ROI From CMMI®
A DACS and SEI Collaboration

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Outline

- **Introduction and Background**
- Current Status of SEI and DACS Sites
- Desired User Displays and Issues
- Data Identification and Vetting Process
- Tasks

Introduction

- Many expect or have experienced improved performance with CMMI
- Some who have not tried, are skeptical
- SEI and DACS need evidence to address skeptics' concerns, especially business-oriented evidence
- SEI and DACS web sites present CMMI performance data
- We seek improvements without duplicating effort

Background

- Widespread demand exists for credible, quantitative evidence on the results of process improvement based on CMMI models
- Collaborative Agreement between CMU/SEI & ITT/DACS
  - Initiates a strategic partnership to at least 31 May 2012
  - Supports mutual goal to provide info about performance effects of CMMI-based process improvement …
  - … That is empirically valid and of practical use for the software & systems engineering community

Background (Cont'd)

- Purpose: Harmonize two websites containing similar information
  - SEI's "CMMI Performance Results"
  - DACS "ROI Dashboard"
- Access to that information is in mutual interest of SEI, DACS, & wider community they both serve

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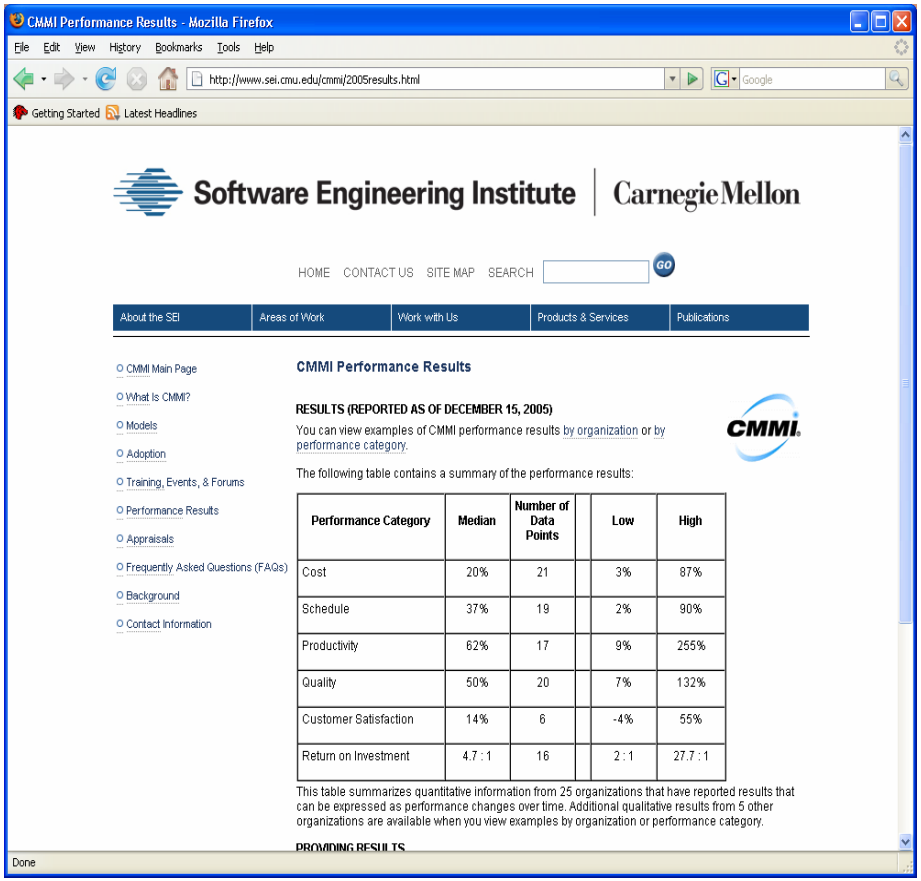
Current Status of SEI and DACS Web Sites for CMMI Performance

- 2005 SEI results: http://www.sei.cmu.edu/cmmi/2005results.html
- 2007 SEI Results in March 2007 issue of DACS' Software Tech News: https://www.softwaretechnews.com/stn_view.php?stn_id=41
- DACS: https://www.thedacs.com/databases/roi/

SEI CMMI Performance Results



- Summarizes Results through 2005
- Results through 2007 Published in DACS *Software Tech News* (March 2007 issue edited by Dennis Goldenson)

Software Engineering Institute | Carnegie Mellon

- CMMI Main Page
- What Is CMMI?
- Models
- Adoption
- Training, Events, & Forums
- Performance Results
- Appraisals
- Frequently Asked Questions (FAQs)
- Background
- Contact Information

CMMI Performance Results

View by Performance Category

The performance results examples contain brief assertion statements and their sources and sometimes are accompanied by graphic illustrations. To view the graphic or source for a statement, click the View link.

Cost | **Schedule** | **Productivity** | **Quality** | **Customer Satisfaction** | **Return on Investment**

Cost

	Assertion Statement	Organization
View	20 percent reduction in unit software costs as the organization integrated its engineering processes	Lockheed Martin Management and Data Systems
View	15 percent decrease in defect find and fix costs as the organization integrated its engineering processes	Lockheed Martin Management and Data Systems
View	Reduced cost of poor quality from over 45 percent to under 30 percent over a three year period as the organization moved from SW-CMM maturity level 5 towards CMMI maturity level 5	Siemens Information Systems Ltd.
View	5 percent improvement in cost performance index with a 34 percent decline in variation as the organization improved from SW-CMM maturity	Raytheon North Texas Software Engineering

- What Is CMMI?
- Models
- Adoption
- Training, Events, & Forums
- Performance Results
- Appraisals
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Assertion Statement Detail

