ROI From CMMI® A DACS and SEI Collaboration

8th Annual CMMI Technology Conference

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



SEI CMMI Performance Results

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About the SEI Areas of	of Work Work with	Us	Products &	Services	Publications	
O CMMI Main Page	CMMI Performance Re	sults				
O What Is CMMI?	RESULTS (REPORTED AS OF	DECEMBER	15, 2005)			
O Models	You can view examples of Ch	1MI performa	nce results by or	ganization or	by	СММІ.
 Adoption 	performance category.					
O Training, Events, & Forums	The following table contains a	a summary o	f the performanc	e results:		
O Performance Results	Performance Category	Median	Number of Data	Low	High	
Appraisals			Points			
O Frequently Asked Questions (FAQs)	Cost	20%	21	3%	87%	
 Background 	Schedule	37%	10	2%	90%	
 Contact Information 		5770	1.3	2.0	30%	
	Productivity	62%	17	9%	255%	
	Quality	50%	20	7%	132%	
	Customer Satisfaction	14%	6	-4%	55%	
		14.0		-470		
	Return on Investment	4.7 : 1	16	2:1	27.7:1	
	This table summarizes quant	itative inform	ation from 25 or	anizations tr	at have reporte	d results that
	ann ha average of as perform	iance change	es over time. Add	litional qualitz	ative results from	n 5 other

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



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😂 CMMI Perfomance Results - Mozilla Firefox	x	
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P Getting Started 🔂 Latest Headlines		
CMMI Performance Results	CMMI Perfomance Results	•
O What Is CMMI?	Assertion Statement Detail	2
O Models	Statement	-
O Adoption	engineering processes	
O Training, Events, & Forums	Organization	
O Performance Results	Lockheed Martin Management and Data Systems	_
O Appraisals	Graphic	
O Frequently Asked Questions (FAQs)	Average Engineering Hourly Rate	
 Background 	x Overhead Rate	
Contact Information	x Hours per LOC	
	x Constant Dollar Adjustment Factor	-
	Software Unit Cost	
	120%	
	Real	
	Bottom 80%	=
	Line 60%	
	Savings	
	20%	
	0% Pre NW/IPQ Post NW/IPQ	
	Source	-1
	Lockheed Martin Integrated Systems and Solutions. "Key Business Indicator	-
	view 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	
	Termining, Commenter, Denver, CC, Horemoti 2005.	

DACS ROI Dashboard©

DACS Return on I	nvestment (RO	I) Dashboard - Mozill	a Firefox						
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P Getting Started 👧	Latest Headlines								
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						Password: [?]	*******	Log	in
The Data	r & Analysis Ce	inter for Software				Register with th	DACS	Why Regis	ter?
Site Search:		Go Advanced Search	Search: <u>Bibliog</u>	raphic Data	pase(SEB)	<u>D) Lifecycle Datab</u>	ase(SLED)	DoD Acrony	ms
DACS Home 1	ACS Services	Publications	Training	Aber	<u>it Us</u>	DACS Store		Suggest A Lini	<u>s</u>
Rate this page's co	ntent:		poor 🏓		*	★ ★ excell	ent	Submit	
DACS ROI	Dashboard	ł							
open and public features and u: Step 1: Select the impro examining (sele Improvements a benefit data an improvements o please view our details about Cl	wement areas to f the Re wement areas to up to four b are split into tw d those with o rganizations h improvement 4M and CMMI i	ata and provides s OI Dashboard@ ple: you are interested y using the control k wo groups: those wit nave implemented oc <u>area matrk</u> . To view improvements <u>click h</u>	tandard stati ase read the rey). Note: th extensive view what ncurrently, v more ere.	Stical an overview Step 2: What typ O Box F O Bar F O Text	e of dis of dis Plot <u>(det</u> lot <u>(det</u>	splay are you inte (alis) (alis) (alis) (alis) (alis) (alis)	earn mo	n?	
Agile Developm CMM Software F CMMI Process II Cleanroom Inspections Measurement P PSP / TSP Reuse Limited E	ent Process Improv mprovement rogram Data Available	rement							
Submit									
If you have data submit them for	a about the be inclusion in th	enefits from software e ROI Dashboard©,	e process impl please <u>Subm</u>	rovement it a Case	s at you <u>Study</u> (ur organization a (if you have conc	nd would erns reg	d like to arding	~
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- 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

