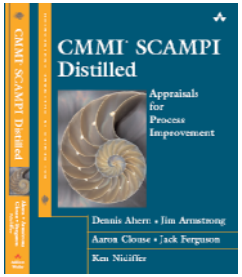
CMMI SCAMPI Distilled

Using Appraisals for Process Improvement



Tutorial

Dennis Ahern
Northrop Grumman Corporation
dennis.ahern@comcast.net

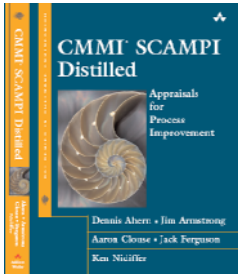
Jim Armstrong
Software Productivity Consortium
armstrong@software.org

Aaron Clouse
Raytheon Company
liatree@comcast.net

Jack Ferguson
Software Engineering Institute
jrf@sei.cmu.edu

Ken Nidiffer
Software Productivity Consortium
nidiffer@software.org

Will Hayes
Software Engineering Institute
wh@sei.cmu.edu



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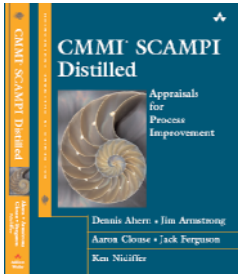
Agenda



Part I Why SCAMPI Now?

- Process Appraisal Strategies
- Other Quality Management Initiatives

Part II SCAMPI Appraisals

- New aspects of SCAMPI method
- SCAMPI Class A method definition
- SCAMPI Class B and C Methods (Afternoon Tutorial by Will Hayes)
- SCAMPI for internal assessments
- SCAMPI for external evaluations

Part III Using SCAMPI

- Issues with appraisals and process improvement

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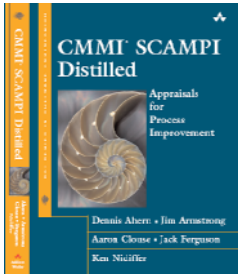

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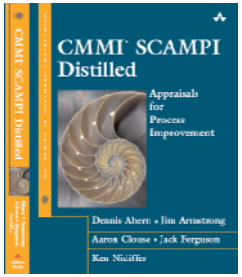
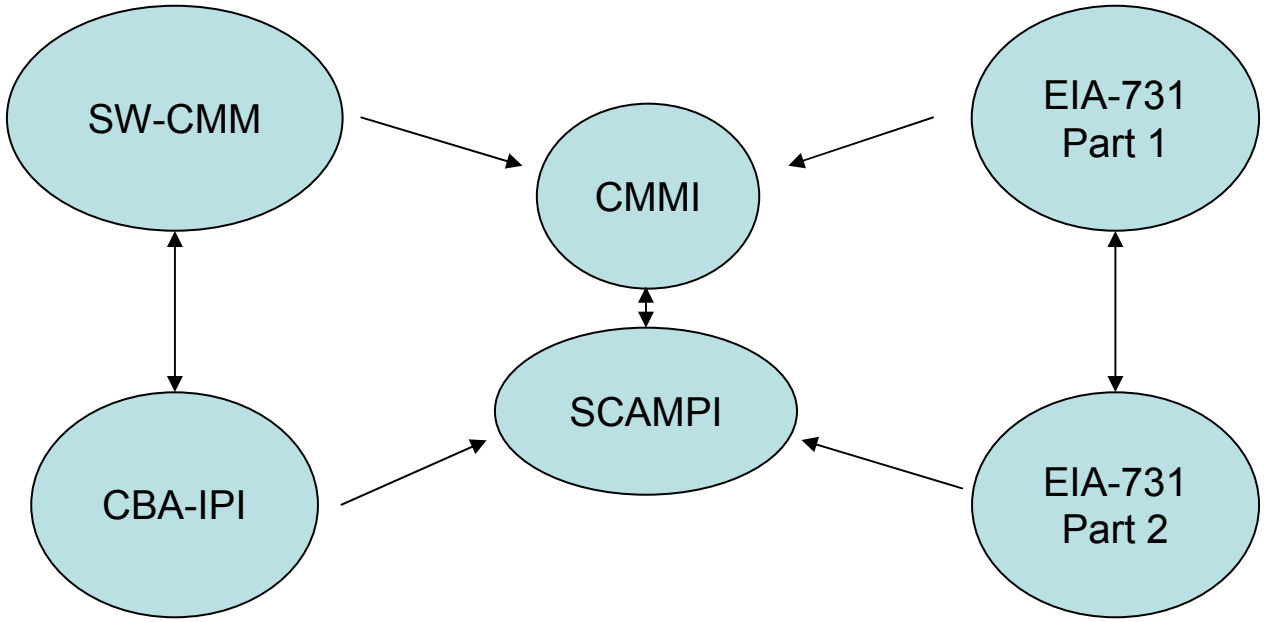
Process Appraisal Strategies

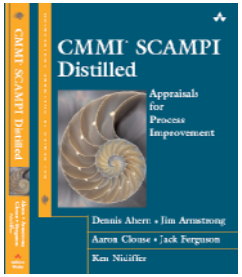


- **Process Improvement Models and CMMI**



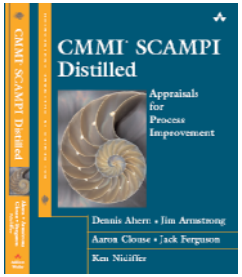
SCAMPI resembles CMM CBA-IPI more so than EIA-731-2

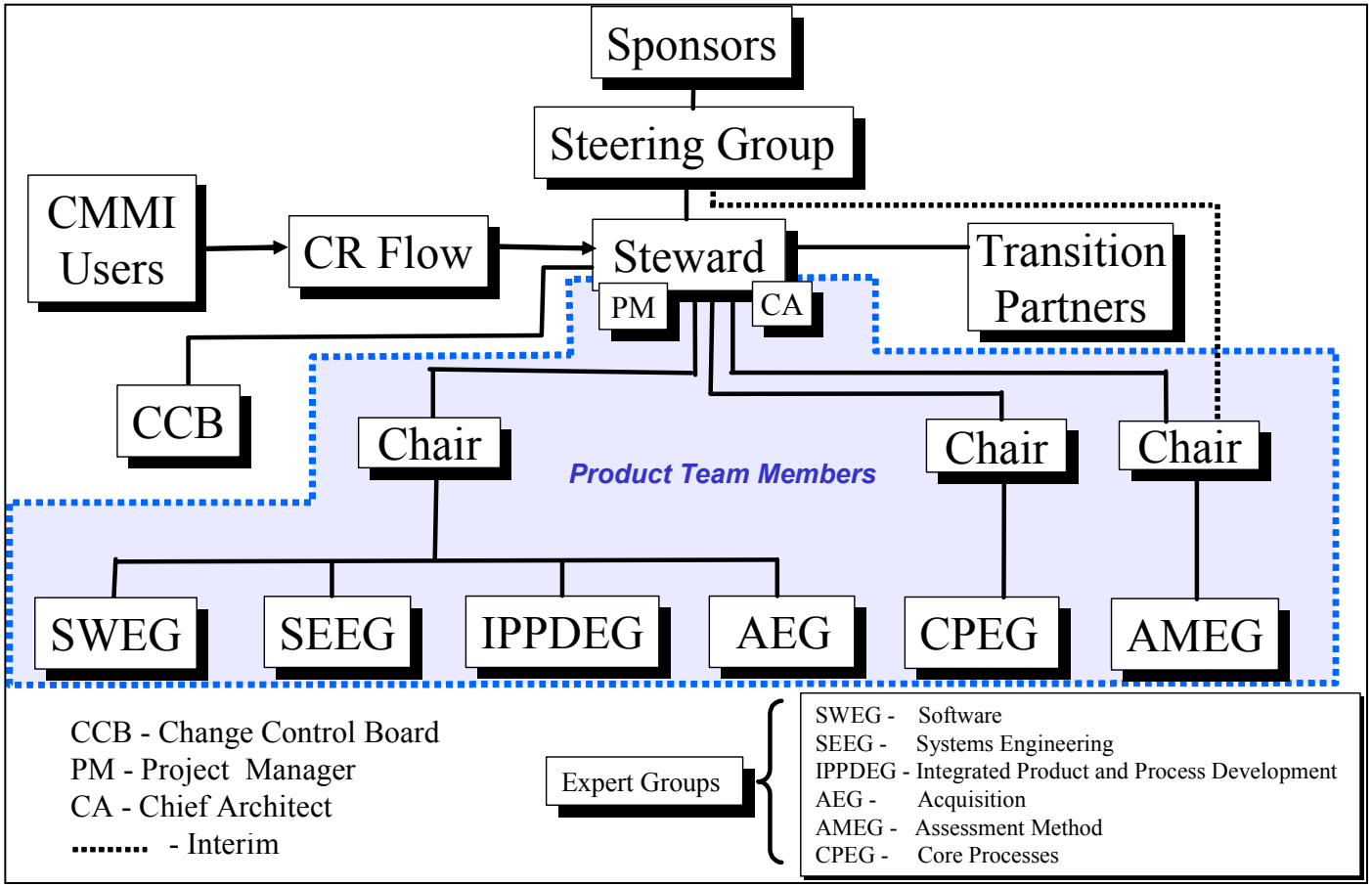
The CMMI Product Suite Today



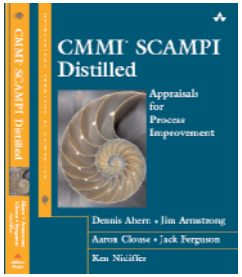
- CMMI V1.1 was released in 2002
- V1.2 is currently under development by the Product Team
- Wide acceptance of the model by multiple disciplines
- SCAMPI v1.1 was released in 2001

CMMI Product Team



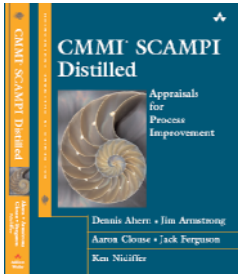


Project Management PAs



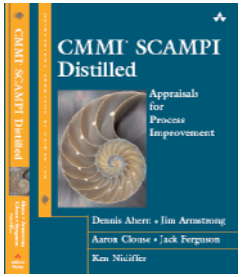
Process Area	ML	Category	Goals	Practices	Number of Subpractices
Integrated Project Management for IPPD	3	Project Mgmt	4	13	70
Integrated Teaming	3	Project Mgmt	2	8	29
Project Monitoring and Control	2	Project Mgmt	3	9	38
Project Planning	2	Project Mgmt	2	10	37
Quantitative Project Management	4	Project Mgmt	2	8	42
Risk Management	3	Project Mgmt.	3	7	25
Supplier Agreement Management	2	Project Mgmt	2	7	37
		Total	**18**	**62**	**278**

Engineering PAs



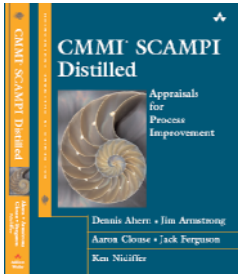
Process Area	ML	Category	Goals	Practices	Number of Subpractices
Product Integration	3	Eng	2	4	22
Requirements Development	3	Eng	3	12	35
Requirements Management	2	Eng	1	5	18
Technical Solution	3	Eng	3	11	52
Validation	3	Eng	2	5	19
Verification	3	Eng	3	8	44
		Total	**14**	**45**	**190**

Support PAs



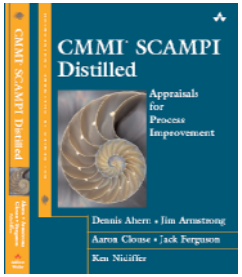
Process Area	ML	Category	Goals	Practices	Number of Subpractices
Causal Analysis and Resolution	5	Support	2	5	13
Configuration Management	2	Support	3	7	38
Decision Analysis and Resolution	3	Support	1	6	22
Measurement and Analysis	2	Support	2	8	34
Organizational Environment for Integration	3	Support	2	6	26
Process and Product Quality Assurance	2	Support	3	14	36
		Total	**13**	**44**	**169**

Process Management PAs



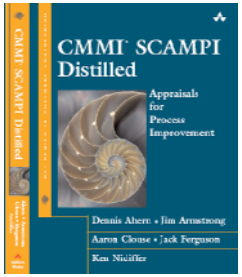
Process Area	ML	Category	Goals	Practices	Number of Subpractices
Organizational Innovation and Deployment	5	Process Mgmt	2	7	47
Organizational Process Definition	3	Process Mgmt	1	5	34
Organizational Process Focus	3	Process Mgmt	2	7	42
Organizational Process Performance	4	Process Mgmt	1	5	20
Organizational Training	3	Process Mgmt	2	7	28
		Total	**8**	**31**	**171**