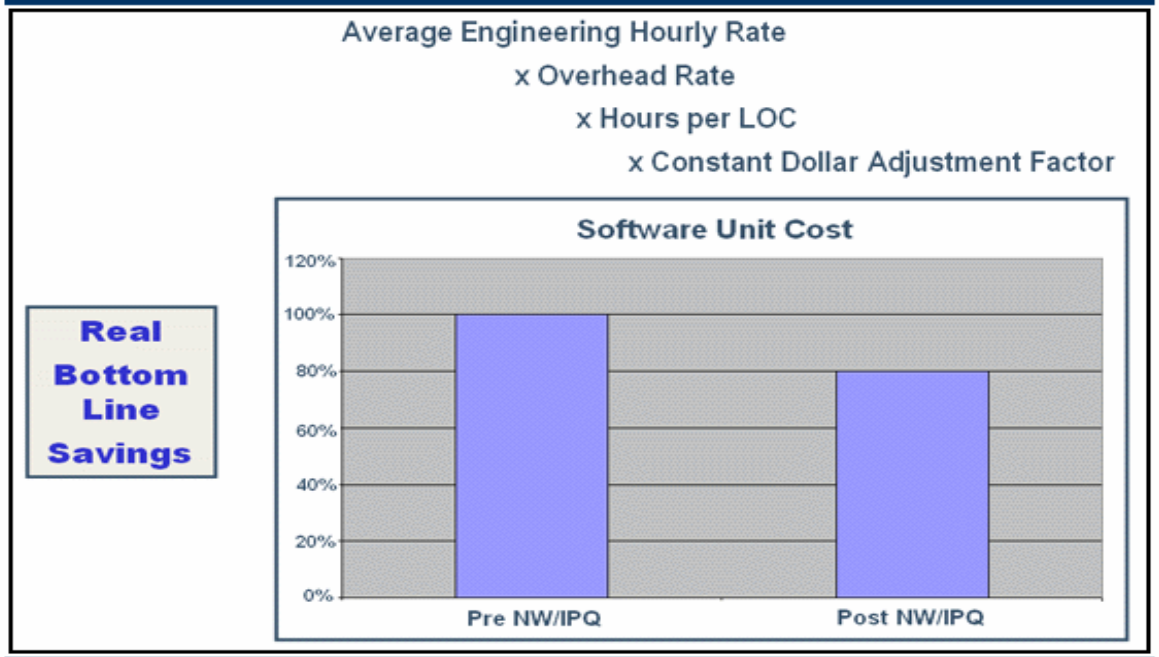
Statement

20 percent reduction in unit software costs as the organization integrated its engineering processes

Organization

Lockheed Martin Management and Data Systems

Graphic

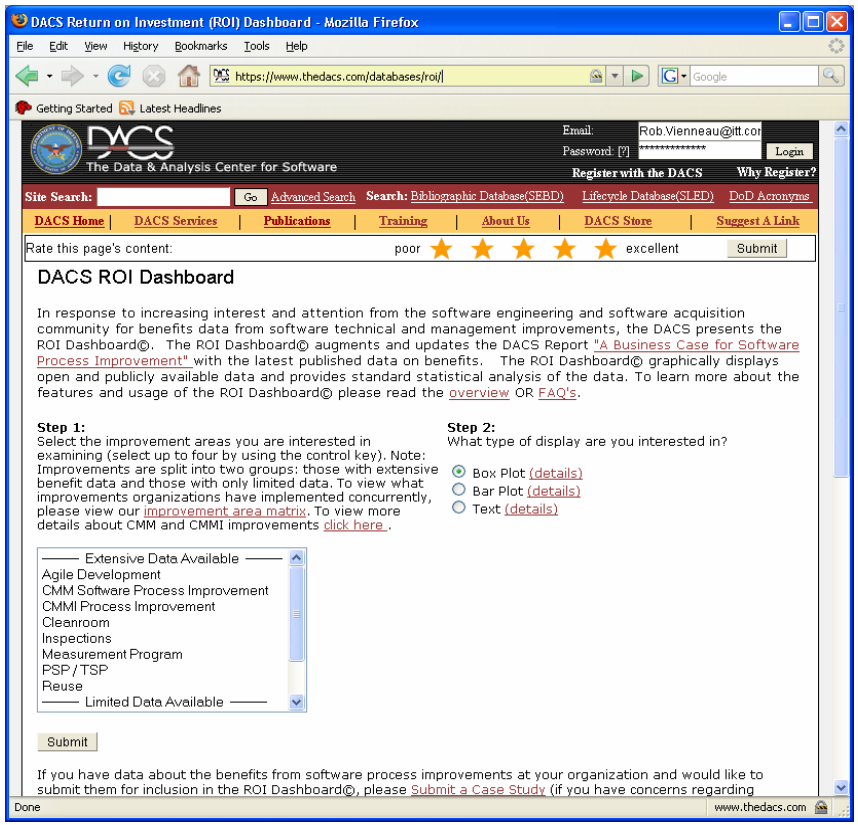


Source

View

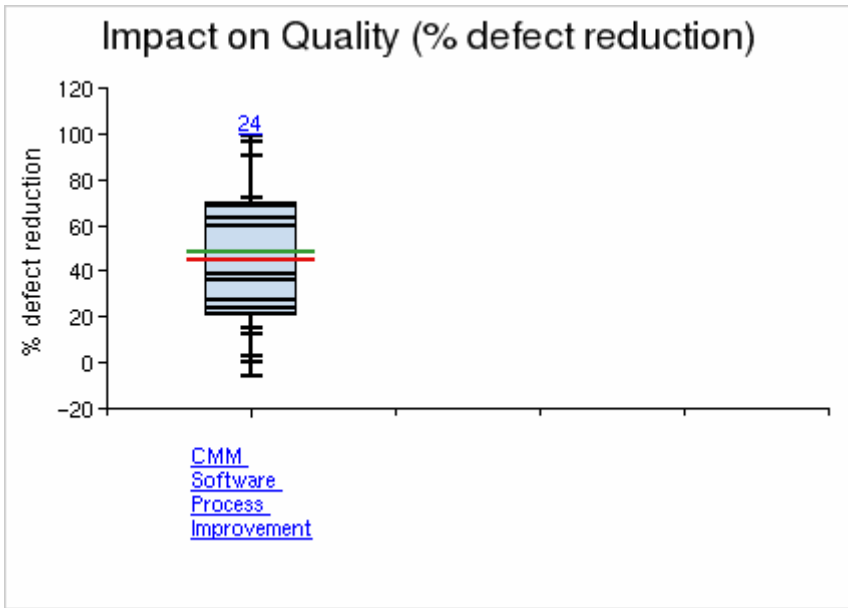
Lockheed Martin Integrated Systems and Solutions. "Key Business Indicator Trends During the Journey from SW-CMM Level 2 to CMMI Level 5 at Lockheed Martin Management & Data Systems." McLoone, Peter. CMMI Technology Conference. Denver, CO, November 2003.

