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Implementing Practical Metrics in an Outsourcing Environment

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ABSTRACT

IT firms that specialize in outsourcing must provide assurances to their customers that they are adding value to that business relationship. The purpose of this paper is to describe a practical set of metrics that are focused on customer satisfaction and that are easily understood by both customer and developer organizations. The metrics established by Keane, Inc., a large US-based IT services firm, are based upon the goals and concepts of the Software Engineering Institute's (SEI) Capability Maturity Model (CMM®) for software.

INTRODUCTION

Outsourcing is one of the fastest growing segments of the IT market. For example, IDC estimates that the number of large outsourcing contracts rose 100% between 1997 and 1998 and Chris Pickering's 1998 Survey of Advanced Technology reported that 75% of organizations surveyed have significant backlogs of IT work making outsourcing an increasingly attractive option for many CIOs. Dataquest, an IT industry research firm, estimated this market at approximately $116 billion in the U.S. and $80 billion in Europe for 1999. Industry sources believe these amounts represent approximately 20% of the total expenditures for software development and management. Most IT-related spending is currently allocated to in-house delivered initiatives. Industry analysts, however, forecast a greater share of this spending will rapidly shift to external service providers. Outsourcing, whether in the plan, build, or manage phases, can yield faster time to market and hence a competitive advantage in leveraging technology to achieve greater business value.

Keane, Inc. is a $1 billion IT services firm headquartered in Boston, MA that has positioned itself to focus on the large and rapidly growing outsourcing market by integrating the SEI's CMM for software into their application development and management methodology. They believe that organizations will increasingly seek to outsource the management of their application software as a strategic means for achieving process improvements. Keane educates its customers that by improving the software management process, businesses can significantly improve productivity, achieve qicker development cycles, lower application support costs, and improve quality. In short, their software applications will better support their business.

Keane has sought to differentiate itself in the outsourcing marketplace by emphasizing he integration of the CMM into their application development and management methodolgies. Considering the volatile nature of the outsourcing market it is not unusual to find some outsourcing arrangements that are focused simply on the lowest common denominator, i.e. providing a specified (and usually limited) set of services at a competitive cost. Keane, in comparison, strategically leverages their rigorous and comprehensive application management methodology (AMM) with the CMM to provide customers with a strong process-driven environment that often adds significant value beyond the initial outsourcing contract.

A central component of Keane's CMM strategy is the collection and strategic use of metrics in their outsourcing engagements. The systematic collection and analysis of appropriate metrics can be an invaluable component of a rigorous feedback and control process whereby software development and maintenance organizations are able to verify that performance levels are within the bounds of established customer expectations. Metrics programs, however, have been notoriously difficult to implement in many organizations and, in many cases, have not progressed beyond simple measurements of schedule, cost, and level of effort. While these basic measurements provide some project management guidance, they are often insufficient in providing strong evidence of customer satisfaction.

The software Capability Maturity Model (SW-CMM®) developed by the Software Engineering Institute (SEI) requires the basic metrics set of schedule, level of effort, size, and critical computer resources just to reach CMM® Level 2. Part of the rationale behind this set of metrics is that measurement baselines need to be established for individual projects so improvement goals can be established for each project in these areas. At CMM® Level 3, the Software Engineering Process Group (SEPG) is systematically analyzing this data, which now resides in an organizational database, to design and implement organization-wide improvement plans that target these specific areas, e.g. increased schedule control and predictability.

While these measurements and these improvement efforts are certainly translatable back to customer satisfaction, schedule issues are only one quality area in which customers now have high quality expectations. The CMM® Level 4 Key Process Areas of Quantitative Process Management and Software Quality Management drive software development and maintenance organizations to more fully identify and then meet customer expectations of quality. The data collected and analyzed by higher maturity organizations are frequently utilized to educate and fully inform the customer on standard control limits, identifying variations away from these control limits, and courses of corrective action for when these variations occur. As a result these metrics are highly influenced by customer expectations of quality in many areas.

This paper presents a set of metrics that can be gathered while organizations are at Levels 2 and 3 of the CMM® but that are also highly useful for Level 4 efforts. These metrics are focused on maintaining control over customer expectations by providing both developer and customer organizations with an ongoing report of contract compliance.

