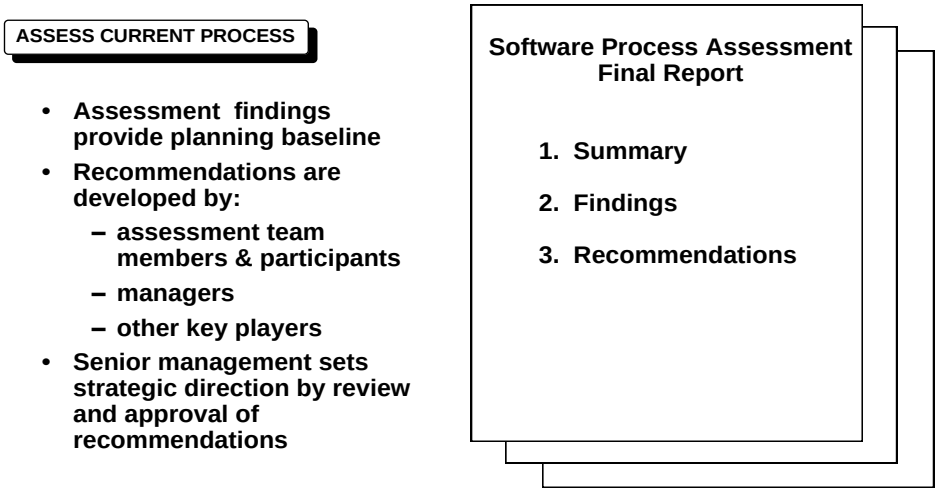

Figure 1: Software Process Assessment Final Report

The strategy for implementing the recommendations should be addressed in a plan that accomplishes the actions as a series of small projects. The plan should identify the resources (including personnel, capital outlays, and software and hardware tools) needed to execute the projects, the schedule, associated tasks, project responsibilities, and measures that will be utilized to indicate success or failure. At the top level, we have the overall plan, which identifies and prioritizes the individual projects. Rough, order-of-magnitude costs for executing these projects are estimated, together with a schedule that shows the phasing of each of these projects. Once the long-range plan has been approved, detailed implementation plans for each of the approved projects can then be developed. These plans would contain a more refined cost estimate and schedule for performing each of the projects. Figure 2 illustrates the process.

The long-range action plan should be one that is commensurate with the overall business objectives of the organization.

In developing this plan, a team is organized consisting of the personnel who participated in the assessment, as well as any other personnel who have a vested interest in the outcome of the planning effort. This team is the focal point for the planning process. In Part IV, we discussed the concept of the Quality Council. We pointed out that sometimes the role of the Quality Council is

split between senior management and the Software Engineering Process Group (SEPG). Members of that Quality Council (the SEPG) will typically participate in this team. As we will show a little later, senior management also has an important role to perform.

To expedite undertaking the various analyses that need to be performed and to achieve agreement on priorities, the planning process is typically conducted in a workshop mode, led by a facilitator.