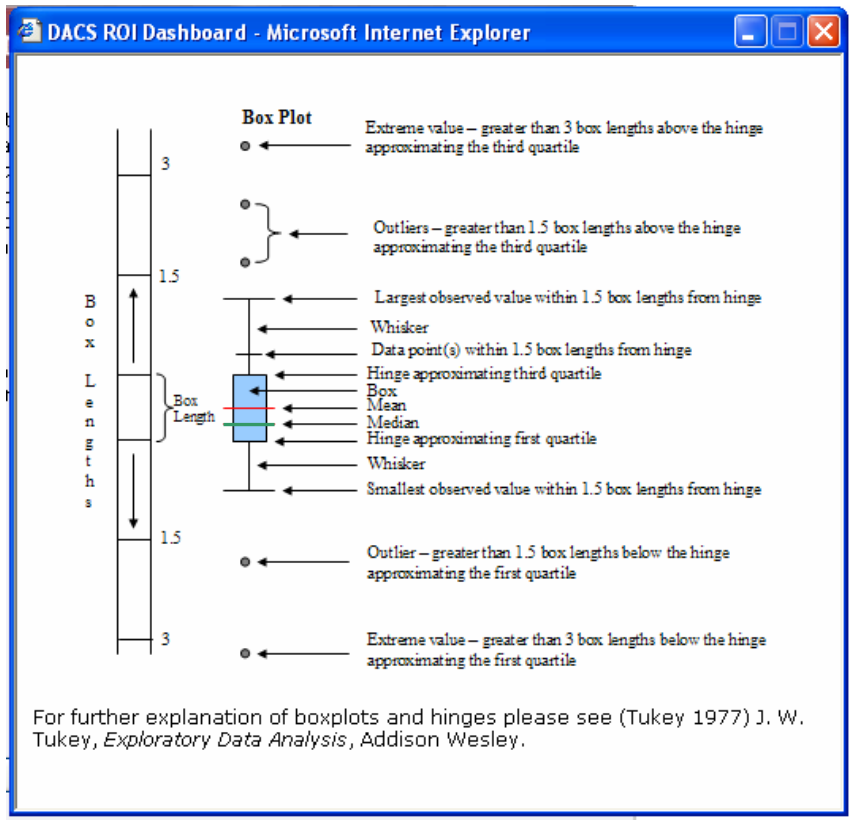
DACS ROI Dashboard©



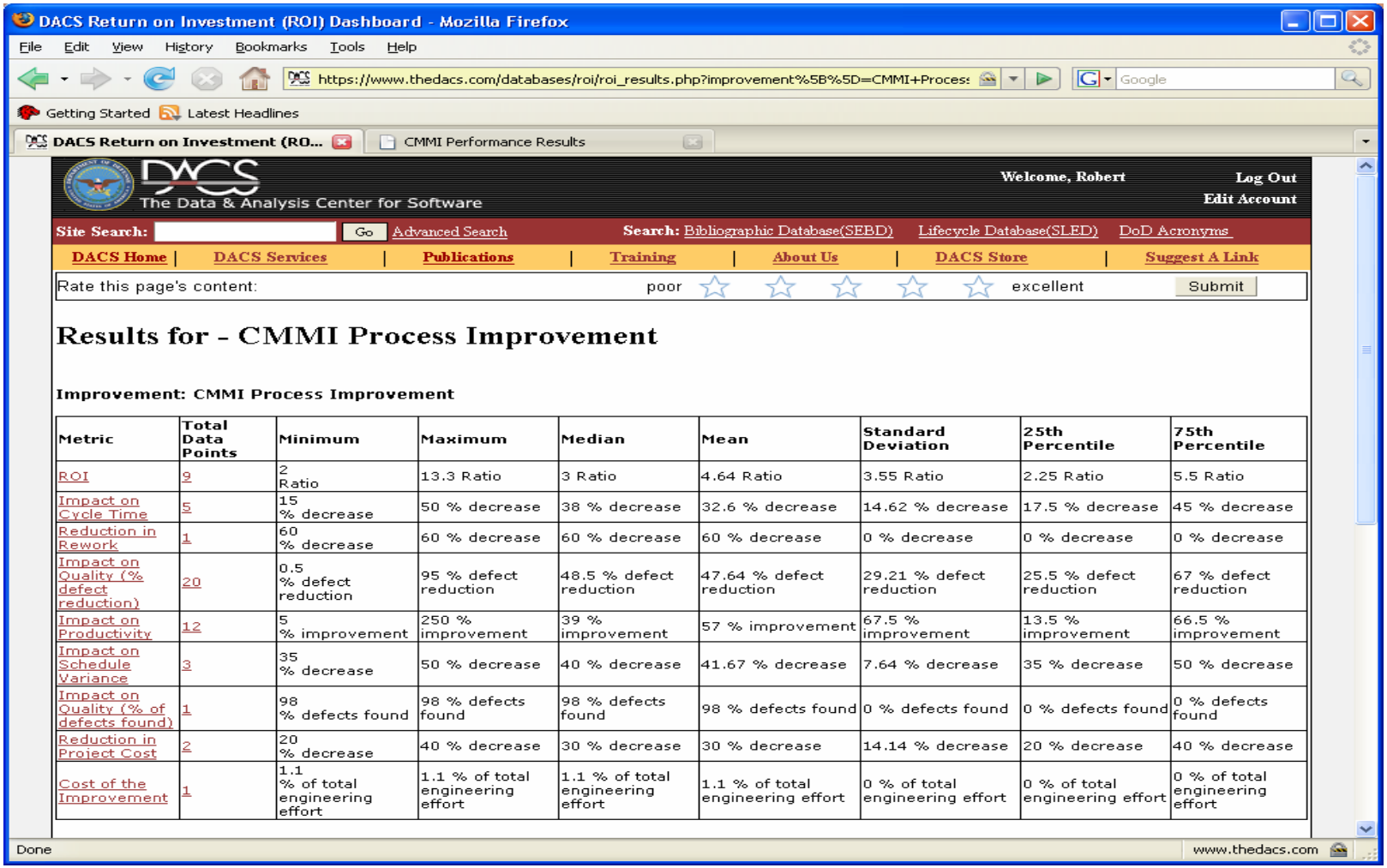
- Objective: Transition from Anecdotal Evidence to Industry Trends
- Captures 10 Years of Open and Public ROI Data from Industry and Acquisition Organizations
- Organizes and Displays Data from Similar Improvements and Benefits

