How To Estimate ROI for Inspections?

RETURN-ON-INVESTMENT (ROI) FOR INSPECTIONS

* DEVELOPMENT: The ROI for inspections is about six to one (6:1) if you ignore maintenance or total life cycle costs.

Phased Return-on-Investment (ROI)

- It's good to model ROI after every software life cycle phase, software process, and activity (e.g., analysis, design, code, and test).

- This shows that we're smart software managers and we really know what we're doing, we use ROI for project planning and management, and we are of the "very" high-maturity variety.

- This shows that there is ROI for software process improvement (SPI), ROI can be achieved very early (in hours, days, and weeks), and software processes are measurable.

(Many still believe SPI has no ROI at all, has no early ROI, or its ROI is simply not quantifiable!)

* MAINTENANCE: The ROI for inspections is about thirty-six to one (36:1) if you include maintenance or total life cycle costs.

Cumulative Return-on-Investment (ROI)

- ROI figures based on total life cycle costs enable us to create "strong" business cases for justifying software process improvement (SPI) budgets.

- It's imperative to calculate total life cycle or maintenance costs to select development strategies which will maximize product success when complete.
- While, software process improvement (SPI) is kind of a near-term activity, it is the long-term outlook that we're concerned with.

- Government agencies, in particular, need to plan "total" life cycle costs, budget the cost of software maintenance, minimize the cost of software maintenance, maximize product success, and divert scare resources toward development and away from maintenance.

  (When the U.S. Air Force is still in the conceptual stages of a new weapon system, total life cycle costs are calculated to justify new programs.)

  (NASA scrapped a version of the Space Station after spending $11 billion, when scientists determined maintenance estimates were cost-prohibitive and physiologically impossible for humans in space.)

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**HOW TO CALCULATE RETURN-ON-INVESTMENT (ROI)**

* DEFINITIONS

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  . BENEFIT/COST RATIO (BCR): Magnitude of benefits to costs.

  . RETURN-ON-INVESTMENT (ROI): Magnitude of benefits, less costs, to costs times one-hundred.

* EQUATIONS

  . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

  . BENEFITS
BCR = -------- or BENEFITS/COSTS:1

BENEFITS - COSTS

ROI = ------------ * 100

COSTS

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BASIC COST OF QUALITY (COQ)

* BASIC COST OF QUALITY (COQ)

INSPECTION EFFORT = 1 Hour per Defect
TEST EFFORT = 10 Hours per Defect
MAINTENANCE EFFORT = 100 Hours per Defect
INSPECTION/TEST SAVINGS = 9 Hours Saved
INSPECTION/MAINTENANCE SAVINGS = 99 Hours Saved

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BASIC RETURN-ON-INVESTMENT (ROI)

* BASIC ROI FOR INSPECTION VS. TEST (INSPECT, TEST & SHIP)

BCR = ------------ = 9:1
Test = 1 hr spent

ROI = ---------------- * 100 = 800%
Test = 1 hr spent
* BASIC ROI FOR INSPECTION VS. MAINTENANCE (CODE & SHIP)

<table>
<thead>
<tr>
<th>Inspection</th>
<th>99 hr saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCR</td>
<td>-----------</td>
</tr>
<tr>
<td>Maint</td>
<td>1 hr spent</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Inspection</th>
<th>99 hr saved - 1 hr spent</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCR</td>
<td>------------------------</td>
</tr>
<tr>
<td>Maint</td>
<td>1 hr spent</td>
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</tbody>
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ADVANCED COST OF QUALITY (COQ)

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| Inspection Efficiency (IE) = 70% |
| Test Efficiency (TE) = 70% |
| Inspection Hours = 1*IE = .7 |
| Test Hours with Inspection = (1-IE)*TE*10 = 2 |
| Test Hours w/o Inspection = TE*10 = 7 |
| Test Hours Saved = 7-2 = 5 |
| Maintain Hours with Inspection = (1-IE)*(1-TE)*100 = 9 |
| Maintain Hours w/o Inspection = (1-0.7)*100 = 30 |
| Test/Maint Hours Saved = (7+30)-(2+9) = 26 |

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ADVANCED RETURN-ON-INVESTMENT (ROI)

ADVANCED ROI FOR INSPECTION VS. TEST

Inspect 5 hr saved
BCR ------ = ----------- = 7:1
Test .7 hr spent

Inspect 5 hr saved -.7 hr spent
ROI ------ = ------------------------ * 100 = 614%
Test .7 hr spent

ADVANCED ROI FOR INSPECTION VS. MAINTENANCE

Inspect 26 hr saved
BCR ------ = ----------- = 37:1
Maint .7 hr spent

Inspect 26 hr saved -.7 hr spent
ROI ------ = ------------------------ * 100 = 3,614%
Maint .7 hr spent

COMPARISON OF SOFTWARE PROCESS IMPROVEMENT (SPI) METHODS

SOFTWARE PROCESS IMPROVEMENT (SPI): MODELING ROI

ROI Comparison for Six SPI Methods

Lifecycle ROI Development ROI

Inspection 37:1 7:1
PSPSM 33:1 6:1
**BOTTOM-LINE CONCERNING TOTAL LIFE CYCLE ROI**

* TOTAL LIFE CYCLE ROI IS NOT FUZZY MATH

ROI estimates for total life cycle costs are well-established methods within the U.S. DoD, and are based on solid data, empirical relationships, and valid mathematical equations.

