Model-Based Software Process Improvement

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This presentation demonstrates our organization's approach to model-based Software Process Improvement (SPI). Our organization, a Process Transfer Technology Affiliate of the STARS program, was selected in April 1993 to participate as a field test site for the Software Engineering Institute (SEI) Software Process Definition (SPD) project. The products tested included the improvement model itself, descriptive modeling techniques, the CMM level 2 framework document, and the use of process definition guidelines and templates.

The SPI model developed by the SPD project at the SEI represents a five stage cyclic approach for organizational process improvement. The cycle consists of the initiating, diagnosing, establishing, acting, and leveraging phases. Our organization's three year Total Quality Initiative facilitated the adoption of this model for our software improvement teams.

The process improvement infrastructure includes the steering committee, SEPG team leader, the SEPG core advisors, Quality Management Boards (QMB), and designated working groups chartered by the SEPG. The QMB's directly support the strategic goals of the organization. Monthly briefings from the SEPG team leader to the steering committee and the QMB's facilitate the integration of the SPI initiative with the strategic business goals.

The SPD project at SEI field-tested the Process Framework Document for CMM level 2 at our organization. The document provides checklists to determine CMM compliance for each Key Process Area (KPA). In addition, we gained insight into the necessary organizational components to support well-defined processes.

Process Definition (PD) training was provided for our SEPG, Technology QMB, and the Project Planning Working Group. Our SEPG recognized the need to establish a documented standard approach for PD that all software improvement teams can use (i.e. a well-defined process!). Our Process Breakdown Structure establishes planning, definition, and enactment as the top-level phases of the Process Engineering life-cycle.
The process planning phase is necessary to baseline and document the current process by establishing the purpose and the high-level process flow. In addition, it is important to set the policy that will over-arch the process and help set the context for the follow-on process definition engineering. The process definition phase is decomposed into three activities: layout, design, and enactment information. The layout activity establishes the process relationships by organizing the high-level entry/tasks/validation/exit (ETVX) information and defining the work flow and work products associated with the process. In addition, a mid-level process flow is established during this step which will facilitate using the information organizers in the design activity. The agents that will perform each task are also identified during this activity.

The design activity of the definition phase is characterized by the use of multiple information organizers (i.e. templates) which provide the necessary data to develop the enactment information. Measurement criteria and the validation method are further defined in this stage of process definition.

The development of the enactment information is the last activity to be performed in the definition phase of process engineering. The procedures must be developed during this activity in order to trial test the process during a pilot project. The training requirements for the process must also be established at this time.

The enactment and process support is the final phase of process engineering and constitutes the institutionalization of the process. This phase must establish process control and process assurance procedures to ensure that the process has the ability to improve. A training plan is important to support the on-going use of the process.

The outer ring represents all of the work products developed during the process engineering life-cycle. In an attempt to avoid shelfware, the SEPG is targeting a Process User’s Manual for each KPA that will contain only the essential information required for the user of the process.
MODEL - BASED SOFTWARE

PROCESS IMPROVEMENT

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SPI MODEL
IMPROVEMENT INFRASTRUCTURE
ESSENCE OF LEVEL 2
PROCESS DEFINITION FRAMEWORK
  - PLANNING
  - LAYOUT
  - DESIGN
  - ENACTMENT
PROCESS MANUAL
SOFTWARE PROCESS IMPROVEMENT MODEL

Initiating

Stimulus for Improvement

Set Context and Establish Sponsorship

Establish Improvement Infrastructure

Leveraging

Appraise and Characterize Current Processes

Revise Organizational Approach

Document and Analyze Lessons

Acting

Implementation plan
Define processes
Define measures
Plan and execute pilot(s)
Plan, execute, and track installation

Establish Process Action Teams

Establishing

Action Planning

Set Strategy and Priorities

Develop Recommendations & Document Phase Results

PAT Charters & Plans

Diagnosing

Closing

Current Planning & PAT Charters & Plans

Establish Improvement Infrastructure

Set Context and Establish Sponsorship

Stimulus for Improvement
NSWC - PHD - ECO
PROCESS IMPROVEMENT INFRASTRUCTURE

STRATEGIC PLAN

QUALITY IMPROVEMENT DEPARTMENT

SEPG LEADER

SEPG CORE ADVISORS

STEERING COMMITTEE

MQMB

IQMB

TQMB

WEQMB

RDQMB

QA

WG

WG

WG

WG

WG

WG

WG

WG

WG

DEPT A

DEPT B

DEPT X

DIRECTOR

OIC

SEPG -- SOFTWARE ENG. PROCESS GROUP

TQMB -- TECHNOLOGY

MQMB -- MARKETING

IQMB -- ISEA

WEQMB -- WORKFORCE ENHANCEMENT

RDQMB -- RESOURCE / DEMOGRAPHICS

QA -- QUALITY ASSURANCE

WG -- WORKING GROUP
NSWC PROCESS DEFINITION FRAMEWORK

PLANNING
- PROCESS PLANNING
- PROCESS LAYOUT

DEFINITION
- Stage 1
- Process Planning
- Process Layout
- Stage 2
- Process Design
- Stage 3
- Process Enactment Information