Three Key Appraisal Documents



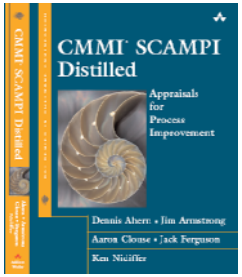
- Appraisal Requirements for CMMI (ARC)
- Standard CMMI Appraisal Method for Process Improvement (SCAMPISM) Method Definition Document
- SCAMPI Version 1.1: Method Implementation Guidance for Government Source Selection and Contract Process Monitoring. Assessment

Appraisal Method Development Teams



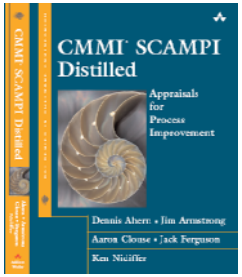
- Assessment Methodology Team (AMT)
  - Developed assessment documentation for version 1.0 of the CMMI Product Suite
- Assessment Method Integrated Team (AMIT)
  - developed appraisal documentation for version 1.1 of the CMMI Product Suite
- Assessment Methodology Expert Group (AMEG)
  - provided product development support and feedback to the AMIT for version 1.1 of the CMMI Product Suite

CMMI Training



- Introduction to CMMI (Staged Representation)
- Introduction to CMMI (Continuous Representation)
- Intermediate Concepts of CMMI
- Introduction to CMMI Instructor Training
- SCAMPI Lead Appraiser Training (SLAT)
- CMMI Instructor and SCAMPI Lead Appraiser Workshops

Agenda



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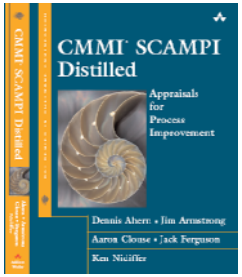
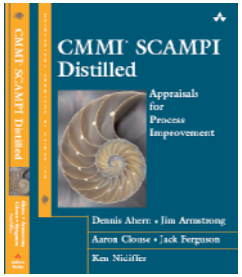
Process Improvement Strategies



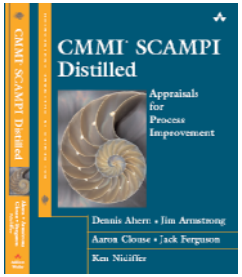
- Lean
- Six Sigma
- ISO 9000
- Agile

Lean



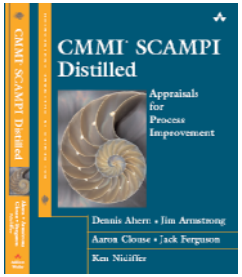
- Lean was created to reduce the cost of producing aircraft and other aerospace products
- Lean focuses on the elimination or reduction of waste to improve the flow of information and work products, and the efficient creation of value for the enterprise
- Lean Aerospace Initiative (LAI) is a consortium of the U.S. Government, industry, labor, and universities

Lean - 2



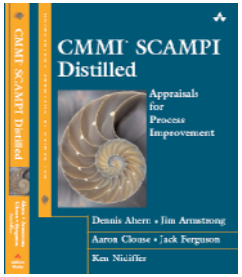
- The Lean Enterprise Model contains 12 overarching practices:
  - Identify and Optimize Enterprise Flow
  - Implement Integrated Product and Process Development
  - Maintain Challenge of Existing Processes
  - Assure Seamless Information Flow
  - Ensure Process Capability and Maturation
  - Maximize Stability in a Changing Environment
  - Optimize Capability and Utilization of People
  - Develop Relationships based on Mutual Trust and Commitment
  - Nurture a Learning Environment
  - Make Decisions at Lowest Possible Level
  - Promote Lean Leadership at all Levels
  - Continuously Focus on the Customer

LAI and CMMI Mapping 1



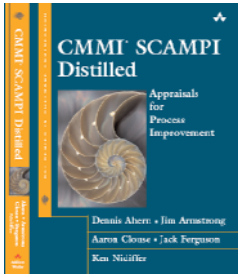
LAI Enabling Practices	*CMMI Process Areas (PAs)*	*CMMI Maturity or Capability Levels*
Systems Engineering Approach	Engineering PAs	
Requirements	REQM, RD	
Design for Mfg, Support…	REQM, TS	
Inspections	PPQA, Peer Review Goal in VER	Level 2
Planning	PP, IPM, QPM	Level 2
Risk Management	RSKM	
Data Management	PM	
IPTs	IPPD extension	

LAI and CMMI Mapping 2



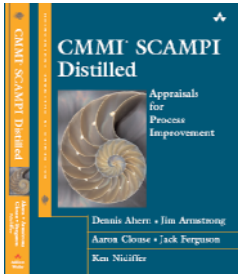
LAI Enabling Practices	*CMMI Process Areas (PAs)*	*CMMI Maturity or Capability Levels*
Stakeholder involvement	Throughout	Level 2
Skills and training	OT	Level 2
Software Factory	Engineering PAs	
Metrics	MA, QPM	Levels 2, 3 & 4
Define processes	OPD	Levels 2 & 3
Model process flow	OPD	Levels 2 & 3
Data and root causes	QPM, CAR	Levels 2, 3, 4 & 5
Variability reduction	QPM	Levels 4 & 5
Improvement targets	OID	Level 5
Continually improve processes	CAR, OID	Level 5

Lean Assessments



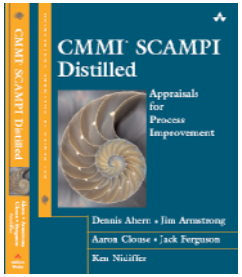
- Lean Enterprise Self-Assessment Tool (LESAT) has been developed for organizations that have embraced LAI
- LESAT uses a concept of five levels to rate each practice on a scale from least capable (Level 1) to world class (Level 5

Lean Generic Level Definitions



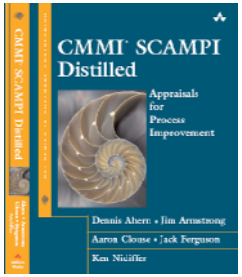
Level	*Definition*
Level 1	Some awareness of this practice; sporadic improvement activities may be underway in a few areas.
Level 2	General awareness; informal approach deployed in a few areas with varying degrees of effectiveness and sustainment.
Level 3	A systematic approach/methodology deployed in varying stages across most areas; facilitated with metrics; good sustainment.
Level 4	On-going refinement and continuous improvement across the enterprise; improvement gains are sustained.
Level 5	Exceptional, well-defined, innovative approach is fully deployed across the extended enterprise (across internal and external value streams); recognized as best practice.

Lean & CMMI Appraisals



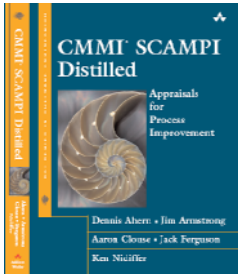
- Lean: Capability Maturity Matrix
- CMMI: Standard CMMI Appraisal Method for Process Improvement (SCAMPI)
- Assessment approaches are similar
  - Both assist an organization in assessing its progress in its transformation
  - It is expected that the assessment will be performed on a regular, periodic schedule
  - The outcomes of a particular assessment should provide guidance to the organization in refining and adjusting its continuous improvement plans

Six Sigma



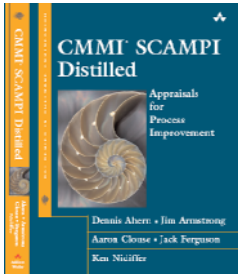
- The fundamental objective of the Six Sigma methodology is the implementation of a measurement-based strategy that focuses on process improvement and variation reduction through the application of Six Sigma improvement projects

Six Sigma



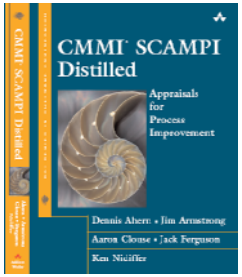
- Six Sigma has four major intentions:
  (1) maintain control of process,
  (2) improve constantly,
  (3) exceed customer's expectations, and
  (4) add tangibly to the bottom line.
- Six Sigma does not include any process models

Six Sigma & CMMI



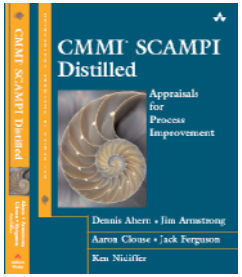
- In Six Sigma, individual processes are selected based on their ability to affect business results and provide visible value to the customer
- CMMI is more focused on having the organizational processes defined, codified and institutionalized
- Six Sigma evolved out of the manufacturing world, a world with operational processes (e.g. manufacturing, logistics)
- CMMI evolved out of the creative world of software and systems engineering

ISO 9000



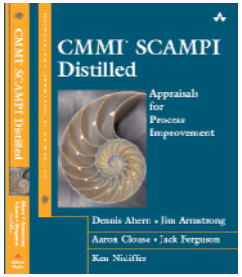
- The family of ISO 9000 quality standards includes:
  - ISO 9000:2000, *guidelines*
  - ISO 9001:2000, *requirements*
  - ISO 9004:2000, *guidelines*

ISO 9001



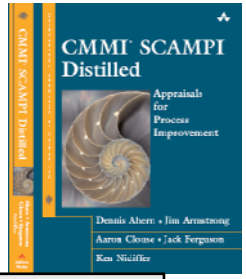
- ISO 9001 represents the process requirements, It contains the requirements for five areas:
  - Quality Management Systems
  - Management responsibility
  - Resource Management
  - Product realization
  - Measurement, analysis and improvement

ISO 9001 – CMMI Mapping



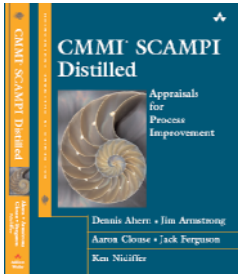
Section	*ISO 9001 Title*	*CMMI PA, Generic Practice*
4	*Quality Management System*	
4.1	General requirements	OPF, OPD
4.2	Documentation requirements	OPF, OPD, CM, GP 2.6
5	*Management responsibility*	
5.1	Management commitment	GP 2.1
5.2	Customer focus	RD, GP 2.7
5.3	Quality policy	OPF, GP 2.1
5.4	Planning	OPF, OPD, OPP, GP 2.2
5.5	Responsibility, authority and communication	GP 2.4
5.6	Management review	OPF, PMC, GP 2.10

ISO 9001 – CMMI Mapping



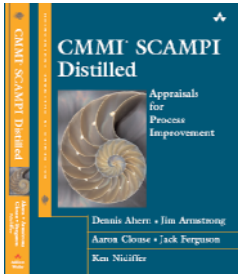
6	*Resource Management*	
6.1	Provision of resources	GP 2.3
6.2	Human resources	OT, OEI, GP 2.3
6.3	Infrastructure	OEI
6.4	Work environment	OEI, PP
7	*Product realization*	
7.1	Planning product realization	OPD, PP, IPM, GP 2.2
7.2	Customer--related processes	REQM, RD, TS, VER
7.3	Design and development	PP, PMC, CM, IPM, RD, TS, PI, VER, VAL
7.4	Purchasing	SAM, TS, ISM
7.5	Production and service provision	RD, TS, PI, VAL, CM
7.6	Control and monitoring of measuring devices	VER, VAL, MA

ISO 9001 – CMMI Mapping



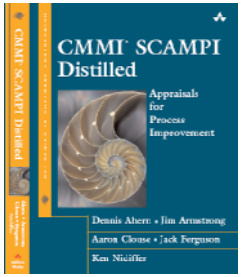
8	*Measurement, analysis and improvement*	
8.1	General	MA, QPM
8.3	Control of nonconforming product	MA, PMC, PPQA, OPF, OPD, VAL, VER
8.4	Analysis of data	CM, PMC, MA, RD, QPM, GP 3.2
8.5	Improvement	PMC, MA, OPF, CAR

ISO 9001 Audits



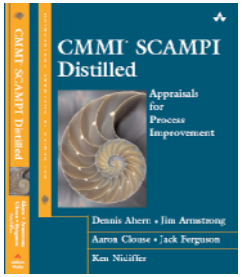
- ISO 9001 Audits are performed on an organization to ensure that the quality objectives and practices are met by an organization
- In general terms, an organization that satisfies CMMI will also satisfy ISO 9001:2000

Agile



- Agile development emphasizes:
  - *Individuals and interactions* over processes and tools
  - *Working software* over comprehensive documentation
  - *Customer collaboration* over contract negotiation
  - *Responding to change* over following a plan
- Agile Alliance

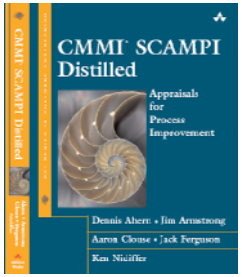
Integrating Appraisal Efforts



"Improvement of the process increases uniformity of product, reduces rework and mistakes, reduces waste of manpower, machine-time, and materials, and thus, increases output with less effort. Other benefits of improved quality are lower costs ... happier people on the job and more jobs, through better competitive position of the company."

