ESTABLISHING A MEASUREMENT PROGRAM

Guidelines from the SEL

The most important rule is to

Understand that software measurement is a means to an end, not an end in itself

Three key reasons for Software Measurement

Understanding Software
  - Baseline models and relationships
  - Key process characteristics

Managing Software Projects
  - Planning and estimating
  - Tracking actuals versus estimates
  - Validating models

Guiding Process Improvement
  - Understanding
  - Assessing
  - Packaging
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Understanding Software

The most important reason for measurement is to understand your business

How much are we spending on software development?
Where do we allocate and use resources throughout the life cycle?
How much effort do we expend specifically on testing software?
What types of errors and changes are typical on our projects?
How long will it take me to finish testing this software?
Is reliability a function of testing time?
Should I impose stronger testing standards?

...So we need to build baseline models and relationships as a basis for all forms of understanding

ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Understanding Software

Associated with whatever we want to understand are a set of characteristics that provide us with insights into achieving that particular goal

If we want to understand the cost of development
then key characteristics include:
  - distribution of effort among development activities
  - typical cost per line of code
  - cost of maintenance
  - hours spent on documentation
  - computer resources required
  - amount of rework expected

If we want to understand the reliability of our systems
then key characteristics include:
  - number and classes of defects found
  - how and when defects are found
  - pass/fail rates for integration and system testing
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Managing Software Projects

Planning and estimating
Build models of relationships for key variables

Tracking actuals versus estimates
Track your progress in real time and compare to your baselines

Validating models
Learn how and when your models are changing so you can modify them

Focus on applying results rather than collecting data

ETABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Guiding Process Improvement

The three basic steps are:
Understanding
Assessing
Packaging

Understanding and characterizing helps you understand where you are

Assessing involves learning what works and what doesn’t

Packaging involves making what you have learned a part of your business
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Key Issue for Setting Up a Program

Understand the goals
prioritize

Understand how to apply measurement
multiple customers for the results

Set expectations for change
measurement introduces change

Plan to achieve an early success
show the investment is worth while

Focus locally
gain should be to local organization

Start small
let the scope evolve based upon success

---

Organize the analysts separately from the developer
their goals and processes are different

Make sure the measures apply to the goals
don’t collect data for data’s sake

Keep the number of measures to a minimum
there is a real cost associated with measurement

Avoid over-reporting measurement data
make the results as crisp and clear as possible

Budget for the cost of the measurement program
include all costs in planning and tailor it to fit the goals and budget

Plan to spend at least three times as much on data analysis and use as on
the data collection
the real payoff is in the analysis and use
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Costs

The cost of data collection should not add more than 2 percent to the software development or maintenance budget
   includes completing forms, participating in interviews, attending training sessions and helping characterize project development

The data processing element of the measurement program may cost 3 to 7 percent of the total development budget
   includes collecting, archiving, validating, and maintaining the measurement data

The cost of the analysis element of the measurement program ranges from 5 to 15 percent of the total project budget
   includes design of studies, information analysis, project interaction, packaging

ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Core Measures

Cost
   reporting period dates
   total effort
   effort by development and maintenance activity

Errors
   dates error reported and corrected
   effort to isolated and correct the error
   source and class of error

Process Characteristics
   identification of programming language
   indication of the use of significant processes
   description of measurement study goals
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Core Measures

Project Dynamics
changes to requirements
changes to code
growth of code
predicted characteristics

Project Characteristics
development dates
total effort
project size
component information
software classification

Collect effort data at least monthly, preferably weekly
Clarify the scope of the effort collection (who, what, when, why)
Collect defect data only for configuration controlled software
Do not expect to measure error correction effort precisely
Do not expect to find generalized, well-defined process measures
Do not expect to find a data base of process measurements (check reports)
Understand the high-level process characteristics
Use simple definitions of life cycle phases
Use lines of code to represent size
Specify which software is to be counted
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Operation of a Measurement Program

Do not expect to automate data collection

Make providing data easy

Use commercially available tools

Expect measurement data to be flawed, inexact, inconsistent

---

Example Goals: Understanding

**Language Evolution Goal**: Analyze the project set to characterize the language usage trend from the point of view of the organization

