

Measurement and the CMMI^(SM): an Impact Analysis



PSM Users' Group Conference - Keystone, Colorado - July 2002

Pascal Rabbath

R2-6-B045, Russell Offices, Canberra ACT 2600, Australia

Tel: int + 61 2 6265 6965

Mob: int + 61 417 243322

e-mail: pascal.rabbath@defence.gov.au

Directorate of Software Engineering (DSWE)

Materiel Policy and Services (MPS)

Defence Materiel Organisation (DMO)

Australian Department of Defence



Overview



- What is the CMMI?
- Australian DoD Appraisal Background
- Impact of Measurement on the CMMI
- Aggregated Appraisal Results
- Lessons Learnt
- Summary



What is the CMMI?



- The Capability Maturity Model Integrated (CMMI) is a model of world's best practice covering:
 - Process Management
 - Project Management
 - Systems Engineering
 - Software Engineering, and
 - Support Functions including QA, CM, Measurement & Analysis, and Decision Making







Category	Process Areas	
Process Management	Organizational Process Focus Organizational Process Definition Organizational Training Organizational Process Performance Organizational Innovation and Deployment	(SE/SW) (SE/SW) (SE/SW) (SE/SW) (SE/SW)
Project Management	Project Planning Project Monitoring and Control Supplier Agreement Management Integrated Project Management Risk Management Integrated Teaming Integrated Supplier Management Quantitative Process Management	(SE/SW) (SE/SW) (SE/SW) (SE/SW/IPPD*) (SE/SW/IPPD) (SE/SW/IPPD/SS) (SE/SW)
Engineering	Requirements Management Requirements Development Technical Solution Product Integration Verification Validation	(SE/SW) (SE/SW) (SE/SW) (SE/SW) (SE/SW) (SE/SW)
Support	Configuration Management Process and Product Quality Assurance Measurement and Analysis Decision Analysis and Resolution Organizational Environment for Integration Causal Analysis and Resolution	(SE/SW) (SE/SW) (SE/SW) (SE/SW) (SE/SW/IPPD) (SE/SW)
Safety*	Safety Management Safety Engineering	(+SAFE) (+SAFE)



CMMI - DMO Model Choice



- CMMI was selected for the following reasons:
 - Defence acquires total system capabilities not just software
 - Able to perform concurrent or separate appraisals
 - Can tailor to focus on specific process areas
 - Can produce a capability profile as well as an organisational maturity level
- CMMI sources:
 - EIA/IS 731, SW-CMM, IPD-CMM, SA-CMM
 - PDT (Industry, Academia, Government)



CMMI Trials - Objectives



- Evaluate the model
- Understand the appraisal methodology & resources required.
- Encourage (SE/SW) PI in Australian Defence industry.
- Establish appraisal expertise.
- Map CMMI to ISO/IEC 15504 correspondence & translation.



CMMI Trials - Status



- 15 appraisals completed to date (6 SCAMPI A^(SM), 9 SCAMPI B^(SM))
- As a result of Trials Program, DSWE has a team of highly experienced appraisers
- CMMI to ISO 15504 mapping completed
- Development of safety process extension (+SAFE)
- Generated interest from Defence, Defence industry, non-Defence industry and other Australian government departments



Appraisal Outputs



- Observations for each practice 300 to 500 + (dependent on scope of appraisal)
- Findings (global and per Process Area) strengths and improvement opportunities
- Ratings against goals
- Capability Profile
- Non-CMMI findings



Example Capability Profile







Impact Analysis of Measurement

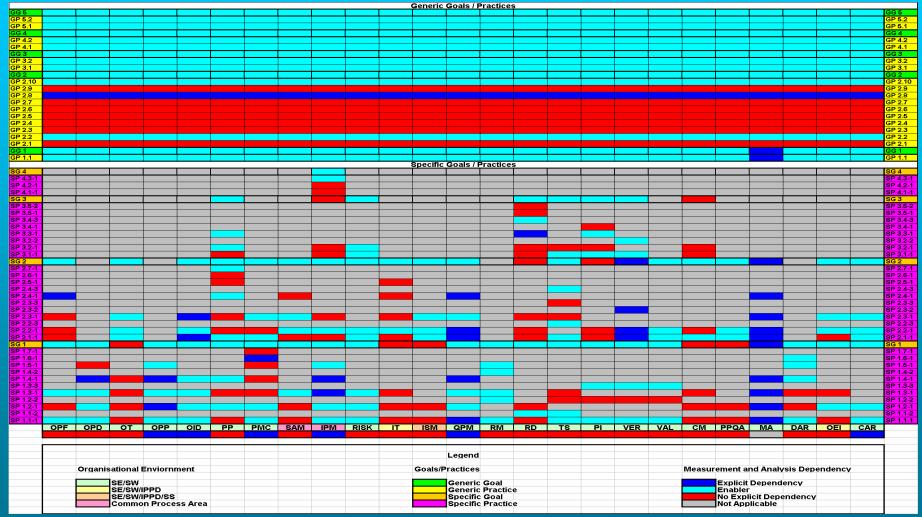


- Measurement and Analysis mapped onto the rest of the CMMI in one of three categories:
 - Explicit dependency
 - Enabler (including implicit dependency)
 - No explicit dependency
- Method Used:
 - Review of CMMI (Normative and Informative sections of the model)
 - Appraisal experience