BACKGROUND

There has been a good amount of recent discussion on the practical implementation and use of metrics as organizations attempt to gain a quantitative understanding of their software projects. Daskalantonakis (1992) provides a multidimensional view of metrics that encompasses usability, categories, users, user needs, and levels of metrics in the context of a widespread and successful organizational metrics program. His conclusion is that metrics can only show problems and that it is the actions taken as a result of analyzing the measurement data that produces results. Also, Schneidwind (1992) proposes a comprehensive metrics validation methodology to integrate quality factors, metrics, and quality functions. Criteria such as consistency, predictability, and repeatability are identified as critical to the success of a metrics program.

Metrics programs are currently receiving increased attention as many organizations attempt to achieve Level 4 in the CMM® (Chatmon & Holden (1999); Felschow, et al (1999); Florence (1999); Harvey (1999); Natwick (1999); Purcell (1999). These authors all describe current efforts at implementing metrics programs within their organizations. Common themes include identifying the business value of the metrics, establishing quality goals and insuring that the data provide consistent information.

The following sections of this paper present the practical implementation of a rigorous metrics program that is in place at Keane, Inc., an international IT solutions firm whose objective is to help clients plan, build and manage application software. The major components of Keane's metrics program include the Project Control and Reporting Process, the Project Status Display Workbook, Quality of Service Reports, Service Level Agreement Reports and Software Quality Assurance Audit Reports.

PROJECT CONTROL AND REPORTING PROCESS

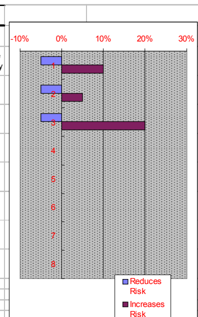
The foundation of Keane's metrics program is the Project Control and Reporting Process (PCRP). The process was developed to provide management with a snapshot of compliance with corporate project management standards and to obtain an early indication of issues that may impact cost, schedule or quality.

PCRP standards identify critical measurement points before, during and after a project and set the stage for on time, on budget delivery of a quality product.

Since Keane's various methodologies are built around a common four-phase "framework", the PCRP was similarly configured to facilitate the establishment and execution of quality and measurement checkpoints. Adherence to the standards is quantified on a project report card, using a scale of 1 (poor/unacceptable) to 4 (excellent/fully meets requirements), and is summarized at the branch and corporate level. This provides a point-in-time view of project progress and compliance at all levels of the organization. Projects rated below a defined minimum score are placed on a corporate 'watch list', and must develop and execute a plan to bring the project back within acceptable limits. Ratings are performed and report cards issued on a quarterly basis or at the completion of a project phase.

Phase 1: Proposal Development

Risk Variables	Impact	Range	Definitions	Risk Mitigation Action	Reduces Risk	Increases Risk
	Positive Impact		*Negative Impact*			
SME Availability	Gather info. More efficiently		Lost time due to unavailability	Schedule in advance	-5%	10%
Review and Signoff of Deliverables	Critical path delivery not affected		Lost time in critical path	Weekly review and focus on signoff	-5%	5%
Vendor Inventory Completeness/Accuracy	Vendor letters sent on time		Increased duration and scope	Client IDs vendors and prioritizes prior to	-5%	20%



TOTAL CHANGE OF SCOPE BUDGET = 20.00%

As a proposal for services is being developed, the risks associated with the project are assessed, quantified and graphically represented using the Project Risk Assessment Method (PRAM) Profile. The PRAM provides measurements that may indicate adjustments to a proposed estimate or schedule.

PRAM Profile

Phase 2: Project Initiation

During the project initiation phase, the project management environment is established, the defining documents (i.e., statement of work or service level agreement) and project plan are prepared, and the PRAM Profile is re-evaluated. Ratings are applied to each of these deliverables.

Phase 3: Project Execution

Throughout the project execution phase, PCRP monitors and reports on the following attributes:

- team status meetings
- weekly project status report
- weekly status review with client
- maintenance of a project notebook
- project plan updates
- change control procedures
- acceptance procedures
- Project Summary Display (PSD)/trend reporting (see below)
- monthly branch project review
- branch support
- client satisfaction

Phase 4: Post Project Summation

At the conclusion of a project, PCRP requires that all deliverables have been formally accepted by the client, the project notebook and other key assets used to manage the project have been archived, and a 'lessons learned' document has been prepared by the project manager.