* TOTAL LIFE CYCLE ROI ESTIMATES ARE NOT INCORRECT

Total life cycle costs are based on estimating statistical software defect populations through software maintenance and retirement, and the costs of removing software defects at various life cycle stages.

* TOTAL LIFE CYCLE ROI IS NOT UNCONVENTIONAL

While, total life cycle costs aren't typically considered by most software organizations, they do represent a higher-state of maturity and responsible economic philosophy.
* ROI OF INSPECTIONS DECREASES AS EFFICIENCY INCREASES

Ironically, the ROI of inspections actually decreases as inspection efficiency increases. That is, as inspections begin achieving world-class performance levels, they become so efficient, that testing and maintenance costs decrease radically, and thus decrease the magnitude of the benefits to costs. In other words, as the latent defect population is reduced by highly-efficient inspections, maintenance costs decrease radically, lessening the dramatic impact of inspections on total life cycle costs.

(This is obviously a good problem to have, low ROI, but very low total life cycle costs!)

* ROI OF INSPECTIONS INCREASES AS EFFICIENCY DECREASES

Conversely, as inspection efficiency decreases, that is, inspections detect fewer defects, the ROI of inspections increases radically. This is caused by the shift in latent defect populations to the testing and maintenance periods, where the cost of defect elimination is ten, to even a thousand, times more. Since testing and maintenance become so cost-prohibitive, the ROI of performing inspections increases radically, and makes for real good case studies on justifying costs of doing inspections based on ROI.

ROI seems to have use in the low-maturity software organization that instinctually transfers its latent defect population into testing and maintenance. ROI may have very little usefulness to the high maturity organization that either prevents its defect population from occurring or removes it with very efficient defect-mitigating processes and tools!

I designed some fascinating equations to model this most unusual phenomenon!

But, not to worry, as most organizations are of the
extremely low-maturity variety, and are sure to exhibit eye-popping ROI levels for the simplest of improvements!!!

* COUNTER-INTUITIVENESS CONFUSES ROI ANALYSIS

I can guarantee that this phenomenon of efficient processes having lower ROI than inefficient processes can confuse cost analysts to no end. That is, finding a low ROI when searching for a big ROI.

Finding a big ROI can be almost as unnerving. People are too hesitant to express ROI of more than 5 or 10 to one for fear of being perceived as incredulous. And, people are less willing to accept a large ROI versus a small one. It's more socially acceptable to have an ROI of 3:1 versus 100:1. A so-called European expert once decried the claim of high ROI as pure American fantasy, and swore software process improvement had no ROI whatsoever. That was just last year!

ROI analysis is not magic, alchemy or pseudo-science. ROI is a well established discipline and scientific procedure which is routinely practiced in every major professional discipline except software engineering. There were only two ROI briefs at the SEPG 2002 Conference. This is only an continuing indication of the software engineering discipline's painful infancy!

STATE-OF-THE-PRACTICE FOR RETURN-ON-INVESTMENT (ROI)

* ROI ANALYSIS IS NOT COMMON KNOWLEDGE

ROI is not a well-known technique among software managers. It will take a few more years before more, substantial, and comprehensive ROI metrics, models, studies, data, and results are published as books,
papers, and reports. ROI analysis for software engineering is still a leading-edge practice today.

* SPI EXPERTS AND SEPG MEMBERS BIGGEST SKEPTICS

ROI figures for software engineering, software process improvement (SPI), and inspections are not commonly held to be true.

A software engineering manager of a manufacturer of mission-critical, spaceborne components swears there is no data to support ROI for inspections.

Software engineering process groups (SEPGs) and software process improvement (SPI) specialists continue to remain the largest skeptics, nay sayers, and disbelievers when it comes to software metrics, models, measurements, and ROI data.

* CAN'T CONVINCE THEM WITH STATISTICS

It's a well-known principle that skeptics of software process improvement (SPI) can't be convinced of SPI's benefits, to try SPI, or to try SPI methods using metrics, models, measurements, and ROI data (no matter how much data you have, how convincing it is, or how valid it is).

In other words, logic can never be used to goad someone into doing something they do not want to do!

* CRISIS IS THE ONLY CATALYST FOR CHANGE

The only effective method for changing someone's behavioral pattern is the threat of imminent crisis (e.g., death, disaster, or economic tragedy)!

Software process improvement (SPI) is futile in the absence of crisis!
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