Box Plot



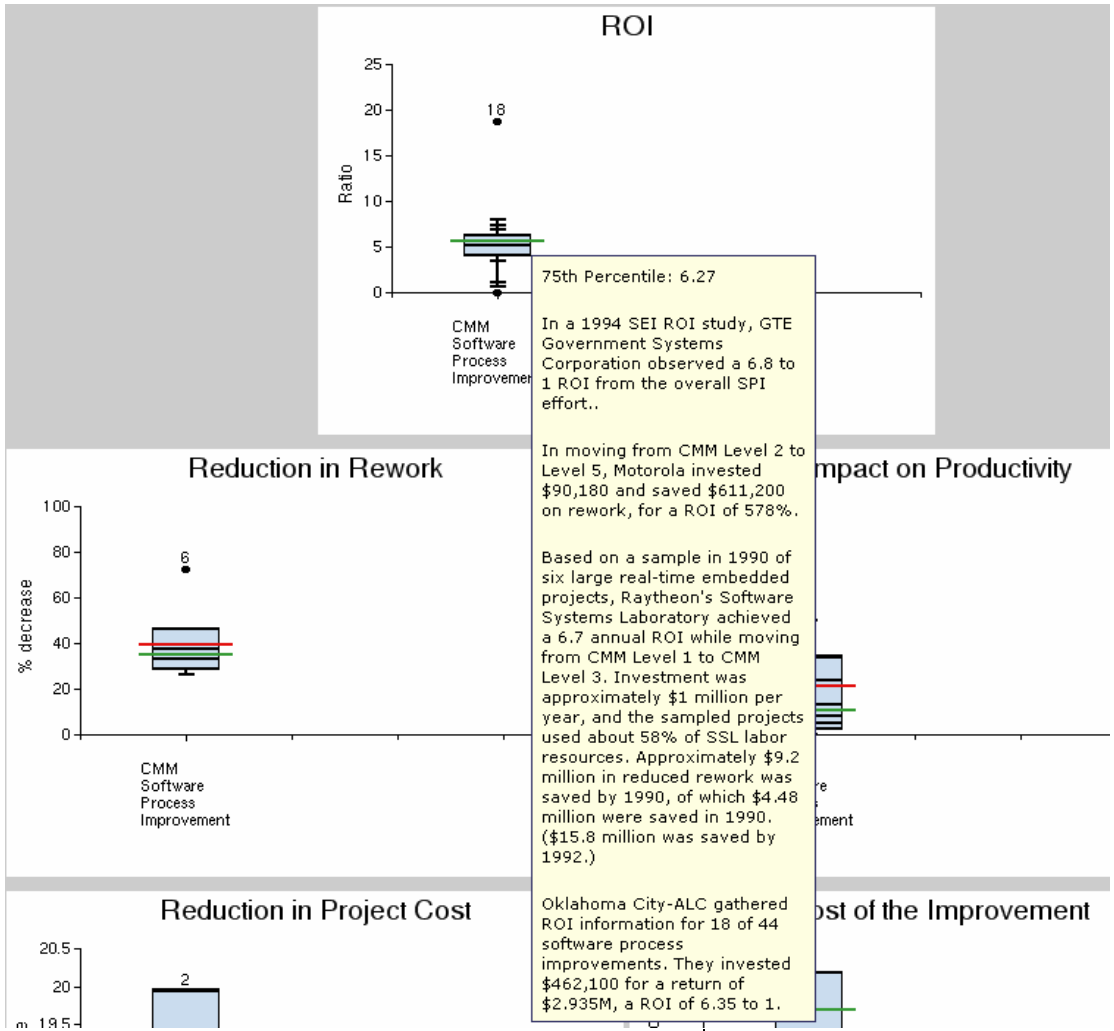


Tabular Display

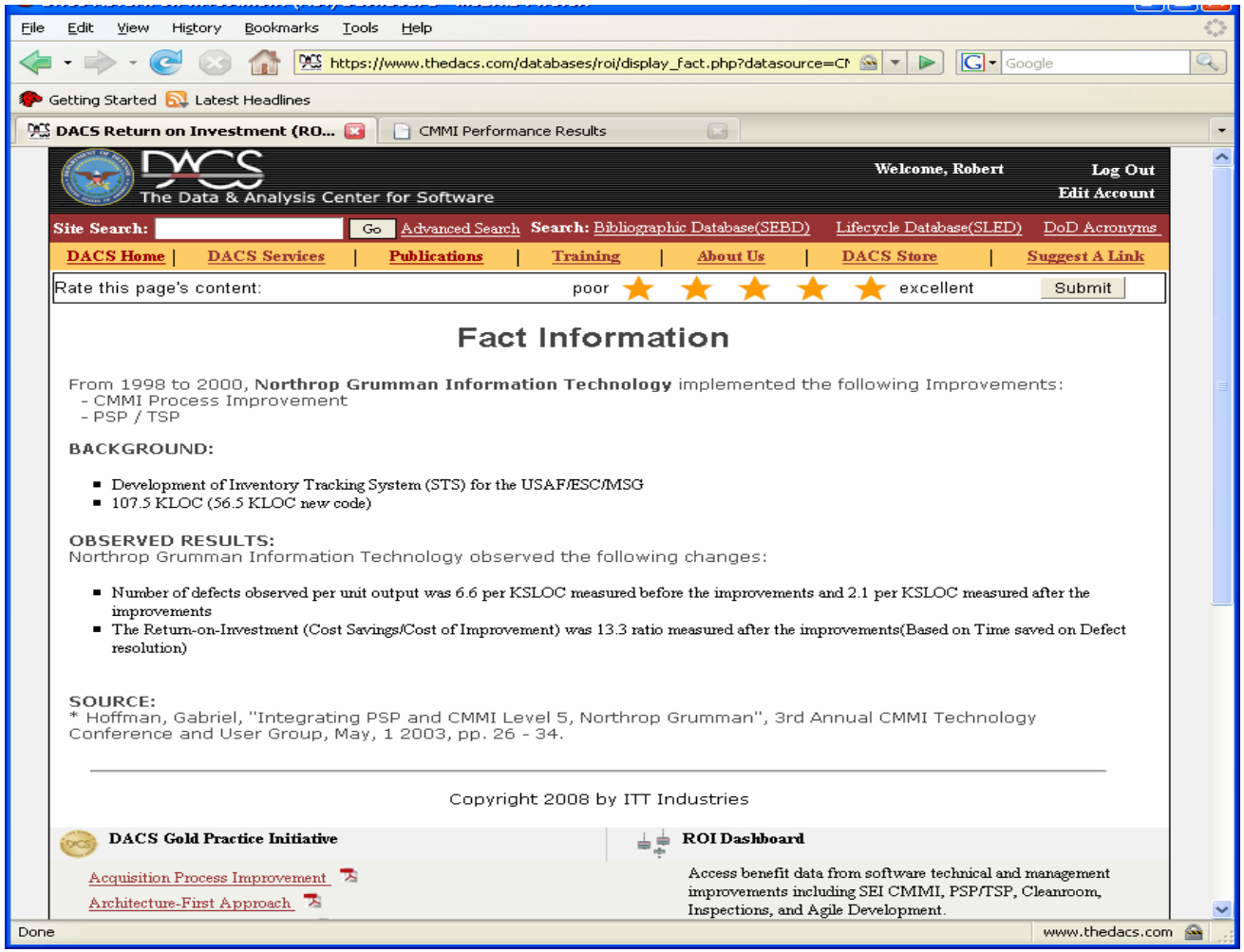


Metric	Total Data Points	Minimum	Maximum	Median	Mean	Standard Deviation	25th Percentile	75th Percentile
ROI	9	2 Ratio	13.3 Ratio	3 Ratio	4.64 Ratio	3.55 Ratio	2.25 Ratio	5.5 Ratio
Impact on Cycle Time	5	15 % decrease	50 % decrease	38 % decrease	32.6 % decrease	14.62 % decrease	17.5 % decrease	45 % decrease
Reduction in Rework	1	60 % decrease	60 % decrease	60 % decrease	60 % decrease	0 % decrease	0 % decrease	0 % decrease
Impact on Quality (% defect reduction)	20	0.5 % defect reduction	95 % defect reduction	48.5 % defect reduction	47.64 % defect reduction	29.21 % defect reduction	25.5 % defect reduction	67 % defect reduction
Impact on Productivity	12	5 % improvement	250 % improvement	39 % improvement	57 % improvement	67.5 % improvement	13.5 % improvement	66.5 % improvement
Impact on Schedule Variance	3	35 % decrease	50 % decrease	40 % decrease	41.67 % decrease	7.64 % decrease	35 % decrease	50 % decrease
Impact on Quality (% of defects found)	1	98 % defects found	98 % defects found	98 % defects found	98 % defects found	0 % defects found	0 % defects found	0 % defects found
Reduction in Project Cost	2	20 % decrease	40 % decrease	30 % decrease	30 % decrease	14.14 % decrease	20 % decrease	40 % decrease
Cost of the Improvement	1	1.1 % of total engineering effort	1.1 % of total engineering effort	1.1 % of total engineering effort	1.1 % of total engineering effort	0 % of total engineering effort	0 % of total engineering effort	0 % of total engineering effort