PROJECT STATUS DISPLAY WORKBOOK

The Project Status Display (PSD) Workbook is a tool that enables project managers to track and report project status and financial results at a deliverable level and provides client management with a summarized view of the project on a weekly basis. Based on data from the project plan, the PSD is maintained with an Excel workbook, consisting of six worksheets:

- Project & Billing information – General information for the initiation of the project is recorded, including a project number, client number and other standard information that will be used as headings for the other sheets in the workbook.
- Planned – Includes planned resources, billing rates and weekly hours.
- Actual – Records actual resources assigned, billing rates, and actual hours spent on the project. The estimated hours to complete is captured and used to project variances.
- Project Status Summary (PSS) Data Sheet – For each deliverable in the project plan, the estimated effort hours and cost, actual effort hours and cost, client acceptance, and any change control applied are updated weekly.
- Formatted PSS – A tabular report computed from the data sheet.
- Summary Sheet – A graphical and tabular summary of the project's value and actual costs, an analysis of variance, and notes related to change control. Significant variations between planned and actual performance must be addressed by project management through a formal action plan.

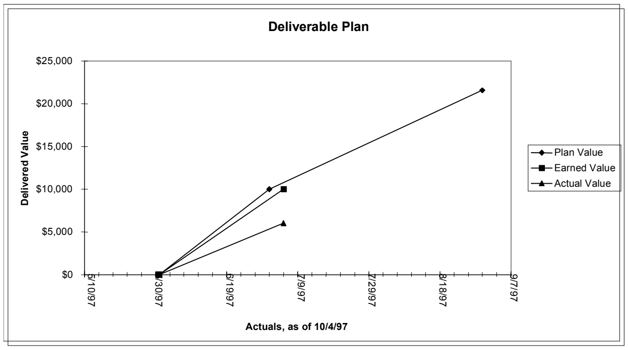
The tabular summary below contains the following computed fields:

- Original Contract Value – The total original estimate of effort and value approved at contract award.
- Total Approved Changes – Total effort and value of approved changes to be performed under change control terms.
- Total Current Estimate – Original contract value plus approved changes.
- Activity to Date – Actual effort hours and associated value (billing rate*hours) as well as any non-effort expended to date on all products in the project plan.
- Estimate to Complete – The effort and associated value, as well as any non-effort associated value remaining to be expended on all products in the project plan.
- Forecast Total – The sum of the Activity to Date and the Estimate to Complete.
- Project Variance – The total variance between all estimated and all actual effort and value expended.
- Earned Value of Approved Products – The value of all delivered products' original estimates plus their approved change estimates. This does not reflect actual costs incurred (as computed in the Activity calculations). Typically used for fixed price or flat monthly billing where the value of approval is based on planned rather than actual effort.
- Actual Value of Approved Products – The actual value of all delivered products. This does not reflect actual costs incurred from the activity calculations. Typically used for time and materials billing projects where

KEANE

Branch	Branch Name	**Branch Number**	333
Client	Client Name	**Client Number**	1111
Project	Project Name	**Project Number**	222
Project Manager	Joe Cool	**As of Date**	10/4/97

Project Summary	Dollars	Days
Original Contract Value	$21,600	42
Total Approved Changes	($10)	1
Total Current Estimate	$21,590	43
Activity to Date	$6,000	10
Estimate to Complete	$11,600	17
Forecast Total	$17,600	27
Project Variance	$3,990	16
Earned Value of Approved Products	$10,000	
Actual Value of Approved Products	$6,000	
Current Project Billing	$10,000	



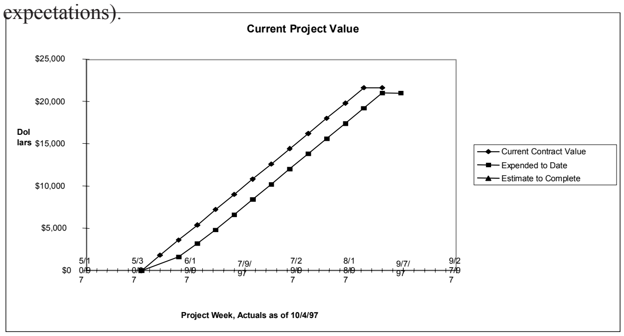
the value of approval is based on actual not planned effort.
- Current Project Billing – For time and materials projects, the cumulative billing amount through the "As of Date" of the project.

