Concepts of Return on Investment for Process Improvement

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Typical Concerns

• How can I maximize my process improvement efforts?
• Which process improvement technologies are the most cost effective?
• How can I measure the return on investment (ROI) for process improvement initiatives?
A Survey

• What kind of organizations and projects are represented?
• How is process improvement currently measured and justified?
  — What indicators?
  — Which initiatives?
• How are benefits measured?
• How are costs measured?
Survey General Findings

• Survey size was small, but relevant
• Respondents were evenly distributed across CMM Levels
• Little consistency in the definition of measures used among organizations
• Most of the organizations track SPI using a growth or improvement factor, rather than financially
• Very few organizations are tracking the true cost or benefit of their SPI initiatives
• No definitive patterns associated with CMM Maturity, or Government vs. Commercial Marketplace
  (Exception was Earned Value)
38% of respondents tracked the cost of SPI initiatives
  — Formal inspections tracked financially by just over half of those who perform them
30% track financial benefits of indicators
  — Financial benefit of quality, productivity, or cycle time tracked by less than 20% of responding organizations
38% of the respondents track rework above the project level
  — One organization tracks the cost of rework for all or most projects
12% track the Cost of Quality at organizational and enterprise level
Survey Conclusions

- Responses reflect a strong engineering focus with a relatively low level focus on cost/benefit of SPI
- Respondents generally are not well positioned to calculate financial ROI of their SPI program
- Lack of standard measurement definitions and ROI process models inhibit progress in justifying SPI from a financial perspective
The Problem With ROI

Multiple Relationships Make it Difficult to Assign the Benefits

- Rework
- Cost?
- Productivity?
- Quality?
- IV&V?
- Cycle Time?
- Customer Satisfaction

Multiple Relationships Make it Difficult to Assign the Benefits

How do we show relationships to profitability and value?
ROI Conundrum

- Rework
- Management Control
- Infrastructure
- Training
- Customer Satisfaction
- PAL
- Defect Prevent
- Inspections, Peer Reviews
- ABC, ABM
- Cost of Quality
- CM
- QA
- Reuse
- COTS
- SEPG
- IV&V
- Cost
- Estimation
- Defined Process
- Productivity
- Reqmts. Mgmt.
- Quality
- Defect Analysis
- Cycle Time
- Tools
- Planning
- Supply Mgmt.
- Measurement

Example Only
Does not incorporate all elements or relationships
Key Indicators

Primary Indicators
- Quality
- Productivity
- Cycle Time
- Cost
- Customer Satisfaction

Other Important Indicators
- Cost of Quality
- Cost of Rework
Conceptual ROI Model

1. Processes
2. Process Improvement Initiatives
3. Base Measures
4. Indicators
5. (Benefits) - 1 = ROI

- f (x) (Benefits)
- f (labor, equipment, training, ...)
- (Costs)
Secondary Indicators

- Quality
  - Required functionality, fewer failures
  - Shorter schedules
  - Lower support and maintenance costs

- Cycle Time
  - Reduced rework
  - Increased capacity

- Productivity

Primary Indicators

- Customer Satisfaction
  - Lower price
  - Shorter schedules

- Cost
  - Reduced effort

Business Goals

- Market Share
  - Image
  - Retention referrals, award fees, bonuses

- Profit
  - Higher margin
  - Low-cost provider

- Time-to-market

Indicator Relationships
Focusing ROI on the Business

Engineering Management  Project Management  Executive Management

SPI Activities  Business Goals

Quality
- Reduced rework

Cycle Time
- Increased capacity

Productivity

Customer Satisfaction
- Required functionality, fewer failures
- Shorter schedules
- Lower support and maintenance costs
- Reduced effort

Cost
- Lower price
- Reduced effort

Customer

Market Share & Profit
- Retention referrals, award fees, bonuses
- Higher margin, low-cost provider
- Time-to-market

Process

Financial

Business Goals
- Lower price
- Lower support and maintenance costs

Cycle Time
- Reduced rework

Quality

Productivity

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Mapping Indicators to Initiatives
(Cycle Time Example)

**Process Initiatives**
- Defined Process
- Measurement Program
- Defined Process
- Process Mapping
- Process Engineering

**Desired Results of Initiatives**
- Better Estimates
- Stable Requirements
- Predictable Schedules
- Efficient Process
- Fewer Steps, Delays

- Quality
- Reduced Rework
- Cycle Time
- Increased Capacity

- Productivity
- Reduced Labor (Cost)
- Early to Market (Market Share)
- Shorter Schedules (Cust. Sat.)

Defined Process → Historical Data
Defined Process → Estimating Model
Defined Process → Requirements Management
Defined Process → Change Control
Defined Process → Process Mapping
Defined Process → Process Engineering

Efficient Process → Fewer Steps, Delays
Efficient Process → Predictable Schedules
Efficient Process → Reduced Rework
Efficient Process → Cycle Time
Efficient Process → Increased Capacity
Efficient Process → Productivity

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Efficient Process → Increased Capacity
Efficient Process → Productivity
Cost of Quality (COQ)

- What is the cost of poor quality?
- What are the key drivers?
- What is the cost of achieving higher quality?
- Which should be the highest priorities?
- How successful are the efforts designed to drive the COQ downward?
Elements of COQ

Cost of Poor Quality (Non-conformance)

Cost of Internal Failure

Defects Discovered Prior to Shipment

Defects Discovered After Shipment

Cost of External Failure

Cost of Achieving Higher Quality

Appraisal Costs

Testing, Inspections, Quality Audits, Assessments

Prevention Costs

SEPG, SQA, CM, Reqmts. Management, Defect Prevention, Training, Risk Mgmt.
Reducing the Cost of Quality

Adapted from: Dion, R., Process Improvement and the Corporate Balance Sheet, IEEE Software, July 1993
Cost of Rework

- Typically 30% to 50% (or more) of project cost for lower maturity organizations
- Only one respondent (of 16) tracks Cost of Rework on all or most projects
- True Cost of Rework is not well known in most organizations
Cost of Rework
Coding Defects Found in System Test

INJECTION PHASE

DISCOVERY PHASE

Req. HLD LDD Code IT ST AT Release

CAPTURE, ANALYZE, PRIORITIZE, APPROVE

REWORK ACTIVITIES PER PHASE

Amount of Rework

Coding Defects Found in System Test

Cost of Rework
Cost of Rework
Requirements Defects Found in Acceptance Test

INJECTION PHASE
- Req.
- HLD
- LDD
- Code

DISCOVERY PHASE
- IT
- ST
- AT
- Release

CAPTURE, ANALYZE, PRIORITIZE, APPROVE

REWORK ACTIVITIES PER PHASE

Amount of Rework
• Measurement programs are typically focused on engineering effectiveness rather than business case
• Organizations generally are not well positioned to calculate financial ROI of their SPI program
• ROI Conundrum can be resolved by focusing on costs and benefits separately
• A focus on Cost of Quality and Cost of Rework can provide significant results
• Data indicate ROI is a ‘growth area’
  — Provides a means for focusing SPI investments on business goals and priorities
  — Helps in establishing effective measurement programs/habits