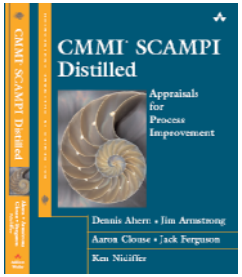
W. Edwards Deming

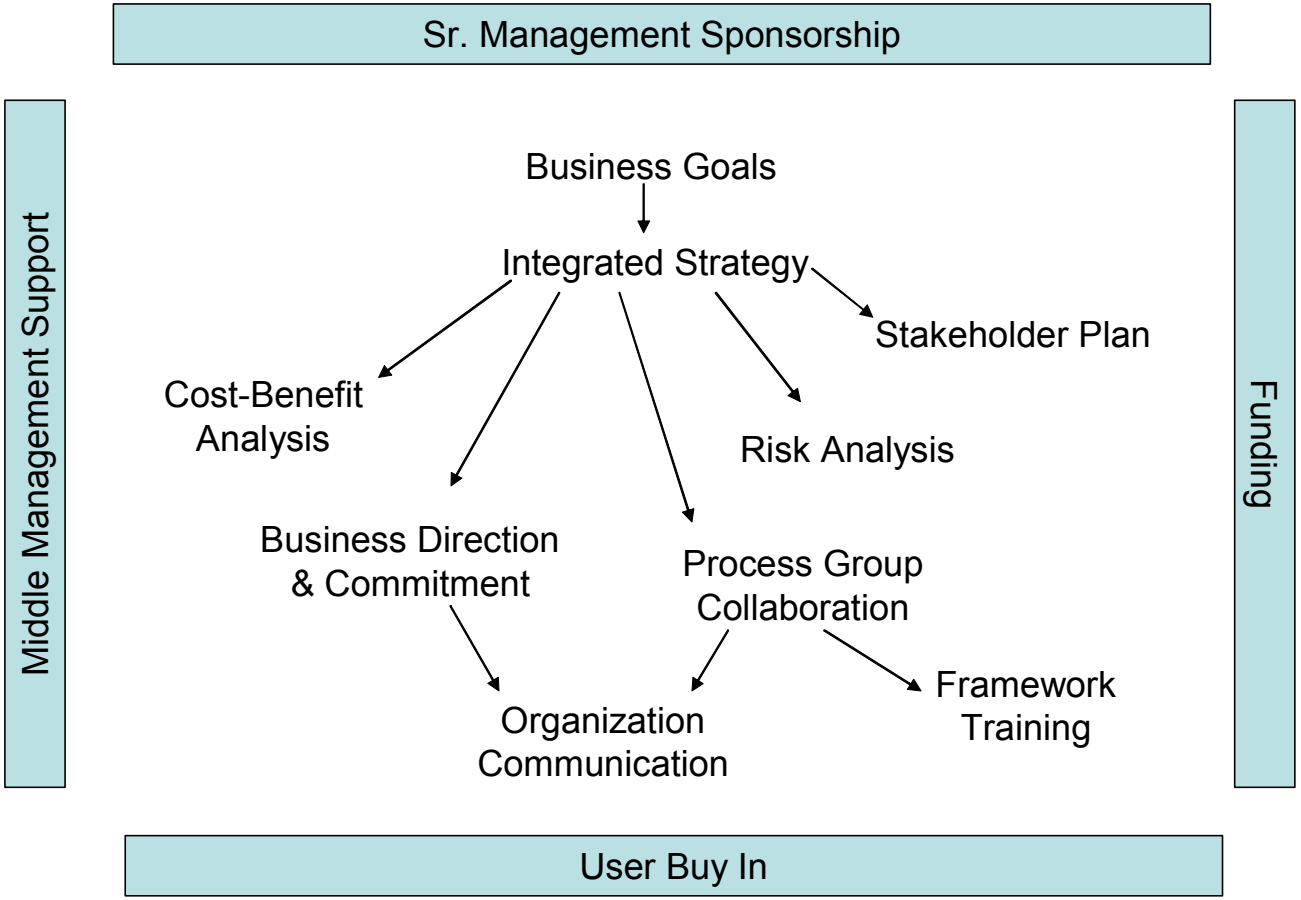
Integrating Appraisal Efforts



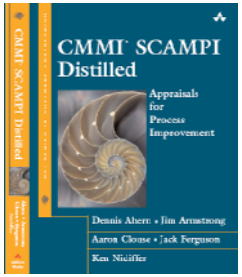
- Integrated frameworks have been developed that combined several discipline-specific frameworks
  - CMMI
  - FAA-iCMM®
  - Process improvement with an integrated model does not by itself imply the existence of integrated processes. What needs to be developed is a strategy for integrated multi-compliant processes derived from business objectives.

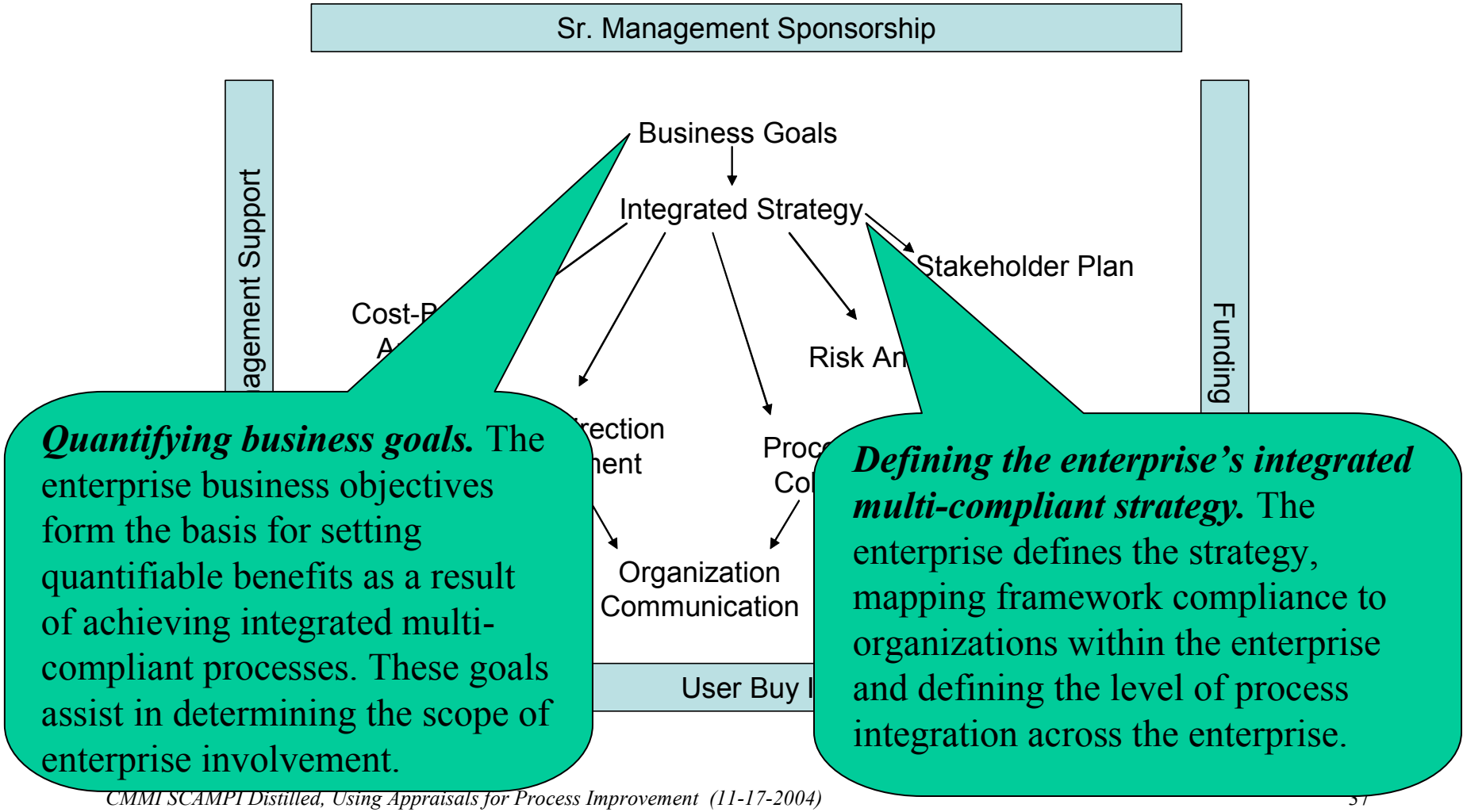
Establishing the Strategy



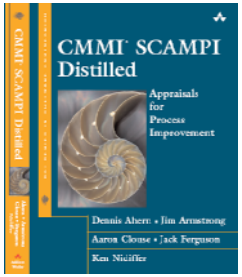


Establishing the Strategy

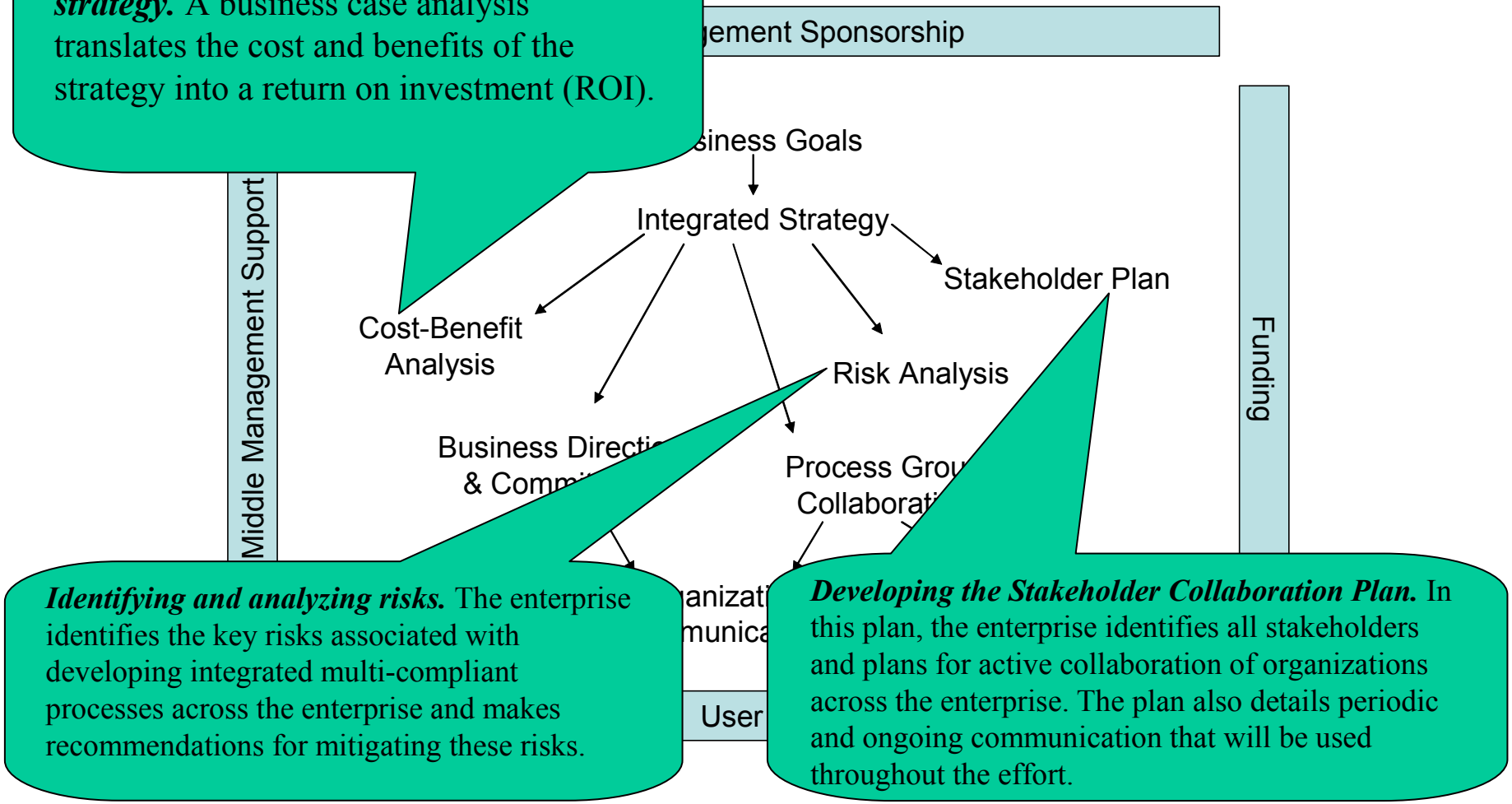




Establishing the Strategy



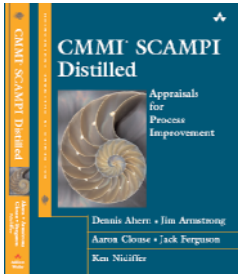
Performing a cost-benefit analysis of the strategy. A business case analysis translates the cost and benefits of the strategy into a return on investment (ROI).