The Deliverable Plan below shows the following data plotted as dollars (Y-axis) over time (X-axis):
- Plan Value – For all products, shows the Current Estimate value of each product at its planned delivery date.
- Earned Value – For delivered products only, shows the Current Estimate value of products already delivered by the As-of-Date. The value is the sum of all products' original estimate plus any approved change estimates.
- Actual Value – For delivered products only, shows the value of the effort actually expended on delivered and accepted products.

The Current Project Value Chart below shows the following data plotted as dollars (Y-axis) over time (X-axis):
- Current Contract Value – For all products, shows the Project Budget.
- Expended to Date – For delivered products only, shows the actuals to the As-of- Date to the Project Forecast.
- Estimate to Complete – Shows Project Forecast estimates from the As-of-Date to the end of the project.

QUALITY OF SERVICE SURVEYS

Although customer satisfaction is one of the attributes that is regularly monitored and quantified through PCRP audits, its focus is typically at a client sponsor level. Quality of Service surveys are intended to solicit feedback from end users, where perspective of quality and satisfaction may differ significantly from client management. Surveys are distributed to individuals in customer business units at predefined intervals, or at completion of a deliverable. The survey consists of a standard set of questions designed to assess what went well and what did not during the specified period, so that best practices and opportunities for improvement can be identified and addressed. End users are asked to rate the quality of service provided on a scale of 1 (poor/ unacceptable) to 5 (excellent/exceeds expectations).

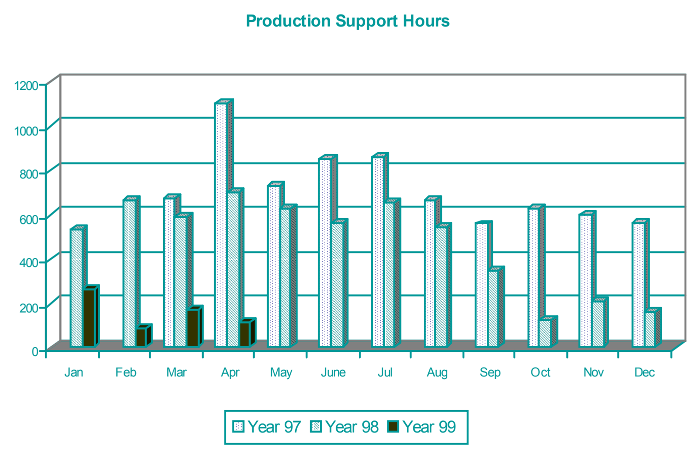


Typical questions include:
- To what extent were expectations met?
- How well were requirements met?
- What is your satisfaction with the professionalism of the team?
- To what extent were you kept informed of the status of your request?
- Was your request fulfilled properly the first time?

SERVICE LEVEL AGREEMENT METRICS

Activity	Cost	Quality: Cycle Time	Quality: Volume
Production Support	# Hours % Effort	Average Response Time	# Calls Hours of Operation
User Support	# Hours % Effort	Average Response Time (on/ off shift) Average Time to Resume Business	# Calls Hours of Operation
Maintenance Requests	# Hours % Effort	% Complete by Due Date	# Requests Completed # Defects per Request
Enhancement Requests	# Hours % Effort	% Complete by Due Date	# Requests Completed # Defects per Request
Development Requests	# Hours % Effort	% Complete by Due Date	# Requests Completed # Defects per Request
Management Control	% Hours % Effort		

The Service Level Agreement (SLA) is an essential tool for managing service-based projects. It defines the scope and objectives of the project in terms of services that will be provided and helps to guarantee a mutual commitment between Keane and the customer. The SLA establishes the volume of work products that will be delivered, the priority of the services provided and acceptance criteria for responsiveness and quality of the deliverables. It becomes the reporting vehicle for performance measurement and provides the opportunity to identify service level improvements throughout the project. Below are suggested minimum metric components of a SLA.