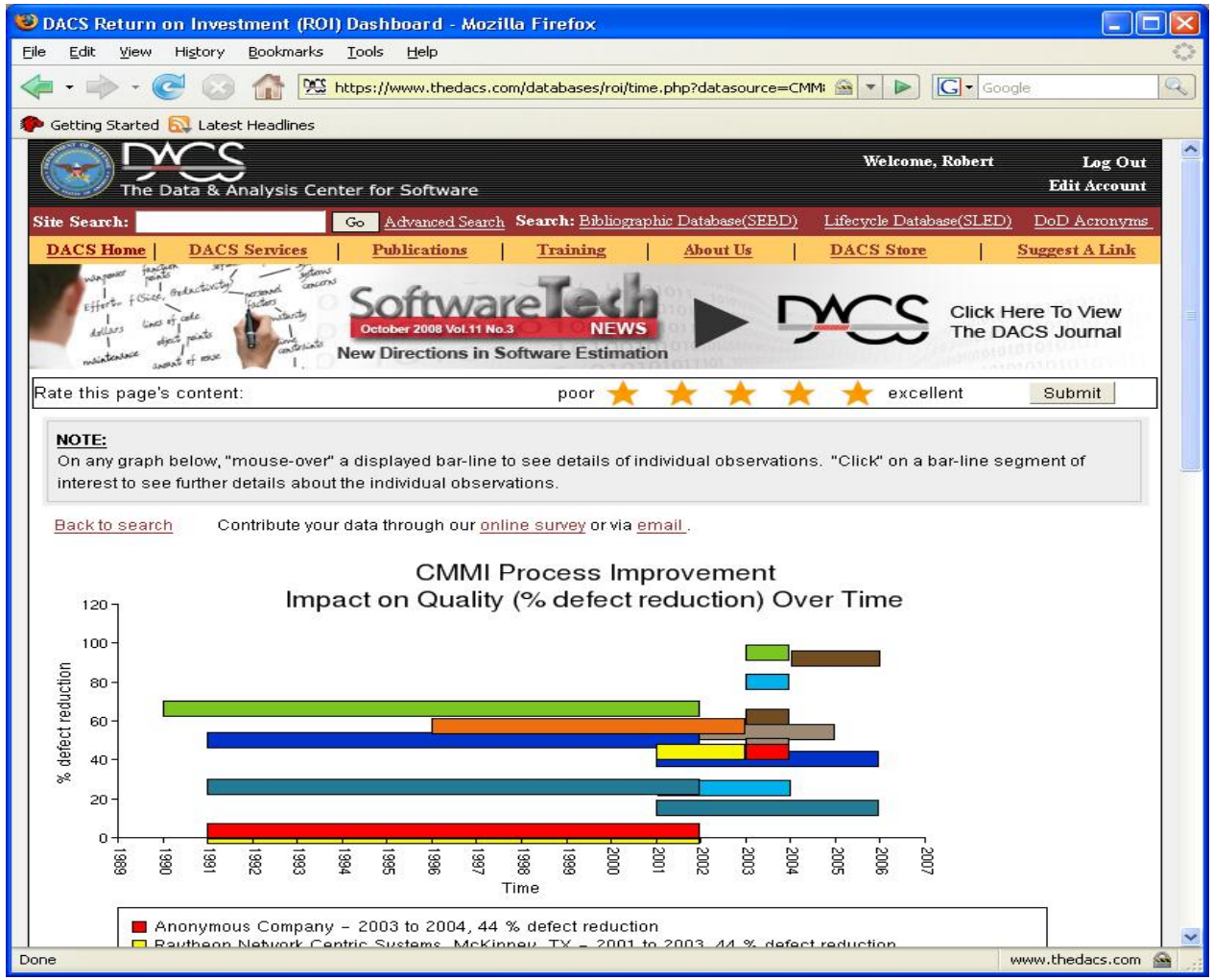
ROI Dashboard© Provides Visibility into Data



