Improved performance in software development can be achieved by investing in best software development practices. Results can be measured by reduced project duration, decreased effort and better delivered product quality. This article will discuss how one organization identified the improvements by using a combination of quantitative measures and qualitative values. Based on the knowledge gained, the organization has utilized the results to advance their process improvement programs and improve their development practices throughout.

The desire to achieve process improvement was driven by senior level management. Management wanted results that would directly impact stated business goals and objectives, which included:

- Reduction of project costs (mostly effort)
- Improvement in their delivery (project duration) of software
- Achievement of better product quality by minimizing defects delivered
- Improved overall organizational performance relative to industry benchmark data points

The organizational strategy to achieve these goals was centered on the implementation of best practices. In order to achieve the findings and the results that followed, senior management had a well defined vision of what they wanted to accomplish, and they agreed to dedicate the resources necessary to realize the desired results. The ability to properly set management expectations and to gain their support was enhanced by the introduction of a measurement model that objectively and quantitatively generated meaningful results.

**Introducing the Measurement Model**

The key to successful performance management is measurement. The inclusion of performance measurement to manage and direct decisions is becoming more commonplace. Organizations have long recognized the need to establish strategic goals and objectives. Equally important, however, is the identification of an appropriate set of measures that will provide quantitative evidence that those goals and objectives have been achieved.

A basic measurement model that was advanced by the Practical Software and Systems Measurement (PSM) program suggests that an organization follow these three steps:

1. Identify the needs of the organization
2. Select measures appropriate to measuring whether the needs have been met
3. Integrate measurement into the software development process.

The management of this organization identified the needs of their organization. The David Consulting Group (DCG) was requested to help the organization select the appropriate measures and to create a measurement model that would result in the quantification of process performance levels. Furthermore, DCG was called upon to utilize a measurement model that would provide the ability to compare internal performance measures to industry benchmark levels of performance.

The basic measurement model used included the collection and analysis of both quantitative and qualitative elements. The quantitative elements included four basic measures: size, effort, duration and defects. The qualitative elements included a variety of data points that were used to evaluate levels of competency regarding process, methods, skills, tools and management practices.

Collected on a project by project basis, quantitative data can be displayed in a measured profile that indicates how well a project is performing. Standard industry measures such as function points per effort month, defect density and project duration must be calculated. If function points are used to measure project size, there is an opportunity to make comparisons to industry data points that are also based on function points.

The qualitative data (again collected on a project by project basis) results in a matching capability profile. This profile data identifies the attributes that contribute to high or low yields of performance, such as those indicated through SEI's Capability Maturity Model Integrated® (CMMI®).

These two elements (quantitative and qualitative) come together to form what is commonly viewed as an organization's baseline of performance. The baseline values are compiled from a selection of measured projects and represent the overall performance level of the organization.

Results can vary significantly. Some projects perform very well (i.e., they have low cost and high quality), and other projects do not perform well at all. Quantitative data provides senior management with an objective view of...
Improved Performance Should Be Expected

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The qualitative data provides the opportunity to examine the attributes of the projects to determine why certain projects have outperformed others. Baseline measures on a sample set of representative projects can provide senior management with the information they needed to make informed decisions. This analysis effort leads an organization to the identification of their best practices and opportunities for improvement.

The organization in this article wanted to determine the impact that SEI CMMI® Level 3 processes had on their performance. In order to determine this improvement, the organization had to first compare its previous baseline of performance and establish a composite profile of contributing attributes.

The organization collected and analyzed project data. Averages for size (function points), productivity (function points per effort month), duration (calendar months) and effort (labor) were computed. Using a composite profile, a mapping of the current project attributes for the organization was developed. In parallel, another model was developed for projects of a similar size with a mapping of attributes that matched CMMI® Level 3 characteristics.

The Findings

The impact of achieving CMMI® Level 3 for this organization was significant. For the same size of enhancement projects (approximately 133 Function Points), productivity (Function Point / Effort Month) was projected to increase by 132%, project duration reduced by 50%, effort reduction by 50% and defect density reduced by 75%. This modeling technique helped this organization to evaluate the potential benefits of CMMI® process improvement.

The potential impact indicated above may appear to be dramatic, but significant gains in productivity and reduction in defects should be expected over time as the organization matures.

In Summary

There are a variety of ways in which measurement data may be used to learn more about:

- An organization's level of performance
- Key factors that contribute to high or low yields of productivity
- The organization's level of performance as compared to industry data points
- The potential impact of strategic initiatives

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<th></th>
<th>Baseline Productivity</th>
<th>CMMI® Productivity Improvements</th>
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<tr>
<td>Average Project Size</td>
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<td>Average FP/EM</td>
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<td>Defect Density</td>
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The utilization of a measurement model that includes both a quantitative perspective and a qualitative perspective is most important. It is from this vantage-point that an organization can access both the measured performance profiles along with an understanding of the process profile elements that contributed to the results. The process profiles have the added advantage of recommending a direction for future improvement strategies.

Readers should not assume that similar outcomes will be achieved in their organizations. The prudent action would be to take your own measures and create your own organizational performance baseline. Utilizing industry accepted measures, such as function points, will allow you to perform the necessary comparative analysis. The investment in a baseline study is relatively insignificant in comparison to the value of the information gained and the potential return from process improvement practices.

About the Authors

**David Garmus** is a Founder of The David Consulting Group (see www.davidconsultinggroup.com), a CMMI® Approved Transition Partner and PSM Transition Organization that supports software development organizations in achieving software excellence with a metric-centered approach. David is Past President of the International Function Point Users Group (IFPUG) and a member of the IFPUG Counting Practices Committee. He received a BS from the University of California at Los Angeles and an MBA from the Harvard University Graduate School of Business Administration.

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