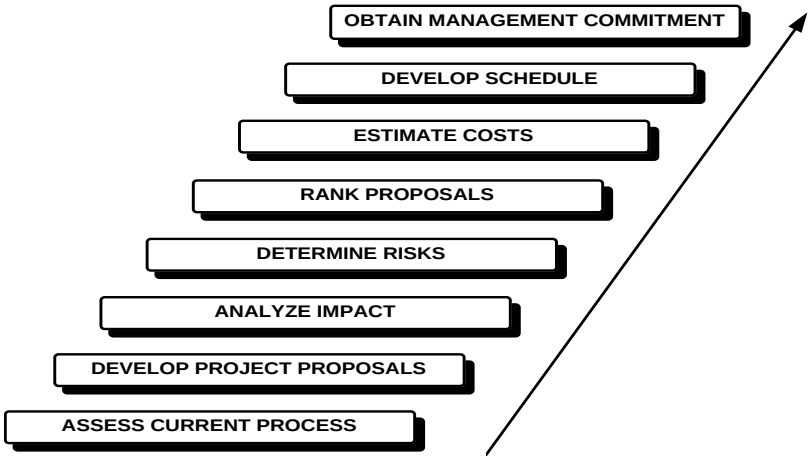

Figure 2: The Long-Range Action Planning Process

Based on the findings of the assessment, a set of recommended solutions to the process issues identified in the assessment report are proposed. This begins the process of project selection. Typically, numerous projects are proposed. Through discussions and nominal group techniques, the list is winnowed down to a manageable size: something on the order of a dozen. All of these projects cannot be implemented at once. Some sort of prioritization must occur. How this occurs is described in the next section.

In arriving at the highest priority improvement projects, three factors must be considered: impact, risk, and benefits. When we look at impact, we are looking at the impact of the projects on the overall strategic business objectives of the organization. If we performed a CMM assessment, we can look at the number of KPAs affected by the project, since an action to be implemented can impact more than one KPA. For example, suppose there is a recommendation to implement configuration management to accomplish the baselining of requirement documentation and instituting change control over them. Suppose there is another recommendation concerning subcontractor management that addresses having a solidified set of requirements for the prospective subcontractors before the subcontract is let. A single project to implement a well-thought out change management process can have impact on the business objectives, as well as implementing process improvement based on both of these KPAs.

In evaluating the business impact, the beginning point is the statement of the organization's business objectives. These are then characterized by a set of critical success factors that help to

determine if these objectives are being met. These should be expressed in terms that relate to the data processing or software development organization. It is best to limit this list to a maximum of about 7 critical success factors (CSFs). Generally, this list, as it relates to the data processing or software development organization, is developed in a joint session consisting of the cognizant senior management and the members of the planning team. If the business objectives have already been clearly and publicly stated by management in some documented form, the focus is then on the development of the CSFs. Sometimes, we find that the business objectives have not been articulated for the organization, and the first order of business then becomes to state those. The intent of the activity is to reach consensus on the CSFs affecting the software development organization, and to establish weights for each of the factors. It is also the intent to enlist senior management participation in this activity, thus establishing their commitment to the process improvement activity.

Each of the projects is then scored against these CSFs, in terms of how well they will support achieving them. For each project, a normalized score is calculated, which is later used for rank-ordering the projects. Figure 3 illustrates the process.

Process Improvement Proposal Impact Analysis for Project "C"

Critical Success Factors Description	Weight	Impact Score	Wtd. Score
CSF 1	6	5	36
CSF 2	4	1	4
CSF 3	10	9	90
CSF 4	2	6	12
CSF 5	8	4	32
TOTALS:	30		174
NORMALIZED			5.8

Figure 3: Performing the Impact Analysis Based on Business Objectives

A second impact analysis is then performed, in which each of the projects is evaluated against their impact on achieving the next level of capability on the CMM. A simpler weighting is used here, based on a high-low scale. Recall that some projects can impact more than one KPA. Those KPAs that are associated with the next level of maturity receive the highest weighting, while those that area associated with higher levels of maturity receive lower weighting. The objective is to get to the next higher level of maturity. Accordingly, as a first cut, all KPAs at the next level of maturity receive the identical (higher) rating, while the KPAs at the next level of maturity receive an identical lower rating. The project is then scored against each of the affected KPAs, and a project normalized score is calculated, as previously described. As a refinement, a second cut at the impact analysis may be performed. At the next level of maturity, some KPAs may be more important than others, based on the assessment findings. The issues that are presented as assessment findings have been identified by consensus, and reflect the most pressing issues for the

organization. Accordingly, the KPAs associated with those issues will receive higher weighting. As before, weightings are established in a consensus gathering session, again using techniques such as Australian balloting. Figure 4 illustrates the process. In performing this analysis, keep in mind that the cumulative sum of the weighted scores for a given KPA across all projects cannot exceed 100%. The significance of a score of 100% is that the KPA is totally achieved. A score in excess of 100 means that the KPA has been more than achieved, which is not logically possible.