The project manager typically reports performance against SLA commitments to the customer and Keane corporate on a monthly basis. Trends over time are used to track productivity and performance improvements. As shown in the sample chart below, process improvement activities such as root cause analysis resulted in a significant decrease in production support effort hours over the course of three years.

SOFTWARE QUALITY ASSURANCE AUDITS

A Software Quality Assurance (SQA) Plan is developed at the beginning of a project in conjunction with the project plan, to identify the quality checkpoints. SQA audits focus primarily on compliance to defined processes. To provide maximum business value, processes which will be included in the audit schedule are mutually agreed to by SQA and project management.

Standard processes incorporated into all SQA Plans include audits and/or reviews of peer reviews, software configuration management, project plans and/or service level agreements, statements of work and other defining documents and the preparation and execution of test plans. Other process audits more specifically related to the project are added to the plan as necessary and appropriate.

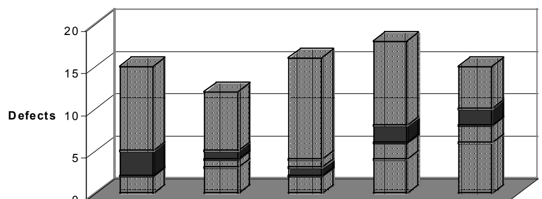
Non-compliance issues identified during an audit are analyzed to determine whether:

- any steps in the process were skipped
- any steps not defined in the process were performed
- the order of execution was changed

Analysis of these points provides a solid basis for determining whether process improvements may be indicated or additional training for the team may be required. SQA is responsible for making recommendations to the SEPG who has the authority to act on these recommendations.

Additional SQA responsibilities include tracking, trending and analysis of defects identified at various stages of the development lifecycle. The major classifications of defect tracked are:

- Defects identified through peer reviews (# of defects, type, severity, SDLC phase) as a means of providing management with insight into areas where process improvements may be indicated, or additional training for the team is needed.
- Defects discovered during the course of a process audit (#, type, severity).
- Defects discovered during any phase of testing (# of defects, type, severity)
- Defects identified by the end user during acceptance (#, type, severity)



	Jun-98	Jul-98	Aug-98	Sep-98	Oct-98
Peer Review	10	7	12	10	5
Audit Discovery	0	0	1	0	0
Test	3	1	1	2	2
Acceptance	0	1	0	2	2
Production Rework	2	3	2	4	6

- Production rework, defined as defects discovered after a deliverable has been placed in production (# of items returned, type, origination).

Analysis of the phase in which defects were discovered should prompt SQA and the SEPG to investigate where earlier defect identification efforts were inadequate so that those efforts can be improved to incorporate additional quality control checkpoints.

EVALUATING METRICS

No metric is useful unless the organization can identify the business value it provides. Frequently cited indicators of business value for metrics are (Humphrey (1989); Paulk 1999):

- Is the metric a good indicator of how well the process is performing, e.g., an indicator of efficiency or effectiveness?
- Can the values for this metric be predictably changed by changing the process or how the process is implemented?
- Can the metric be consistently reproduced by different people?
- Can data be collected and analyzed such that you can predict and/or control process performance?
- Is the data relatively easy and cost-effective to obtain?
- Is the metric one that the customer thinks is an important indicator or process and/or product quality, e.g., an indicator of reliability?
- Is the metric one that the customer requires be reported?
- Is the metric one that the end user thinks is an important indicator of process and/or product quality, e.g., an indicator of usability?
- Is the metric one that senior management thinks is an important indicator of process and/or product quality?
- Is the metric one the organization requires to be reported, i.e., is it one of the common, standard measures defined for the organization?
- Is the metric one that the project manager thinks is an important indicator of process and/or product quality, e.g.,. an indicator of progress?

CONCLUSION

Metrics have little value if they are not aligned with the business objectives of the organization at large and are useful and consistent on the project level. In addition, customer satisfaction plays an increasingly larger role in quality measures. As organizations attempt to progress up the CMM• maturity levels, they must insure that they are capturing the useful metrics, analyzing them in a consistent manner and then taking appropriate actions as a result of the analyzed data. The metrics framework presented in this paper illustrates how one large IT consulting organization is using metrics to provide both internal and customer-focused feedback on core operating procedures. It is also clear that this metric framework meets many if not all of the evaluation criteria specified in the previous section.

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