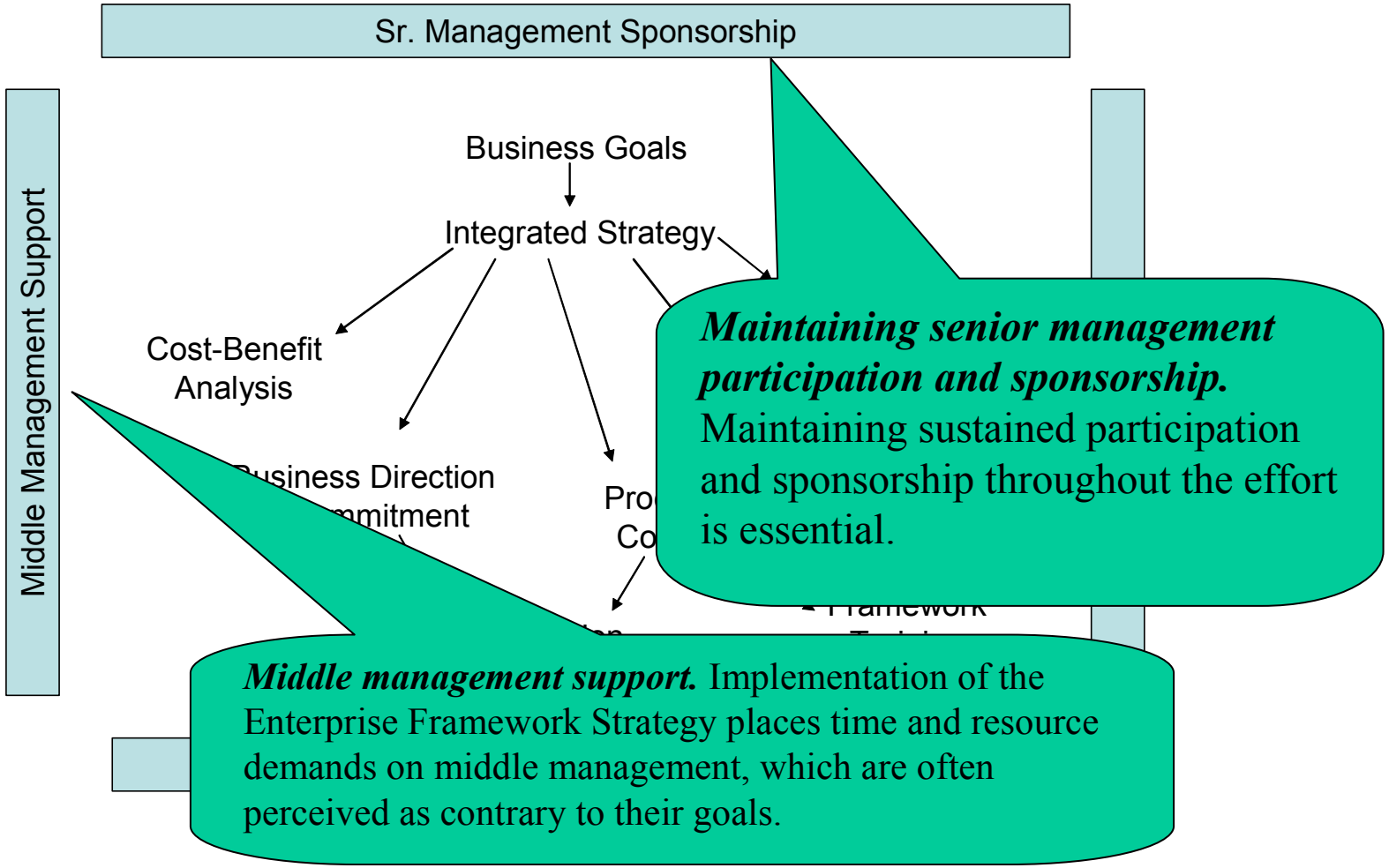


Identifying and analyzing risks. The enterprise identifies the key risks associated with developing integrated multi-compliant processes across the enterprise and makes recommendations for mitigating these risks.

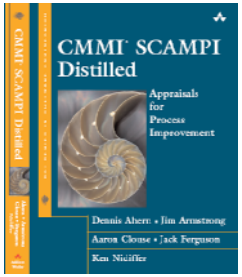
Developing the Stakeholder Collaboration Plan. In this plan, the enterprise identifies all stakeholders and plans for active collaboration of organizations across the enterprise. The plan also details periodic and ongoing communication that will be used throughout the effort.

Establishing the Strategy





Establishing the Strategy



Sr. Management Sponsorship

Maintaining funding throughout the effort. Funding needs are derived from the cost-benefit analysis and can be tracked against performance of the effort.

Lack of process user buy-in. Process users typically are resistant to changes in their processes, particularly if there is no perceived added value. Integration of processes to be compliant with multiple frameworks can be viewed as change for change's sake.

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Framework
Training

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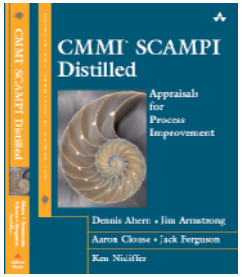
Funding

User Buy In

Establishing the Strategy



Sr. Management Sponsors

Business Goals

Integrated Strategy

Risk A

Process Group
Collaboration

Framework
Training

Organization
Communication

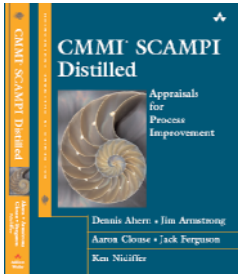
Middle

User Buy In

Inability of diverse organizations to understand each other. The larger and more diverse the enterprise, the more difficult it is to establish communication and integration.

Lack of collaboration among the process team members. In enterprises where multiple process teams were established along discipline or framework boundaries, there may be strong resistance to moving toward an integrated process. Management needs to understand the concerns and actively solicit and direct collaboration among the members of the process group.

Establishing the Strategy



Sr. Management Sponsorship

Lack of knowledge of multiple frameworks. Because the Enterprise Framework Strategy requires compliance with several frameworks, determining process requirements against several frameworks requires a working knowledge of all frameworks in the Enterprise Framework. Lack of sufficient knowledge and experience with all frameworks in the Enterprise Framework results in delays and can produce inaccuracies.

Middle Management

Cost-Benefit Analysis

Business Direction & Commitment

Process Improvement Collaboration

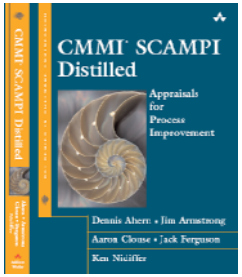
Framework Training

Organization Communication

Funding

Current business directions and commitments. Current commitments and direction may introduce additional risk with respect to resource availability and timeframes.

Agenda



Part I Why SCAMPI Now?

- Process Appraisal Strategies
- Other Quality Management Initiatives

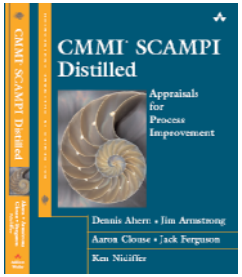
Part II SCAMPI Appraisals

- New aspects of SCAMPI method
- SCAMPI Class A method definition
- SCAMPI Class B and C Methods
- SCAMPI for internal assessments
- SCAMPI for external evaluations

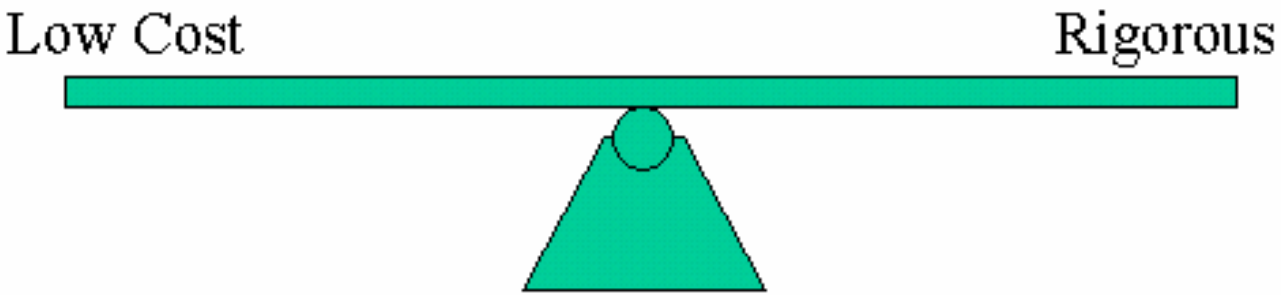
Part III Using SCAMPI

- Issues with appraisals and process improvement

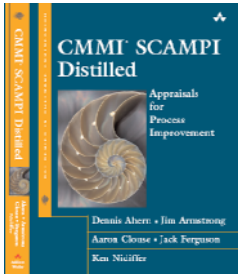
New Aspects of SCAMPI Method



- Objectives of moving from discovery to verification
  - Reduced cost of appraisals
  - Rigorous benchmarking



Focused Investigations

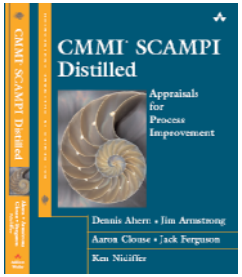


- Track and prioritize the effort needed to verify that the organization satisfies the practices within the appraisal scope
  - 25 PAs for maturity level 5 (SE/SW/IPPD/SS)
  - 185 specific practices

	Direct Evidence	Indirect Evidence	Total
Specific practices	**185**	**185**	**370**
Generic practices	**300**	**300**	**600**
Total	**485**	**485**	**970**

Number of work products per program

Agenda



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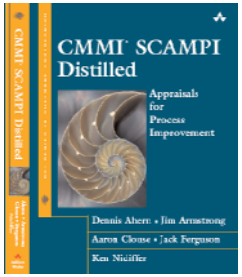
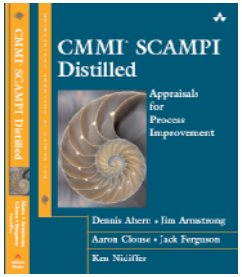
SCAMPI Class A Method Definition



- SCAMPI is a combination of techniques from:
  - CBA-IPI
  - SCE
  - SE-CMM SAM
  - EIA 731-2
- All address three types of source information in different ways and with different emphasis
  - Artifacts
  - Instruments
  - Interviews

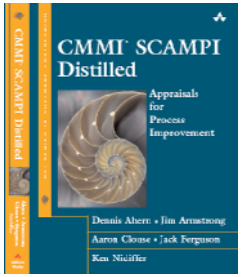
The SCAMPI authors combined these and took the best practices to create a more effective and efficient method.