Measurement Mapping







Impact of Measurement on the CMMI



Measurement Mapping	Explicit Dependency	Enabler	No Explicit Dependency	Totals	Percentages*
Process Areas	6	-	19	25	24%
Generic Goals	0	125	0	125	100%
Generic Practices	25	200	200	425	53%
Specific Goals	3	43	9	55	84%
Specific Practices	26	89	74	189	61%

^{*} Percentages calculated as: (Explicit Dependency + Enabler) / Totals



Explicit Dependency Example



- Goal:
 - Verification Specific Goal 2: Perform Peer Review
- Description:
 - Peer reviews are performed on selected work products
- Practice implementation indicators:
 - Peer review records
 - Data from peer reviews
 - Results from analysis conducted on peer review data



Implicit Dependency Example



- Goal:
 - Project Planning Specific Goal 1: Establish Estimates
- Description:
 - Estimates of project planning parameters are established and maintained
- Practice implementation indicators:
 - Use of estimation parameters
 - Estimation rationale
 - Use of historical data



Enabler Example



• Goal:

- Decision Analysis and Resolution Specific Goal 1:
 Evaluate Alternatives
- Description:
 - Decisions are based on an evaluation of alternatives using established criteria
- Practice implementation indicators:
 - Trigger points for formal decision making process (based on thresholds)
 - Trade studies (eg make, buy or reuse)



Aggregated Appraisal Results*



	Proces	s Manag	gement		Projec	t Manag	ement		Engineering Support										
GG3	0%	0%	0%	0%	0%	10%	13%	0%	0%	0%	0%	0%	0%	0%	10%	0%	0%	0%	GG3
GG2	0%	0%	0%	0%	23%	46%	29%	17%	38%	50%	33%	50%	36%	36%	36%	43%	0%	0%	GG2
GG1	60%	11%	22%	0%	33%	57%	89%	43%	43%	64%	67%	71%	50%	46%	36%	57%	0%	0%	GG1
SG3					79%			50%		64%	100%	79%	85%			64%			SG3
SG2	50%	22%		89%	29%	64%	90%	71%		85%	92%	86%	50%	54%	71%	64%		29%	SG2
SG1	50%	33%	22%	0%	50%	64%	100%	29%	43%	64%	58%	86%	93%	57%	50%	71%	8%	0%	SG1
	ОТ	OPF	OPD	IPM	PP	PMC	SAM	RISK	RM	RD	TS	PI	VER	VAL	PPQA	CM	DAR	M&A	
									Legend										
			Goals								Measur	ement aı	nd Analy	sis Dep	endency	•			
				Generic	Goal							Explicit	Depend	encv					
				Specific	Goal							Enabler							
												No Ехр		endency	,				
											Not Applicable								

^{*} Results from 15 Appraisals Conducted over the period May 2001 - February 2002



Summary from Aggregated Results



Specific Goals	Explicit Dependency	Enabler	No Explicit Dependency	Totals	Percentages
Majority Satisfied ¹	0	19	4	23	58%
Majority Not Satisfied ²	3	12	2	17	42%
Totals	3	31	6	40	100%

Generic Goals	Goal 1	Goal 2	Goal 3	Totals	Percentages
Majority Satisfied ¹	7	0	0	7	13%
Majority Not Satisfied ²	11	18	18	47	87%
Totals	18	18	18	54	100%

- 1: Majority of organisations appraised (ie 51% or greater) achieved Goal Satisfaction
- 2: Majority of organisations appraised (ie 51% or greater) did not achieve Goal Satisfaction



Some Lessons Learnt from the CMMI Based Appraisal Program



- Measurement is currently being done poorly and/or incompletely
- Capability appraisals catalyse adoption of reform initiatives such as measurement
- Pre-conceived notion that you should only worry about measurement for Maturity Level 2 and above
- Resistance to transition from SW-CMM to CMMI significantly reduced after organisations realise the impact measurement has on the model



Summary

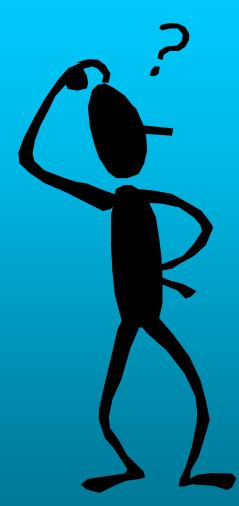


- Measurement although not explicitly required for a large part of the model is still an effective enabler for many practices
- Measurement is key to an effective process improvement program
- Measurement is an enabler for all Process Areas at Capability Levels 1 - 5
- Measurement dependency illustrates the highly integrated nature of the CMMI









(SM): CMMI, SCAMPI A and SCAMPI B are service marks of Carnegie Mellon University