Measures: Project dates, sizes, and languages

**Project Profiles Goal**: Analyze the project set to characterize the levels and trends of code reuse from the point of view of the organization

Measures: Project dates, sizes, and percentage of reuse

**Cost vs. Size Goal**: Analyze the project set to characterize the cost of reusing code and the cost of producing code levels from the point of view of the organization

Measures: Project size, dates, reuse, and effort data
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Example Goals: Understanding

Effort Distribution Goals: Analyze the project set to characterize the cost of each life-cycle phase and the characteristics of staffing profiles from the point of view of the organization

Measures: Project phase dates, effort data, and developer activity data

Cost of Major Activities Goals: Analyze the project set to characterize the cost of maintenance, documentation, quality assurance and configuration management from the point of view of the organization

Measures: Developer activity data, effort, and software size

Defect Rate Goals: Analyze the project set to characterize the average rate of uncovering defects, the defect rate in delivered software and which life-cycle phases yield the most defects from the point of view of the organization

Measures: Project size, phase dates, and reported defects

Error Classes Goals: Analyze the project set to characterize the what types of defects occur most often from the point of view of the organization

Measures: reported defect information

Defects vs. size and complexity Goals: Analyze the project set to characterize the relationship between defect rates and module size and complexity from the point of view of the organization

Measures: Error reports by module, module size, and module complexity

Growth Rate Dynamics Goal: Analyze the project to characterize the local rate of code production from the point of view of the organization

Measures: Phase dates and weekly count of completed code
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Example Goals: Managing

Projected Cost, Scheduling, and Phases Goals:
Estimate cost, schedule, effort, and defects
Analyze the project characteristics to predict the cost, schedule, effort, and defects from the point of view of the project manager

Measures: Project size estimate, project characteristics, models, and relationships

Project Dynamics Goals:
Estimate cost, schedule, effort, and defects
Analyze the project characteristics to predict the expected growth rate, change rate, and defect rate of source code from the point of view of the manager

Measures: Project size estimate, project characteristics, models, and relationships

Example Goals: Tracking

Tracking Code Production Goal: Analyze the project code growth to track it against the estimated code growth from the point of view of the project manager

Measures: Biweekly count of source library size, manager’s updated at-completion estimates

Tracking Software Change Stability Goal: Analyze the project requirements and design changes to monitor/track the project stability from the point of view of the project manager

Measures: Changes to source code and manager’s predicted estimates

Tracking Staff Effort for Possible Replanning Goal: Analyze the project staffing profile to monitor them for replanning the appropriate staffing profiles from the point of view of the manager

Measures: Changes to source code and manager’s predicted estimates
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Example Goals: Tracking

Tracking Test Progress Goal: Analyze the project closed vs. open defect profiles to estimate the test progress from the point of view of the manager

Measures: Failure report data and change data

Tracking Software Defect Quality Goal: Analyze the project defect profiles to assess the defect quality from the point of view of the manager

Measures: Defect report data, historical models, and size estimates

Checking if Cleanroom is being used Goal: Analyze the project library code growth to check for the Cleanroom code growth characteristics from the point of view of the manager

Measures: Project phase date estimates, completed source code, and historical models

Example Goals: Guiding Improvement

Checking if Cleanroom is effective Goal: Analyze the Cleanroom method as applied to several projects to evaluate it with respect to effort, effort distribution, software size, number of defects from the point of view of the organization

Measures: Effort, effort distribution, software size, size growth, number and types of defects

Checking if Independent Validation and Verification is effective Goal: Analyze the Independent Validation and Verification as applied to several projects to evaluate it with respect to cost and extra defects uncovered from the point of view of the organization

Measures: Effort, number and types of defects
ESTABLISHING A MEASUREMENT PROGRAM
Guidelines from the SEL

Experience-Based Guidelines

Data collection should not be the dominant element of process improvement; application of measures is the goal.

The focus of a measurement program must be self improvement, not external comparison.

Measurement data are fallible, inconsistent, and incomplete.

The capability to quantify a process or product with measurement data is limited by the abilities of the analysis.

Personnel treat measurement as an annoyance, not a significant threat.

Automation of measurement has limits.