SCAMPI Class A Method Definition



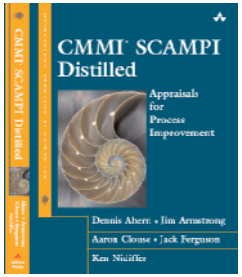
- SCAMPI, version 1.0 was very close to a CBA-IPI with the addition of a structured instrument for written, practice-by-practice input from the projects
  - The method was not very efficient.
- This drove a requirement for the version 1.1 to generate major improvements in SCAMPI.
  - One new requirement was to reduce the amount of on-site time needed for a level 3 appraisal to 100 hours

SCAMPI Class A Method Definition



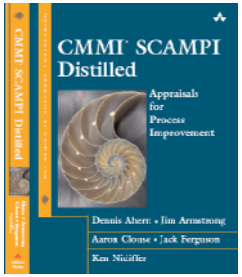
- With CMMI two things changed:
  - The model grew substantially
  - Organizations were generally more mature
- Level three focus groups don't tend to talk as much, making the interviews more difficult
- A truly mature level three organization should know where they stand BEFORE a SCAMPI is held
  - This is a basic premise of SCAMPI and allows the major shift from discovery of CBA-IPI to verification

SCAMPI Class A Method Definition



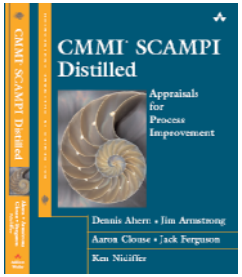
- Subtleties in the CMMI model architecture are also drivers in the SCAMPI method
  - Practices are directly tied to goals
- This allows a more structured scoring and rating logic, a more structured approach to the evidence review, and the ability to have a clearer picture of the status going into interviews

SCAMPI Class A Method Definition



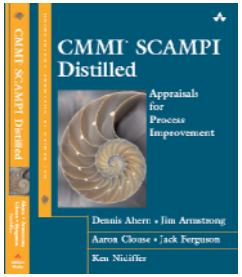
- The SCAMPI method version 1.1 provides a clear definition of the appraisal process
- It is specific about:
  - What is required
  - What the allowable tailoring options are
  - What is just guidance
- Another change is the recognition that the MDD is the rulebook
- Changes to SCAMPI must be made to the MDD through the CMMI CCB process

Tailoring of SCAMPI



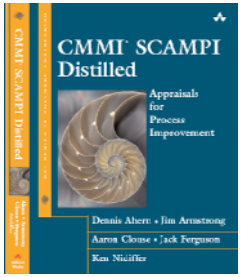
- Adjustments to use the method for evaluations, particularly in a source selection environment, are defined

SCAMPI Class A Method Overview



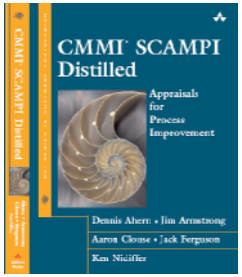
- The changes in SCAMPI to make it a verification method have one key concept tied to them that is both useful and risky to the organization and the appraisal: Process Implementation Indicators (PIIs) and the Process Implementation Indicator Descriptions (PIIDs).
  - They can lay out the available artifacts of process implementation (useful)
  - The organization's opinion of what satisfies the practices may be different than the opinion of the appraisal team members (risk)

PIID's Usefulness



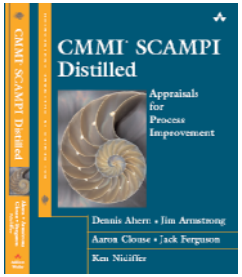
- The knowledge gained by evaluating the organization's PIIDs makes the lead appraiser's life considerably easier
  - Since the organization can show which programs are doing what, what evidence exists, and where the evidence is, the lead can easily see the overall organizational picture
  - Selecting projects to address life cycle coverage and specific artifacts to review becomes a selection task rather than a "bring me a rock" exercise
  - The lead can also see where new processes may have implementation risks in that artifacts from programs that are starting to use the new processes are not available

Using PIIDs



- Organizations need to identify the appropriate products for their processes in their PIIDs
- The programs will then have to tailor these concepts for their own situation
- The down side of PIIDs is that they can become a checklist

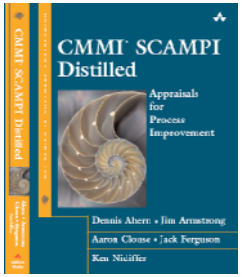
Why are we doing this?

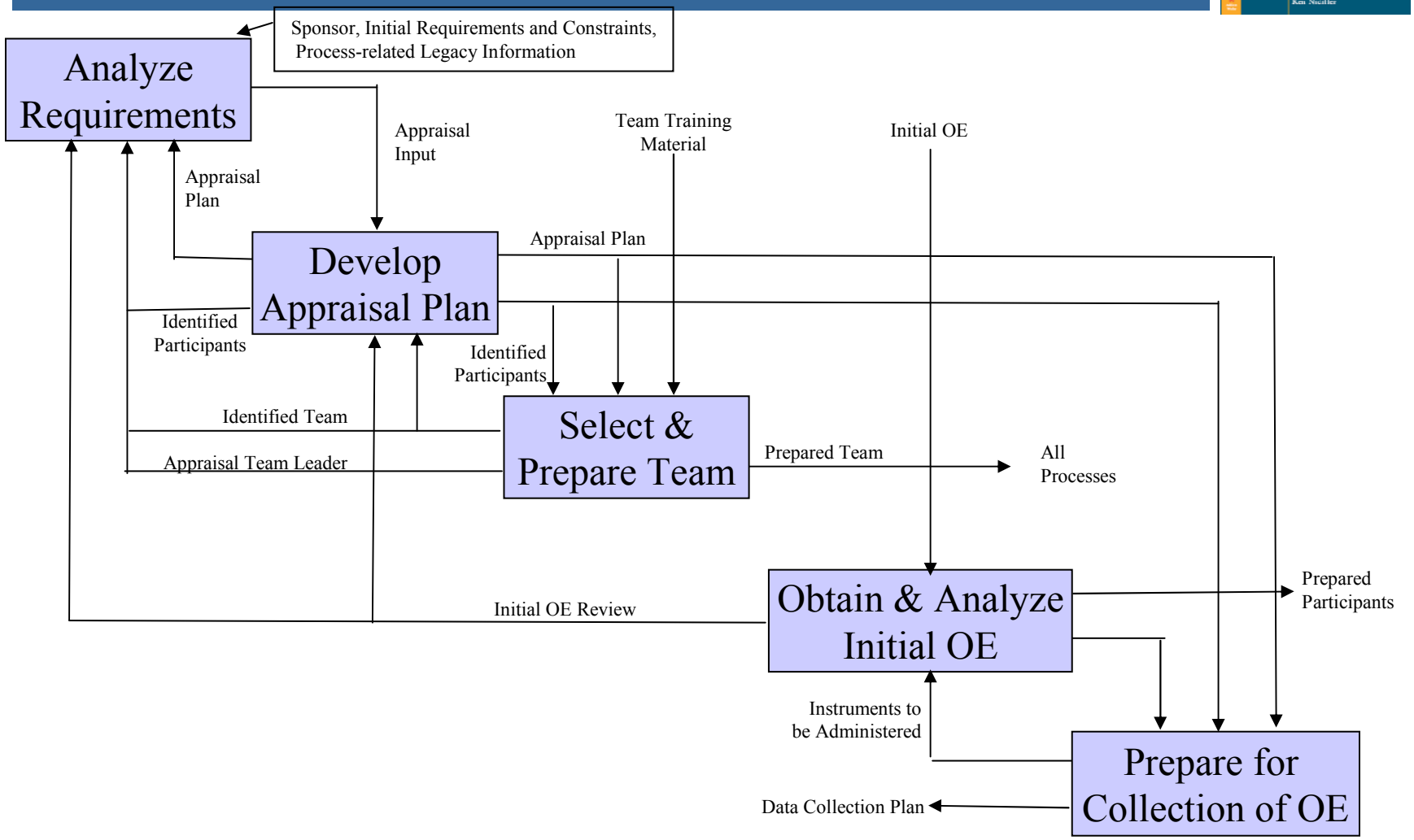


- There are three modes of usage identified in SCAMPI
  - Internal process improvement
  - Supplier selection
  - Process monitoring

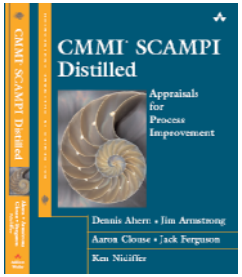
It is hoped that the purpose of the organization's SCAMPI will be to determine where the organization is on the road of process improvement and what the next steps should be.

Plan and Prepare for Appraisal



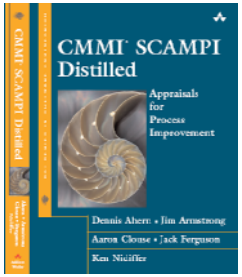


Analyze Requirements



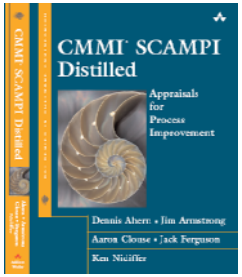
- Define Objectives
- Determine Scope of the Appraisal
  - SE SW Appraisals
  - Things to look out for

Defining Appraisal Objectives



- The first step in defining the objectives is to identify and establish communications between the sponsor and relevant stakeholders.
  - Site Management
  - Lead Appraiser
  - Site Coordinator

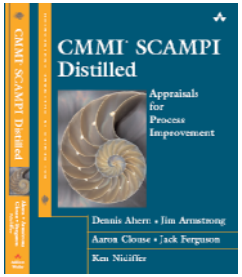
Scope of Appraisal



- Organization size
  - entire company
  - business unit
  - parts of the company with a similar need
  - single program or group of programs
  - almost any combination that one can dream up Model
- Model
  - Process Areas
  - Level(s) to be appraised

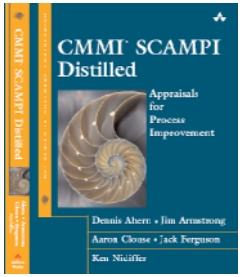
Regardless of which path is chosen, the temptation to enter into long debates about whether to use the staged or continuous representations should be avoided like the plague. **There is only one CMMI.**

SE SW Appraisals



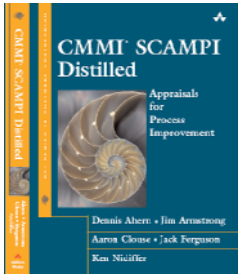
- A rule of thumb is that if the organization has separate processes for each discipline, then there will be two appraisals to cover the two disciplines.
- However, if the disciplines processes are integrated, then a single set of objective evidence will cover both disciplines: A single appraisal.

SE SW Appraisals (2)



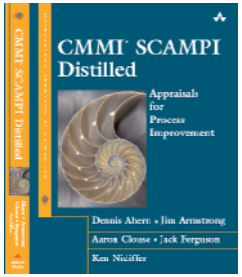
- A variation on this approach is to have a single appraisal with separate ratings for the disciplines.
- This isn't much different in the execution since the appraisers will still have to fulfill the evidence requirements for both disciplines.
- There may be some common areas to reduce the workload. However, that may well be negated by the effort to keep the two sets of books straight.

SE SW Appraisals (3)



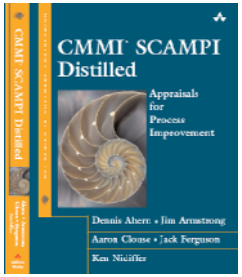
- The approach that most directly supports the intent of the CMMI is a combined appraisal with one rating.
- There may still be different artifacts for each discipline such as a SEMP and a Software Development Plan.
- This approach allows for systems engineering to be responsible for the customer interface in RD SG 1 and software to have increased involvement in the derivation of requirements in SG 2.
- It also adds impetus to using a single configuration management process with tailored procedures for hardware and software, a single quality process, or an integrated organizational training effort.

SE SW Appraisals (4)



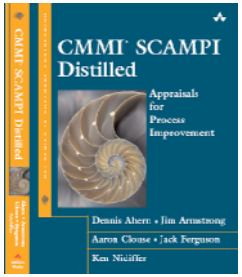
- The organization may prefer the integrated approach but but maybe facing the fact that software is operating at a higher Maturity Level than systems engineering.
- If the difference is level 3 versus 2 or lower, one of the first two approaches may be best.
- If the difference is software at level 4 or 5 and systems engineering at level 3, this can be handled without going all the way back to one of the first two approaches. A combined appraisal can address all requirements up through level 3 and then the level 4 or 5 activities of software can be looked at separately.

Things to look out for



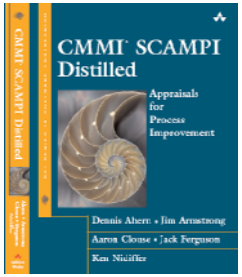
- Constraints
  - Schedules
  - Classified programs
  - Culture
- Risks
  - SCAMPI requires that the risks associated with the appraisal be identified and recorded
    - Maturity of organization
    - Team experience
    - Model interpretation
    - Results are not those expected

Planning



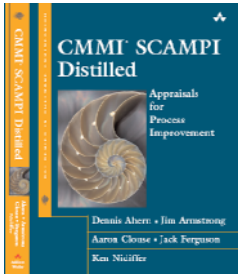
- An approved Appraisal Plan is a mandatory output of the planning phase and is required to start the appraisal.
- The decisions on objectives, scope, and outputs that are documented in the Appraisal Input are the heart of the plan.