Process Improvement Proposal Impact Analysis for Project "C"

Key Process Area KPA	Weight	Impact Score	Wtd. Score
Project Planning	6	9	54
Project Oversight	6	7	42
Requirements Mgmt.	6	2	12
SQA	6	1	6
Config. Mgmt.	6	1	6
Integ. Proj. Mgmt.	2	5	10
TOTALS:	32		130
NORMALIZED SCORE:			4.1

Figure 4: Performing the Impact Analysis Based on Key Process Areas

Risk refers to the difficulty associated with implementing the proposed plan. Is implementing the project a gamble, or are the results reasonably predictable? In determining this, a number of factors are considered, grouped into three categories: project size, structural issues, and technology**.** Project size, as a risk category, refers to the magnitude of the project in terms of staff-hours to implement it. In general, the smaller the number of staff-hours to perform the project, the lesser the risk.

The risk evaluation is performed in a manner similar to that of the impact analysis. In the case of risk, however, a tailored set of risk factors is defined. The list of risk factors shown here are a generic list. The risk factors shown here may be not all be applicable for some organizations. Other, additional factors may be. The list needs to be refined for each organization to be applicable to that organization's specific environment.

For each project, a score is determined for each of the risk factors and a normalized score is calculated, based on the sum of the weighted scores for each of the factors. Note that there is one major difference. In the case of the impact analysis, the greater the impact, the higher the score. In the case of risk, the higher the risk, the lower the rating. Projects with the lowest risk receive the highest score.

Once the impact and risk analyses have been performed, the projects are ranked according to total score. The general equation for calculating the total score is as follows:

Total Score = ($Weight_1$)(Business Objective Impact) + ($Weight_2$)(KPA Impact) + ($Weight_3$)(Risk)

where the impacts and the risk for each project are the normalized scores developed in the manner described in the paragraphs above, and weights 1, 2, and 3 are determined by consensus. To illustrate how the rankings are developed, some organizations may consider all three items of equal importance. Under those circumstances, the equation would reduce to:

Total Score = (Business Objective Impact) + (KPA Impact) + (Risk)

Another organization might consider the business objective impact three times more important than KPA impact, and risk twice as important as KPA impact. Under those circumstances, the equation would reduce to:

Total Score = 3(Business Objective Impact) + (KPA Impact) + 2(Risk)

Each proposed project is thus scored, in turn.

A tentative ranking is now established on the basis of the scores recorded for each project, with the project achieving the highest score ranking the highest. A further refinement of the ranking is then made after the conclusion of the next step.

A cost-benefit analysis (for example, return on investment) is not likely to be performed by organizations to support the ranking process. As a rule, Level 1 and 2 organizations will be unable to accurately forecast tangible benefits to be achieved from the improvement projects. These organizations typically will not have collected the data and metrics to support such projections. Such analyses are feasible for Level 4 and 5 organizations, and may likely be achievable for Level 3 organizations, or organizations close to Level 3.

After the proposals are ranked, the next step is estimating the schedule and cost for each project by itself. In this step, the intent is not to develop fine-grained costs or schedules, but to get an overall rough order-of-magnitude estimate, in order to get an general idea of what the commitments would be for each project. Knowing the staffing and financial resources available for the near-term (for example, the remainder of the fiscal year), the team can then identify the candidate projects for the near-term plan, based on priority and available resources. Figure 5 illustrates the methodology. Considering the fact that the projects have been prioritized, and, in all likelihood, there will be interdependencies between them, the next step is to develop an overall strategic schedule for all the projects which reflects their priorities and interdependencies. Figure 6 is an example of such a schedule. It is an example of a schedule for calendar year 1994, showing that the projects overlap two fiscal years, and the output from Project E becomes an input for Project B, which, as the plan indicates, would be performed in calendar year 1995. Also, the schedule indicates that Projects B and F become inputs to Project D. Consequently, the priority of the projects can change as a result of the interdependencies between projects. Projects A, F, and B may now become the projects recommended for the first year.