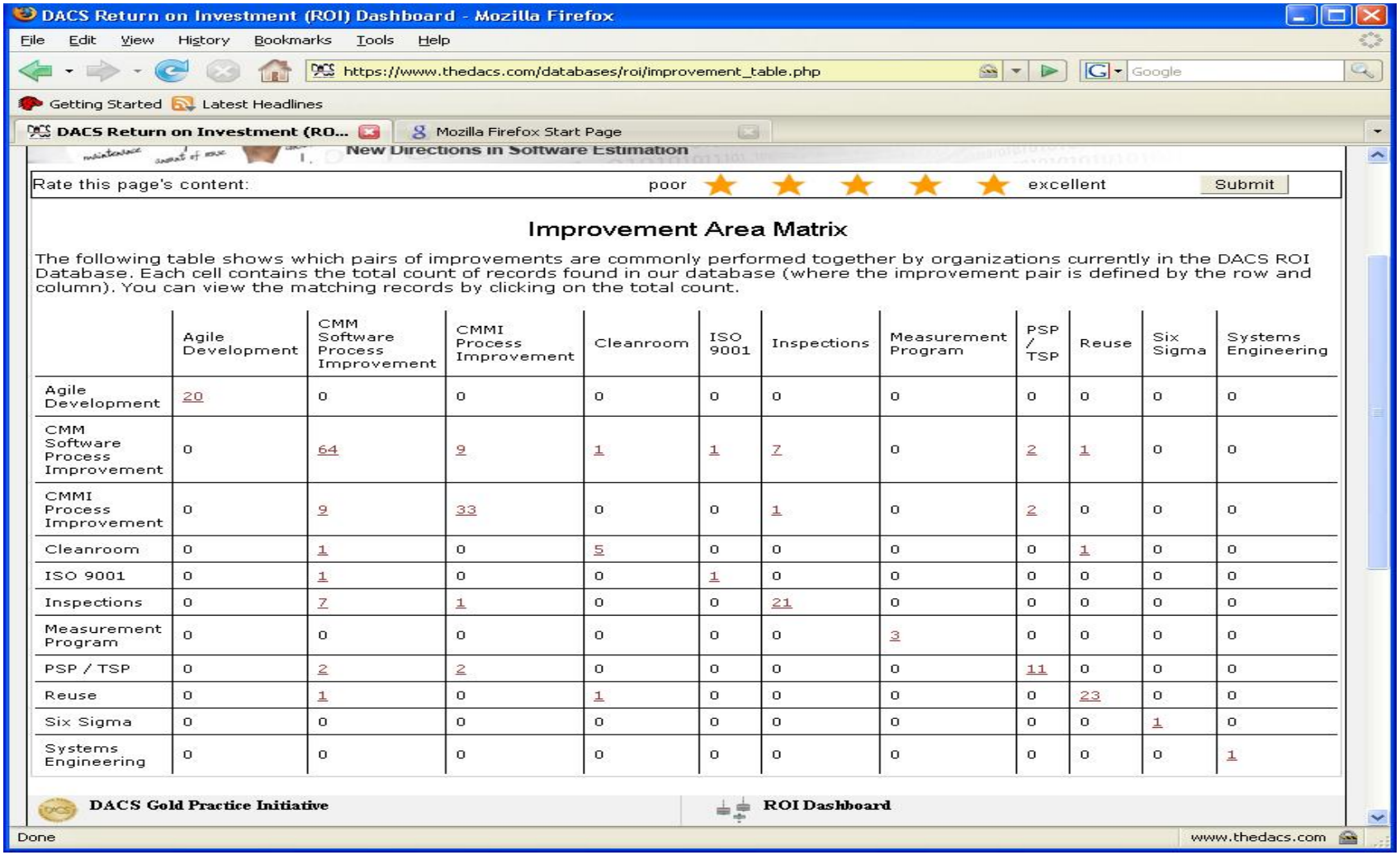
Details Available When Needed



Timeline



Improvement Area Matrix



Improvement Area Matrix

The following table shows which pairs of improvements are commonly performed together by organizations currently in the DACS ROI Database. Each cell contains the total count of records found in our database (where the improvement pair is defined by the row and column). You can view the matching records by clicking on the total count.

	Agile Development	CMM Software Process Improvement	CMMI Process Improvement	Cleanroom	ISO 9001	Inspections	Measurement Program	PSP / TSP	Reuse	Six Sigma	Systems Engineering
Agile Development	20	0	0	0	0	0	0	0	0	0	0
CMM Software Process Improvement	0	64	9	1	1	7	0	2	1	0	0
CMMI Process Improvement	0	9	33	0	0	1	0	2	0	0	0
Cleanroom	0	1	0	5	0	0	0	0	1	0	0
ISO 9001	0	1	0	0	1	0	0	0	0	0	0
Inspections	0	7	1	0	0	21	0	0	0	0	0
Measurement Program	0	0	0	0	0	0	3	0	0	0	0
PSP / TSP	0	2	2	0	0	0	0	11	0	0	0
Reuse	0	1	0	1	0	0	0	0	23	0	0
Six Sigma	0	0	0	0	0	0	0	0	0	1	0
Systems Engineering	0	0	0	0	0	0	0	0	0	0	1

Analysis of ROI Dashboard© Data

As of 8 Oct 08	Agile Development	CMM SPI	CMMI PI	Cleanroom	Inspections	Meaurement Program	PSP/TSP	Reuse	ISO 9001	Six Sigma	Systems Engineering	Total
Number of Reports												
Quality: % Defect Reduction	6	26	20		5	1	5	1	1	1		66
Quality: % Defects Found	1	3	1	1	6		2	1			1	16
Quality: Reduction in Rework		6	1		4							11
Total Quality Related	*7*	*35*	*22*	*1*	*15*	*1*	*7*	*2*	*1*			91
Cost: Productivity Impacts	14	29	12	2	2		1	12			1	73
Cost: Reduction in Program Costs		2	2		1	1	1	2				9
Total Cost Related	*14*	*31*	*14*	*2*	*3*	*1*	*2*	*14*	*0*	*0*	*1*	82
Schedule: Impact on Cycle Time	6	14	5	1				13		1		40
Schedule: Schedule Variance Impact		10	3				2					15
Total Schedule Related	*6*	*24*	*8*	*1*			*2*	*13*	*0*	*1*	*0*	55
ROI: Return on investment	1	18	9	1	15	2	2	3				51
Cost of Improvement		2	1		1	1		1	1			7
Total Benefits Observed	28	110	54	5	34	5	13	33	2	1	1	286

Queries For 1 Year By Registered DACS Users

				2008									
Improvement Type	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Total**
CMMI	1	0	1	112	20	31	90	102	59	45	50	64	575
Agile	1	1	0	96	37	19	39	18	43	32	41	30	357
CMM	0	0	0	103	25	12	20	16	26	31	44	26	303
Six Sigma	28	84	23	1	2	0	3	4	7	1	3	6	162
ISO 9001	40	72	16	1	0	2	1	0	1	2	7	4	146
Systems Engineering	35	37	10	3	1	1	4	0	8	5	2	1	107
Measurement Program	0	0	0	12	5	4	9	11	9	5	29	8	92
Reuse	3	3	0	26	1	0	4	4	8	0	4	8	61
Inspections	3	0	0	11	2	0	5	5	5	4	14	9	58
Achieving CMMI L3	11	20	4	0	3	0	3	0	1	2	2	1	47
PSP / TSP	0	0	0	7	3	10	2	3	0	3	7	2	37
Achieving CMM L2	6	20	3	0	0	0	0	0	3	0	3	2	37
Cleanroom	0	2	0	15	0	2	2	0	0	3	5	2	31
Achieving CMMI L4	3	15	1	0	0	0	0	0	0	0	0	6	25
Achieving CMM L4	4	14	1	0	0	0	0	0	0	0	0	4	23
Achieving CMMI L2	1	1	2	0	0	0	1	0	7	4	2	1	19
Achieving CMMI L5	2	1	1	0	0	0	1	1	3	1	0	8	18
Achieving CMM L3	6	8	2	0	0	0	0	0	0	0	0	1	17
Achieving CMM L5	0	0	7	0	0	0	0	0	0	0	0	2	9
Total	144	278	71	387	99	81	184	164	180	138	213	185	2124

Current User Displays

- SEI:
  - Statistics Table
  - Assertions by Organization
  - Assertions by Performance Category
  - Graphs Associated with Each Assertion
  - Links to source documents
- DACS:
  - Statistics
    - Interactive Graphs
    - Interactive Tables
  - Facts by Performance Category
  - Timelines

Performance Categories

- SEI:
  - Cost
  - Schedule
  - Productivity
  - Quality
  - Customer Satisfaction
  - Return On Investment
- DACS:
  - Cost: Productivity Impacts
  - Cost: Reduction in Project Costs
  - Cost of Improvement
  - Schedule: Impact on Cycle Time
  - Schedule: Schedule Variance Impact
  - Quality: % Defect Reduction
  - Quality: % Defects Found
  - Quality: Reduction in Rework
  - Return On Investment