Planning: Tailoring Decisions



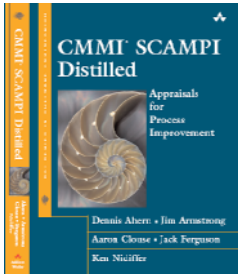
- Inclusion of presentations or demonstrations, particularly tools, as objective evidence?
- Requests for interviewees to bring a document to the interview?
- Use of video/teleconference for interviews?
- Instantiation level decisions by mini-team or full team?
- Reporting of findings by project?
- Including ratings in the final presentation?

Planning: Mandatory Outputs



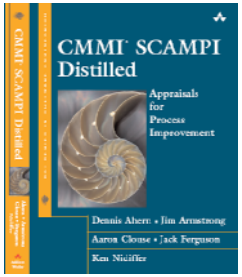
- Appraisal Record
- Appraisal Disclosure Statement
- Appraisal Report

Planning: Optional Outputs



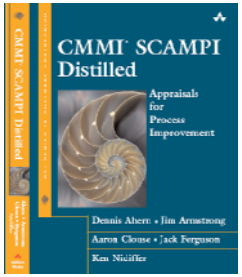
- Maturity and/or capability level ratings
- Discipline specific ratings
- Practice level ratings
- Program specific findings
- Formal Final Report
- Team's estimation of the consequences

Select Appraisal Team



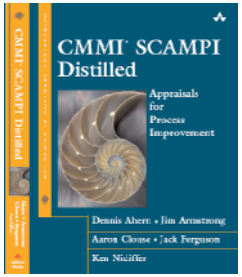
- Team Lead
  - Must understand the model
  - Understands your business model
- Team Members
  - Must have broad and deep experience in the subjects addressed
  - Must have the ability to work in your environment

Get the Evidence



- An organization that truly knows where they are will start out with:
  - a good mapping of the model to the processes
  - accurate awareness of which processes are being applied where
  - knowledge of what artifacts are being generated and where they are located.

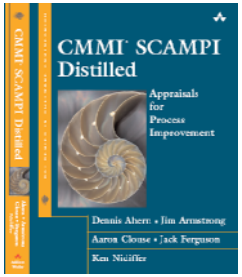
Direct Evidence



- The tangible outputs resulting directly from implementation of a specific or generic practice. An integral part of verifying practice implementation. May be explicitly stated or implied by the practice statement or associated informative material.

If you paint the house, a painted house is a direct artifact.

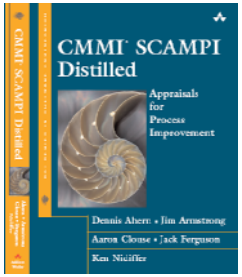
Indirect Evidence



- An artifact that is a consequence of performing a specific or generic practice or that substantiate its implementation, but which is not the purpose for which the practice is performed. This indicator type is especially useful when there may be doubts about whether the intent of the practice has been met (e.g., a work product exists but there is no indication of where it came from, who worked to develop it, or how it is used).

Receipts for the paint or empty cans are indirect as is a note from a spouse that compliments the job

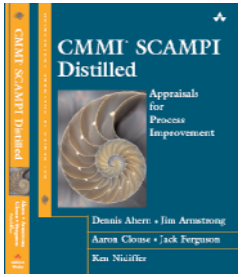
Instruments



- Artifacts used in an appraisal for the collection and presentation of data (e.g., questionnaires, organizational unit information packets). [ARC v1.1] In SCAMPI, instruments are used to collect written information relative to the organizational unit's implementation of CMMI model practices. This can include assets such as questionnaires, surveys, or an organizational mapping of CMMI model practices to its corresponding processes.

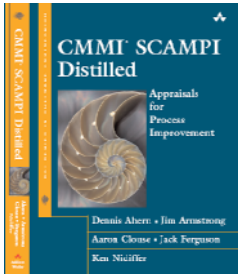
Several forms have been used from general questions about the state of practice to detailed questionnaires asking about individual practices. Yes or no questions have limited value. Some discussion or remark and reference to potential evidence is generally informative. And remember that the PIIDS is an instrument too.

Hints for Evidence Collection



- Reuse data from B & C appraisals
- Educate participants on how the appraisal will be conducted and the general concepts of maturity
- Those involved with providing evidence, before or during the appraisal, need to be informed about what's going on and their part in it
- Have a short class on the model just before administering any instrument
- Have someone available to answer questions

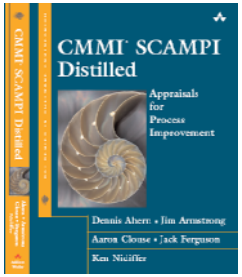
Patchwork Quilt Issue



- Many organizations face program life-cycles longer than the process improvement and appraisal cycle
  - Programs should be appraised for the entire life-cycle to see the continuity of the overall process
  - Extreme use of this approach may give the appearance of cherry picking the best examples
  - To keep the confusion and negative impressions to a minimum, this approach should be limited to where it is truly needed

SCAMPI does not require that single programs provide full life-cycle coverage

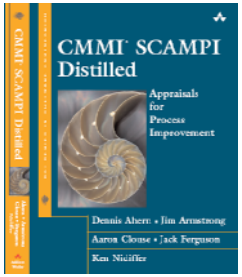
Readiness Review

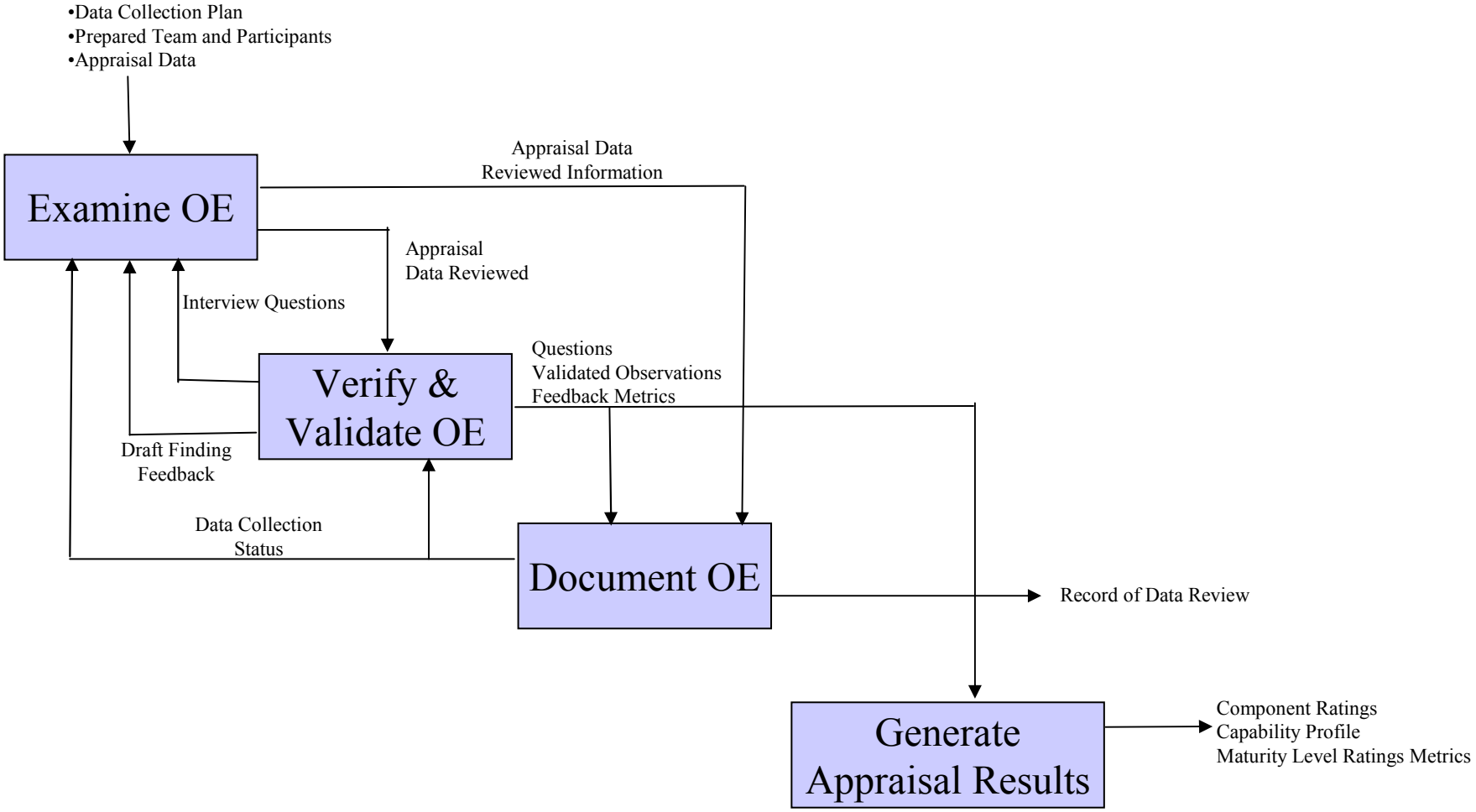


- Final decision point that it's time to gather the team and proceed with the appraisal
- At least one Readiness Review is required
- It can be performed by the lead
- It has been found effective to combine it with team training

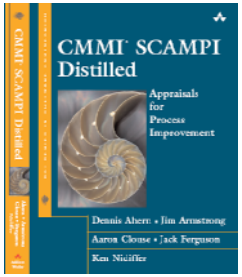
A readiness review may uncover the lack of criteria in the trade studies proposed, but if the review is going to the level of whether the variety of methods applied is a strength, it's overdoing it

Conduct Appraisal





LAST EXIT BEFORE TOLL

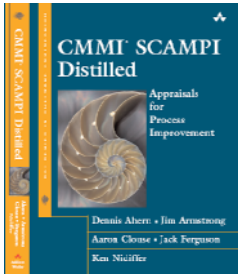


- The idea circulates from time to time that an organization can proceed into the appraisal and, after determining how the evidence plays out, decide if it's a SCAMPI or a B.
- Such may not be the case.
  - Aborting a SCAMPI is one thing
  - The MDD does not address specifics on how to abort a SCAMPI
  - To be a SCAMPI, the preliminary work must have been completed as well as the actual appraisal steps.

The best way to proceed is to start with the SCAMPI preparation activities first.

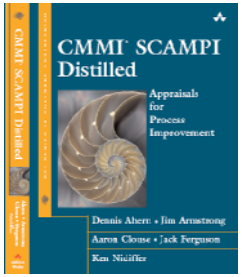
The best time to make the go/no go decision is at the readiness review.

Examining OE



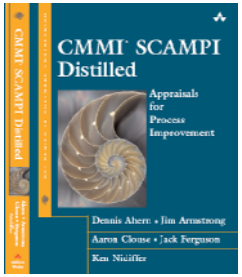
- Triage - focused investigation
- The presence of evidence should be known as a result of the Readiness review
- The team will be aware that sufficient evidence is available to answer the questions
- What isn't known is whether the evidence will answer the question yes or no or provide strengths or weaknesses

How Much Is Enough



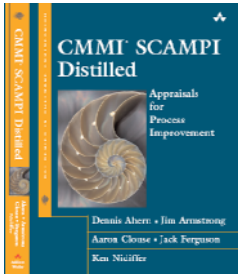
- Remember how much and what types are required
  - Address direct and indirect artifacts and affirmations
  - SCAMPI requires one direct artifact for each instance
- Review of documents will likely provide at least two sources of implementation evidence for each instance
- Direct evidence must be supported by an additional form of evidence
  - indirect artifact
  - instrument - questionnaires
  - Presentations – tool demonstrations
  - Interviews

Objective Evidence Review



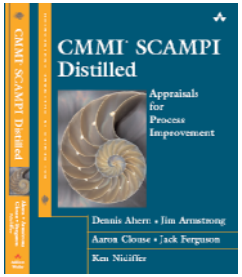
- The requirement is for one direct artifact per practice
- Sometimes more than one is needed to fully determine implementation
- Some practices have compound requirements that may not be covered by a single artifact
- A single artifact will often serve several purposes
- Monitoring progress
  - The number of practice decisions is known
  - How many practices have evidence
  - How many are still open
  - If the initial answer, at least as far as documented evidence goes, is clearly yes or no, then the team should note that and press on
  - There will be several areas where the evidence presented leaves the answer uncertain - This is where attention should be paid