Another consideration is impact and visibility. For low Level 1 organizations, management may not have much credibility where it relates to process improvement. Past experience may prove that management "talks the talk", but doesn't "walk the walk." Considering that, a short-term project having low risk, high visibility, and some non-trivial benefits, may be a better candidate for a high priority, initial project, even though it may have had a much lower ranking.

Process Improvement Cost Summary

Rank	Project	Cost	Cumulative Cost
1	Project A	$23,000	$23,000
2	Project F	55,000	78,000
3	Project D	100,00	178,000
4	Project C	62,000	240,000
5	Project E	15,000	255,000
6	Project B	37,000	292,000

Available Funding Level = $185,000

Figure 5: Defining the Candidate Projects

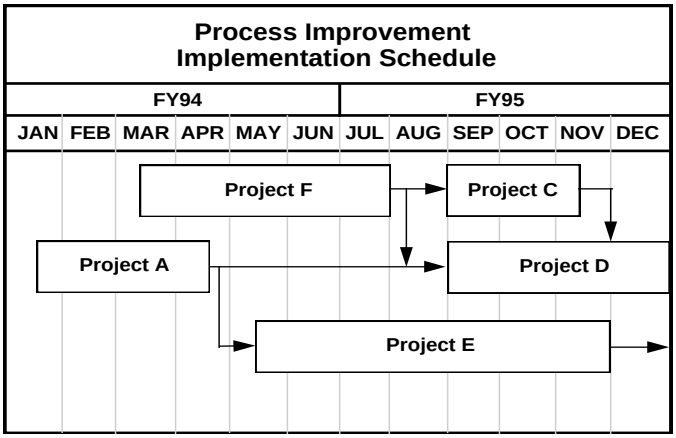

Figure 6: Scheduling the Projects

The next step is to formalize the plan and present it to management to obtain their concurrence and commitment.

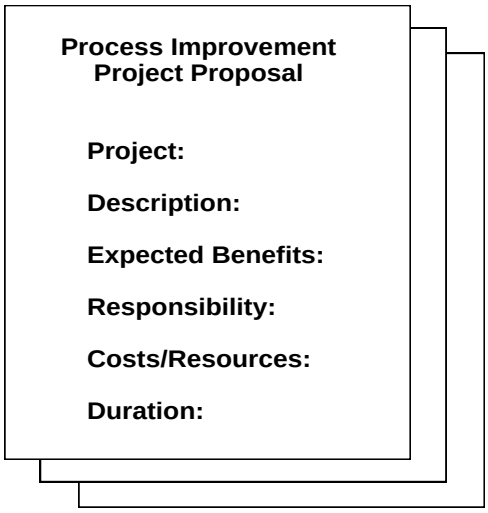

Figure 7: Example of a Process Improvement Proposal

The overall plan for process improvement is prepared and presented to the steering committee. We described this in Part IV, when we described the function of the Quality Council and of the SEPG. Figure 7 illustrates the typical content of the plan. There would be an introductory section in the plan that would explain the purpose of the plan, describe the methodology utilized in developing the content, and briefly summarize the findings and recommendations contained in the assessment report. Typically, it will be the responsibility of the SEPG to coordinate and manage the implementation of the action plan. They should track each project against its planned schedule, funding, and task performance. Most project plans will require a pilot application of the change in the process. Once the trial application has shown that the new methods will work, the SEPG then becomes responsible for communicating this to the organization as a whole. Senior management, acting as a steering committee, meets regularly with the SEPG to discuss progress and status. Senior management also authorizes the official roll out of the changes in the process. After a pilot application shows the efficacy of the change, and feedback from the pilot application has been incorporated into the standards, procedures, and training materials, as appropriate, the SEPG makes a report to the steering committee. The steering

committee then decides if the change should be rolled out, and, if it should provides the authorization. The steering committee also periodically reviews the status of the action plan and decides on which improvement projects to initiate next.
Part VII will introduce the reader to software measurement programs.