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Box Plot



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Tabular Display

DACS Return on Investment (ROI) Dashboard - Mozilla Firefox												
) Edit View History Bookmarks Tools Help												
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DACS Return on Investment (RO 区 📄 CMMI Performance Results												
Welcome, Robert Log Out The Data & Analysis Center for Software Edit Account												
Site Search: Go Advanced Search Search: Bibliographic Database(SEBD) Lifecycle Database(SLED) DoD Acronyms												
DACS Home	DACS	Services	Publications	Training	About Us	DACS Stor	<u>re Su</u>	ggest A Link				
Rate this page	's content:			poor	* * *		excellent	Submit				
Improvement: CMMI Process Improvement												
Metric	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				
<u>Impact on</u> Cycle Time	<u>5</u>	15 % decrease	50 % decrease	38 % decrease	32.6 % decrease	14.62 % decrease	17.5 % decrease	45 % decrease				
<u>Reduction in</u> <u>Rework</u>	1	60 % decrease	60 % decrease	60 % decrease	60 % decrease	0 % decrease	0 % decrease	0 % decrease				
<u>Impact on</u> <u>Quality (%</u> <u>defect</u> 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	1			
Impact on Schedule Variance	<u>3</u>	35 % decrease	50 % decrease	40 % decrease	41.67 % decrease	7.64 % decrease	35 % decrease	50 % decrease				
<u>Impact on</u> <u>Quality (% of</u> <u>defects found)</u>	1	98 % defects found	98 % defects found	98 % defects found	98 % defects found	0 % defects found	0 % defects found	0 % defects found				
<u>Reduction in</u> Project Cost	2	20 % decrease	40 % decrease	30 % decrease	30 % decrease	14.14 % decrease	20 % decrease	40 % decrease				
<u>Cost of the</u> 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				
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ROI Dashboard© Provides Visibility into Data







Details Available When Needed







Timeline



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Improvement Area Matrix

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	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												
C	olumn). You c	an view the m	atching record	s by clicking or	i the total co	unt.	16		1 6 (1				
		Agile	CMM Software	СММІ	Classica	ISO	Tesestiess	Measurement	PSP	Device	Six	Systems	
		Development	Process Improvement	Improvement	Clean oom	9001	Inspections	Program	TSP	Keuse	Sigma	Engineering	
	Agile Development	<u>20</u>	o	o	0	o	o	o	o	o	o	0	
	CMM Software Process Improvement	0	<u>64</u>	2	1	1	z	o	2	1	o	o	
	CMMI Process Improvement	0	2	33	0	o	1	o	2	o	o	o	
	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	Z	1	0	0	21	0	0	0	0	0	
	Measurement Program	0	0	o	0	o	0	3	o	0	0	0	
	PSP / TSP	0	2	2	0	0	0	0	11	0	0	0	
_	Reuse	0	1	0	1	0	0	o	0	23	0	0	
_	Six Sigma	0	0	0	0	0	0	0	0	0	1	0	
	Systems Engineering	0	0	o	0	o	o	o	o	o	o	1	
	DACS Gol	ld Practice Initiat	ive			± ±	ROI Dashboar	rd.					
Dor	e					Ŧ					ww	w.thedacs.com	9



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



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Queries For 1 Year By Registered DACS Users

				2008									
Improvement Type	Oct	Nov	Dec	Jan	Feb	Mar	Арг	May	Jun	Jul	Aug	Sep	Total
СММІ	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
СММ	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



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Current User Displays



- DACS:
 - Statistics
 - Interactive Graphs
 - Interactive Tables
 - Facts by
 Performance

Category





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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



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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 <u>cannot</u> be generalized widely elsewhere
- They <u>can</u> 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 <u>own</u> 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

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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

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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)?



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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



Add ROI Entry

DB Maintenance/ **Update Interface**



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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
- Others, Including
 - SEPG and CMMI Conference Proceedings
 - CMU/SEI Technical Reports

- 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
- User-Supplied Data



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Dimensionless Numbers

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 companyproprietary
- 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



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Comments? Questions?





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