Evaluating GP Related Planning



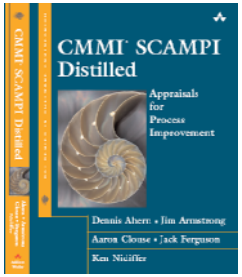
Generic Practice	Document/Section						
	ReqM	PP	PMC	SAM	MA	PPQA	CM
GP2.2 – Plan the Process	PMP 4.1	Plan Matrix, Entry Crit.	PMP 4.1 PMP 5	PMP 4.1	PMP 4.1 PMP 5.4	PMP 4.1 PMP 4.5.2	PMP 4.1 PMP 4.5.1 PMP 4.5.2
GP2.3 – Provide Resources	PMP 3	Plan Matrix, Entry Crit.	PMP 3	PMP 3	PMP 3	PMP 3	PMP 3
GP2.4 – Assign Responsibility	PMP 3.1.7	Plan Matrix, Entry Crit.	PMP 3.1.4	PMP 3.1.4	PMP 3.1.4	PMP 3.1.6	PMP 3.1.8
GP2.5 – Train People	PMP 3.3	Plan Matrix, Entry Crit.	PMP 3.3	PMP 3.3	PMP 3.3	PMP 3.3	PMP 3.3
GP2.6 – Manage Configurations	PMP 2.4	Plan Matrix, Entry Crit.	PMP 2.4	PMP 2.4	PMP 2.4	PMP 2.4	PMP 2.4
GP2.7 – Identify and Involve Relevant Stakeholders	PMP 3.4 Commit List	Plan Matrix, Entry Crit.	PMP 3.4 Commit List	PMP 3.4 Commit List	PMP 3.4 Commit List	PMP 3.4 Commit List	PMP 3.4 Commit List
GP2.8 – Monitor & Control the Process	PMP 5	Plan Matrix, Exit Criteria	PMP 5	PMP 5	PMP 5	PMP 5	PMP 5
GP2.9 – Objectively Eval-uate Adherence	PMP 4.5.2	Plan Matrix, Exit Criteria	PMP 4.5.2	PMP 4.5.2	PMP 4.5.2	See Note*	PMP 4.5.2
GP2.10 – Review Status with Higher Level Management	PMP 5	Plan Matrix, Exit Criteria	PMP 5	PMP 5	PMP 5	PMP 5	PMP 5

Evaluating GP 3.2



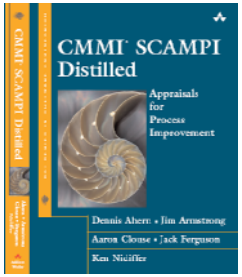
	Instantiation 1			Instantiation 2			Instantiation 3			Instantiation 4		
Process Area	WP	I	M	WP	I	M	WP	I	M	WP	I	M
REQM	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
PP		Y					Y					Y
PMC	Y	Y	Y	Y		Y	Y	Y		Y		Y
SAM							Y			Y		Y
MA	Y		Y	Y		Y	Y			Y		
PPQA	Y					Y				Y		Y
CM	Y		Y	Y	Y	Y	Y				Y	Y
Key	**Items submitted to Organization**											
WP	Work Products											
I	Improvement Information											
M	Measures & Measurement Results											

Doing the Math



- Once the artifacts and affirmations have been individually evaluated, it's time to come to some conclusions
  - It is neither a requirement nor the intent that this step waits for all data to be assembled
  - The team, or even mini-teams should do this as the evaluation progresses
- SCAMPI provides specific guidance on:
  - four levels of implementation guidance at the instance level
  - rules on organizational result based on those instances
  - rules on goals result

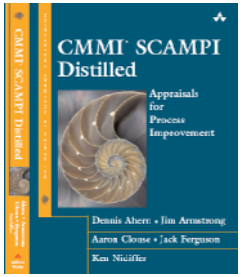
Validating Gaps



- After the team reaches initial conclusions about findings, the participants must be given an opportunity to respond
- SCAMPI does not specifically address it, but individual reviews with the program leads using a listing of the findings is an effective way to get dialog on them
  - can be effectively done by mini-teams
- To remove uncertainties include statements that would benefit from additional input for certainty

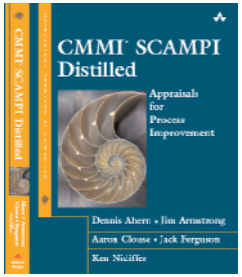
Draft findings are the consensus of the whole team

Replan Data Collection



- Replanning can occur at any time during the collection and review of evidence
- Additional artifacts are identified as needed or interviews changed
- It is possible to actually reduce the inputs needed
- Some interviews can be either eliminated or reduced in length

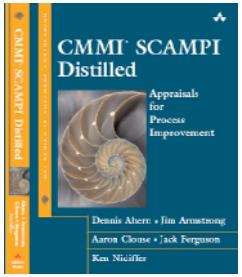
A Few Notes on Notes



- How much effort should be put into note taking?
  - The method is quite specific on the minimums, which are rather comprehensive by themselves
  - The requirement for ALL team members to take specific notes on ALL references within model scope generates a significant amount of data
  - Adding extensive notes on artifacts can overwhelm a team

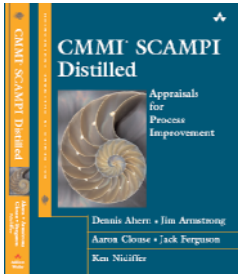
Entering a discussion on a finding and not being able to trace a significant proposed finding to the source is exasperating

Evaluating the Data



- Instance level
  - the team must decide if the direct artifact is appropriate

Agenda



Part I Why SCAMPI Now?

- Process Appraisal Strategies
- Other Quality Management Initiatives

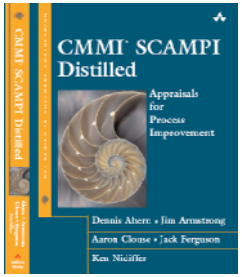
Part II SCAMPI Appraisals

- New aspects of SCAMPI method
- SCAMPI Class A method definition
- SCAMPI Class B and C Methods
- SCAMPI for internal process improvement
- SCAMPI for external evaluations

Part III Using SCAMPI

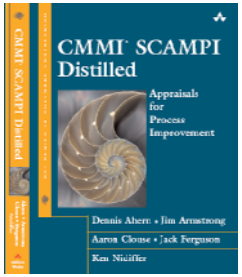
- Issues with appraisals and process improvement

SCAMPI for Internal Process Improvement



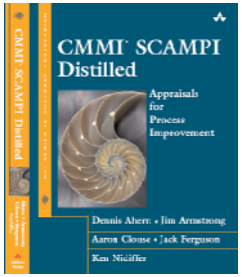
- Using CMMI as a reference model makes it possible to objectively and methodically analyze an organization's processes and identify its strengths and weaknesses
  - Helps the organization target its process improvement activities to maximize effectiveness
  - Enables an organization to track its process improvement progress and refine its process improvement plans

SCAMPI Goals



- SCAMPI was developed to meet the requirement that appraisals under CMMI would be more efficient than *combined* appraisals using the source models
  - CMMI software and systems engineering appraisal must be shorter and less costly than a software engineering appraisal using the SW-CMM *plus* a systems engineering appraisal using EIA 731

SCAMPI vs. CBA-IPI

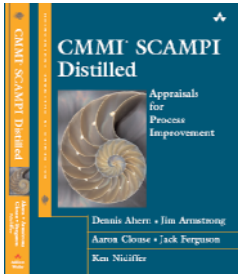


- When comparing the cost and performance of SCAMPI A and CBA-IPI using the same capability maturity model (SW-CMM), Ron Radice1 found that:
  - SCAMPI A is more focused on data management, verification and validation
  - Appraisal team management is basically the same
  - There is reduced variation in method performance for SCAMPI A
  - SCAMPI A is more costly, but the differences are small

1 Radice, Ron. SCAMPI with SW-CMM, delivered at Software Technology Conference, Salt Lake City, April 30, 2003

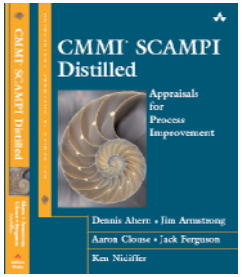
Level 5 Appraisal

(In Calendar Days)



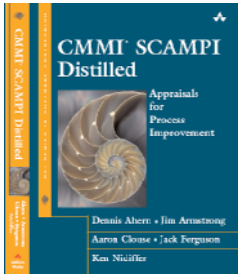
Organization Size	CBA-IPI		SCAMPI A	
	Document Review	Onsite	Document Review	Onsite
<50	1-2	<5	2	<5
50-100	1-2	5	2	5
100-250	2	5	2-3	5
>250	2-3	>5	3-4	>5

Preparation is Critical



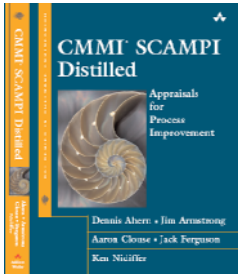
- Objectives of performing a SCAMPI appraisal for internal process improvement are:
  - To set the stage
  - Determine the state of process implementation
  - Help establish priorities for process improvement in an organization

Key Preparation Questions



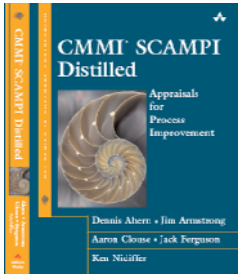
- Should we have an appraisal?
- Should we do it now or later?
- Should SE and SW be appraised together with separate results, or should their appraisals be integrated?
- Which appraisal class should be used?
- What should be included in each appraisal?

Preparation Considerations



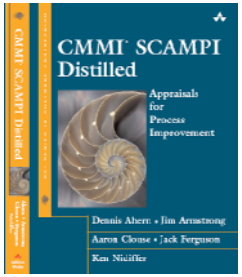
- **Organization scope**
- **Model Scope**
- **Size**
- **Disciplines**
- **Improvement Status**

Internal Appraisal Team



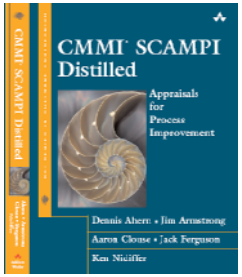
- **Successful appraisal teams require:**
  - **a plan, including objectives, constraints, scope, outputs, tailoring, resources, cost, schedule, logistics, risks, and commitment**
  - **clearly defined goals**
  - **clearly defined roles**
  - **established rules of engagement**
  - **well-defined decision procedures**
  - **understanding of the group process**
  - **clear communications**
  - **proper team behavior**
  - **balanced participation**
  - **training**

Team Composition



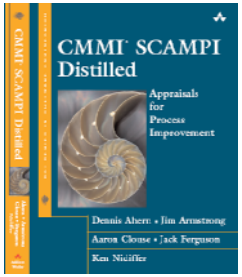
- Typically has 4 to 9 members - every discipline being assessed must be represented on the team with appropriate experience in that discipline
- The SCAMPI A Method Definition Document requires a team average of 6 years engineering experience with a team total of at least 25 years
- The team must have a total of 10 years of management experience, with at least one member having a minimum of 6 years of experience as a manager
- Team members should also have good oral and written communication skills, and, most importantly, have the ability to perform as team players and negotiate consensus

Team Personalities



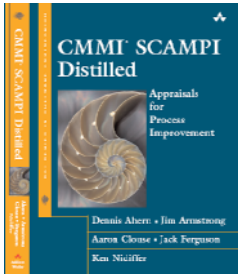
- Introverts need to try to participate more
- Extroverts need to try not to dominate
- Don't rush to closure and be unwilling to consider new information
- *However*, closure *must* be reached within the team's timeline
- The appraisal process is data driven
- *However*, don't get lost in the details