ENACTMENT
- Process Enactment
- Process Support

• BASELINE
• FLOW
• INFORMATION ORGANIZERS
• PROCEDURES

\[ \text{△} = \text{SEPG REVIEW} \]

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A tradition of excellence!
PROCESS DEFINITION FRAMEWORK

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<tr>
<th>PLANNING</th>
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- BASELINE
  - DATA GATHERING
    - AUDIENCE
    - ROLES
    - USAGE
    - KNOWLEDGE
    - MOTIVATION
    - INTERVIEW

- HIGH LEVEL PROCESS FLOW

- POLICY STATEMENT
PROJECT PLANNING COMMITMENT PROCESS

NEW BUSINESS FORM

PREPARE PROJECT PLANNING REQUIREMENTS FORM
STAGE 1

GENERATE PROJECT ESTIMATES
STAGE 2

CONSOLIDATION AND CONCURRENCE
STAGE 3

RESOURCE ALLOCATION GROUP
### Process Definition Framework

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<tr>
<td>Process Planning</td>
<td>Layout</td>
<td>Design</td>
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<td>Work Products Defined</td>
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- **Process Relationships**
  - Initial Model
  - Mid-Level Process Flow
  - Work Products Defined
THE ETVX PROCESS
(ENTRY, TASK, VALIDATION, EXIT)

PURPOSE: Ensure all Departments and Divisions are involved in Project planning process

INPUT
1. Task Letter
2. Estimate Request
3. New Business Opportunity form

ENTRY CRITERIA
- New Business Form
- Formal Project Officer identified

TASK
Agent: Project Coordinator
1. Determine Scope of SOW
2. Establish Key Codes
3. Requirements Brief
4. Complete Checklists
5. Prepare Schedule, WBS, Funding
6. Resolve Comments
7. QA Checkpoints Complete

VALIDATION
- Approval to Proceed

EXIT CRITERIA
- Checklist, WBS
- Resolution Meeting

OUTPUT
1. To Sponsor:
   - Estimate
   - Schedule
   - Risk Analysis
2. Commitment to Task
3. To Resource Allocation Committee:
   - Schedule
   - WBS
   - Funding

PARENT: Project Officer's Handbook
ACTION CODE: Project Coordinator
Project Planning Process
(Bid, Proposal, Potential)

Legend:
- Input
- Activities Performed
- Output
- QA Review

PO = Project Officer
DH = Department Head
PPRF = Project Planning Requirements Form

- Task Letter
- New Business Form
- Estimate Request

PO/DH
- Prepare Conceptual Design
  - White Paper

PO/DH
- Complete Preliminary PPRF

PO/DH
- Distribute Prelim PPRF to all Dept

PO/Div Heads
- Review PPRF and assign Key Codes

PO
- Conduct Project Brief

Key Codes
- Develop Size Estimate

Key Codes
- Develop Schedule Estimate

Key Codes
- Determine Resource Requirements

Key Codes
- Develop Cost Estimate

Key Codes
- Determine Risk Factors

Completed PPRF (incl WBS)

PO
- Consolidate Dept Estimates

PO/Key Codes
- Resolve Conflicts

PO
- Finalize Schedule & Cost Estimates

PO
- Prepare Proposal

Proposal WBS & Schedule

Preliminary PPRF (incl WBS)
PROCESS DEFINITION FRAMEWORK

- INFORMATION ORGANIZERS
  - INPUTS
  - OUTPUTS
  - TASKS
  - AGENTS
  - MEASUREMENTS
  - VALIDATION
### PROCESS DEFINITION FRAMEWORK

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- PROCEDURES
- PILOT PROJECT
- PROCESS MANUAL
- TRAINING REQUIREMENTS
### PROCESS DEFINITION FRAMEWORK

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- **INSTITUTIONALIZATION**
  - PROCESS CONTROL
    - MONITOR
    - MEASUREMENT
    - ANALYSIS
    - IMPROVEMENT
  - PROCESS ASSURANCE
    - TAILORING / GUIDANCE
    - ENFORCEMENT
  - TRAINING PLAN
KEY PROCESS AREA PROCESS MANUAL

QUALITY ASSURANCE

POLICY

PROCEDURES

PROCESS FLOW

TOOLS

TRAINING

MEASUREMENT

AGENTS / ROLES

PROCESS USERS MANUAL