Statistics

- SEI:
  - Number of data points
  - Median
  - Minimum
  - Maximum
- DACS:
  - Number of data points
  - Mean
  - Standard Deviation
  - Median
  - 25th percentile
  - 75th percentile
  - Minimum
  - Maximum

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Using the Results

- Case descriptions alone cannot be generalized widely elsewhere
- They can show what can and has happened elsewhere ... and provide guidance about what has worked well or poorly in otherwise similar situations
- What is needed is better ways to help find examples that are most similar to one's own situation

Desired User Displays

- User-controllable filters to control aggregation of performance measurements
- User-controllable filters to segment by context
  - Size of organizations
  - Application domain
  - Combination of process improvements
- In principle, any user-defined context

Making Meaningful Comparisons

- Major maturity level improvement initiatives
- Finer grained capability improvements implemented at a particular maturity level
- Varying definitions of performance measures
- Size, sector of the economy, domain, time period, additional context

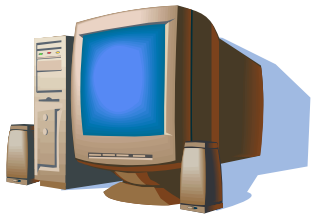
Issue: Variation in CMMI Implementations

- CMMI implementations often accompanied with other process initiatives (e.g. Six Sigma, ISO 9001, Agile)
- Can results for different CMMI levels be meaningfully aggregated?
- Variation in names and definitions of measures
- Are negative results reported (File drawer problem)?

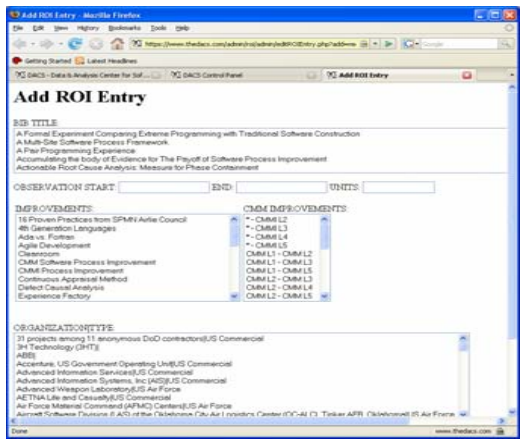
Issues with Organization

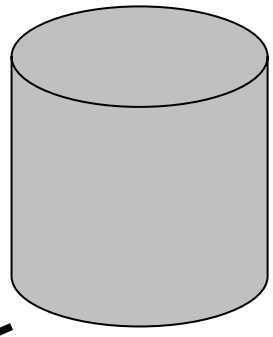
- Organizations change their name, get taken over, spun off
- Organization level data may not record for how many projects
- Data at a lower level than a project or company. Some only for selected phase or development process

A Proposed Future System



DB Maintenance/
Update Interface





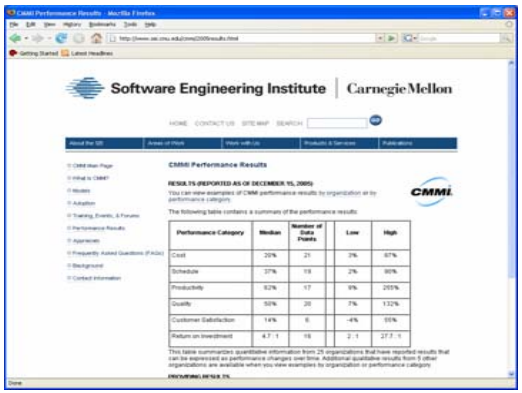
Process
Improvement
Performance
Results

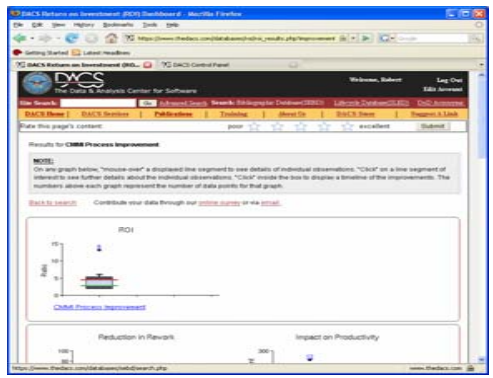
Web Services

WS Client

Web Services

WS Client





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Data Identification and Vetting Process

- To identify, record, validate, verify, & select candidate information. Process includes:
  - Monthly review of new sources
  - Tracking of choices between candidate articles and selected articles
  - Approval of SEI/DACS oversight group
  - Analysis of impact on data, analysis, and displays

Data Identification and Vetting Process
Current Sources in ROI Dashboard

- Journals
  - *American Programmer* (now Cutter Consortium)
  - *Communications of the ACM*
  - *Computerworld*
  - *Crosstalk*
  - *DACS Software Tech News*
  - *IBM Systems Journal*
  - *IEEE Computer*
  - *IEEE Internet Computing*
  - *IEEE Software*
  - *IEEE Transactions on S/W Eng.*
  - *Information Week*
  - *Journal of Systems and Software*
  - *Management Science*
  - *Software Practice and Experience*
  - *Software Process Improvement and Practice*
  - *Software Process Newsletter*
- Others, Including
  - SEPG and CMMI Conference Proceedings
  - CMU/SEI Technical Reports
- User-Supplied Data

Dimensionless Numbers

$$\textbf{Percent Improvement} = 100\ \frac{X_{End} - X_{Start}}{X_{Start}}$$

- Take additive inverse when improvement is a decrease (e.g., fault density)
- Start and end values may be company-proprietary
- Can combine different units (e.g., SLOC per Person-Hour, FP per Person-Month)

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Tasks

- Initial focus on maintenance and enhancement
- Expert SEI & DACS staff will work collaboratively:
  - To define process to identify credible quantitative results
  - To design & prototype innovative displays and summaries
  - To extend, refine, and harmonize databases
- Data acquired with a Non Disclosure Agreement not shared

Comments? Questions?

Contact Information

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