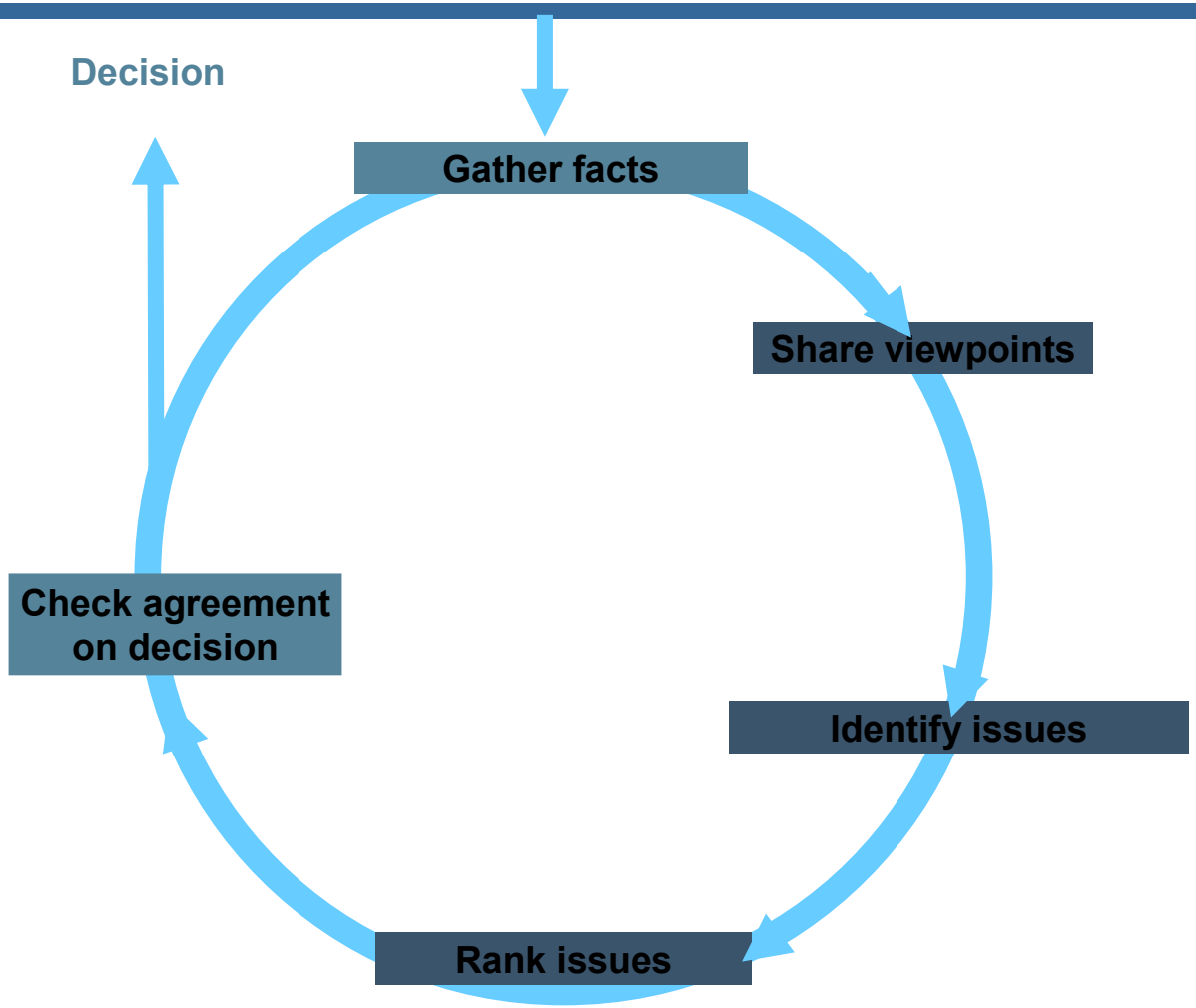
Consensus



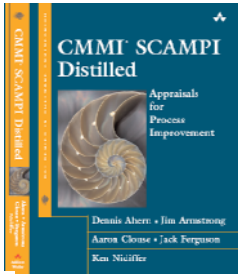
- Decision making on appraisal teams is done by consensus, not unanimous vote nor majority vote
- Consensus is finding a proposal acceptable enough that all team members can support it or live with it, and no team member opposes it
- The consensus process can require several cycles through the decision cycle as the team continues to gather and analyze factual information bearing on a decision
- If consensus cannot be obtained, a decision should not be forced, e.g., through majority vote - the item under consideration must be left not rated

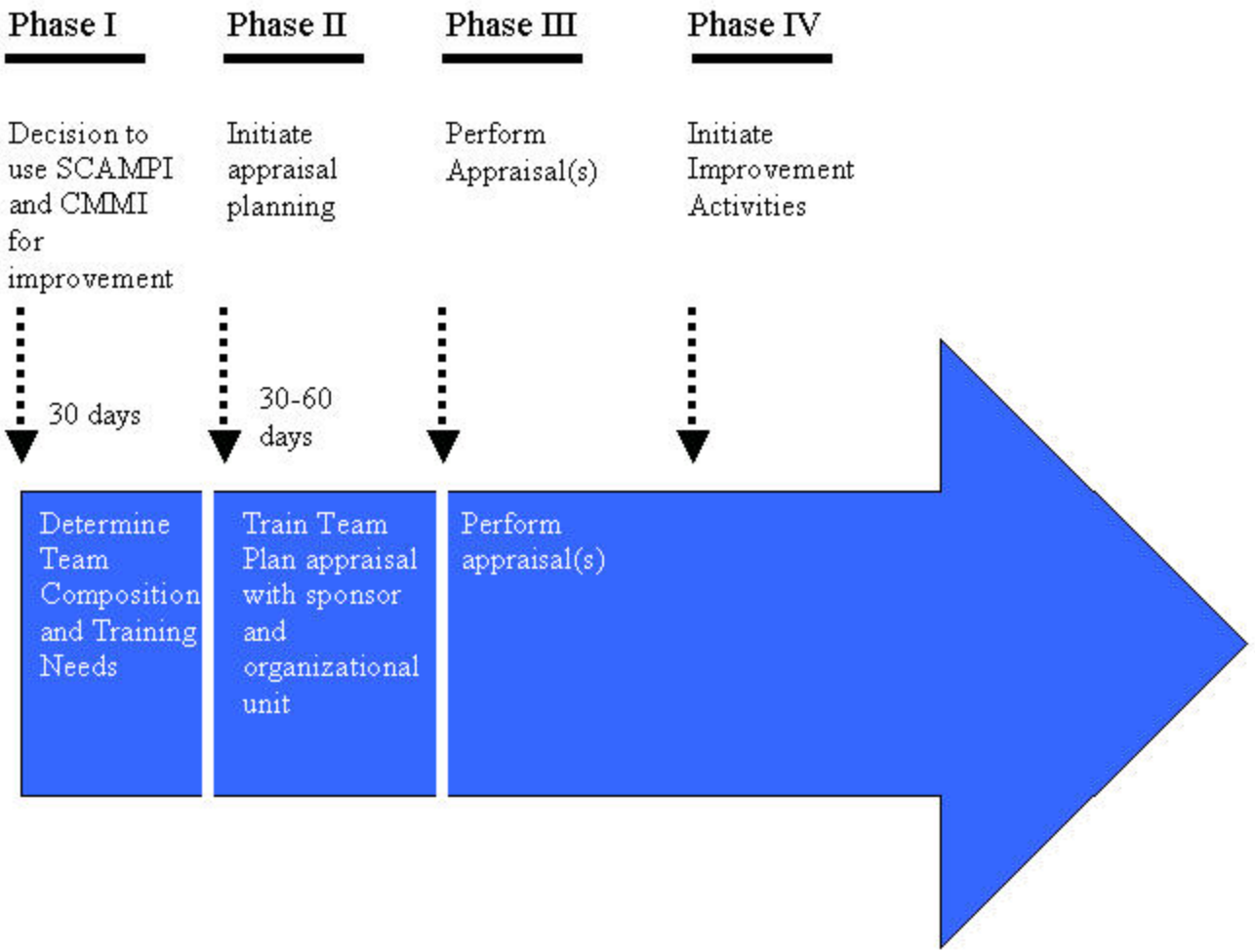
Achieving Consensus

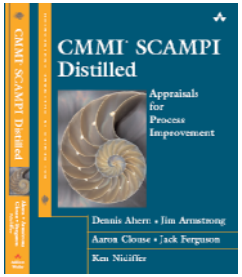




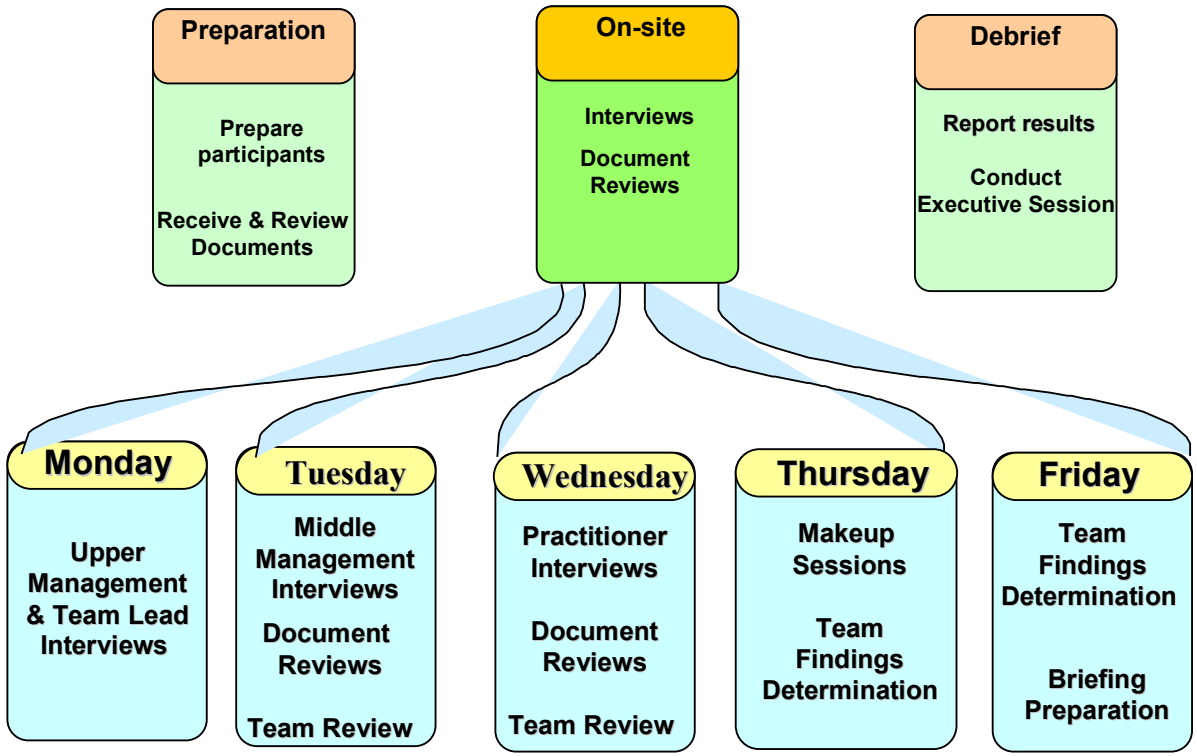
The Appraisal Team's Timeline







Example SCAMPI A Appraisal Schedule



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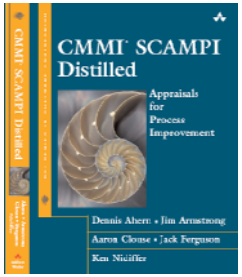
Agenda



Part I Why SCAMPI Now?

- Process Appraisal Strategies
- Other Quality Management Initiatives

Part II SCAMPI Appraisals

- New aspects of SCAMPI method
- SCAMPI Class A method definition
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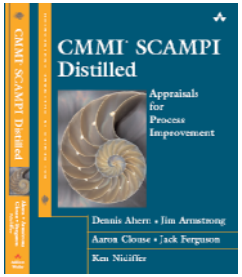
- SCAMPI for external evaluations

Part III Using SCAMPI

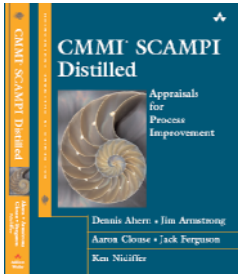
- Issues with appraisals and process improvement

SCAMPI for External Audits



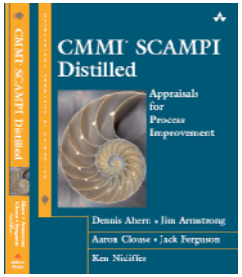
- The Federal Acquisition Regulations - FAR – define the laws for government acquisitions
- Appraisals help acquisition managers achieve the following:
  - Identify risks during supplier selection
  - Manage risk by motivating suppliers to follow and improve development processes
  - Monitor award fee incentives for suppliers who have structured process improvement programs

Appraisal Objectives



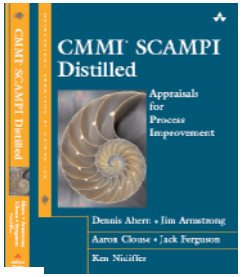
- External appraisals are performed for source selection and for contract performance monitoring
- Use of SCAMPI by acquirers typically has different objectives than for internal process improvement
  - The primary objective is to reduce the risk in the acquisition of systems

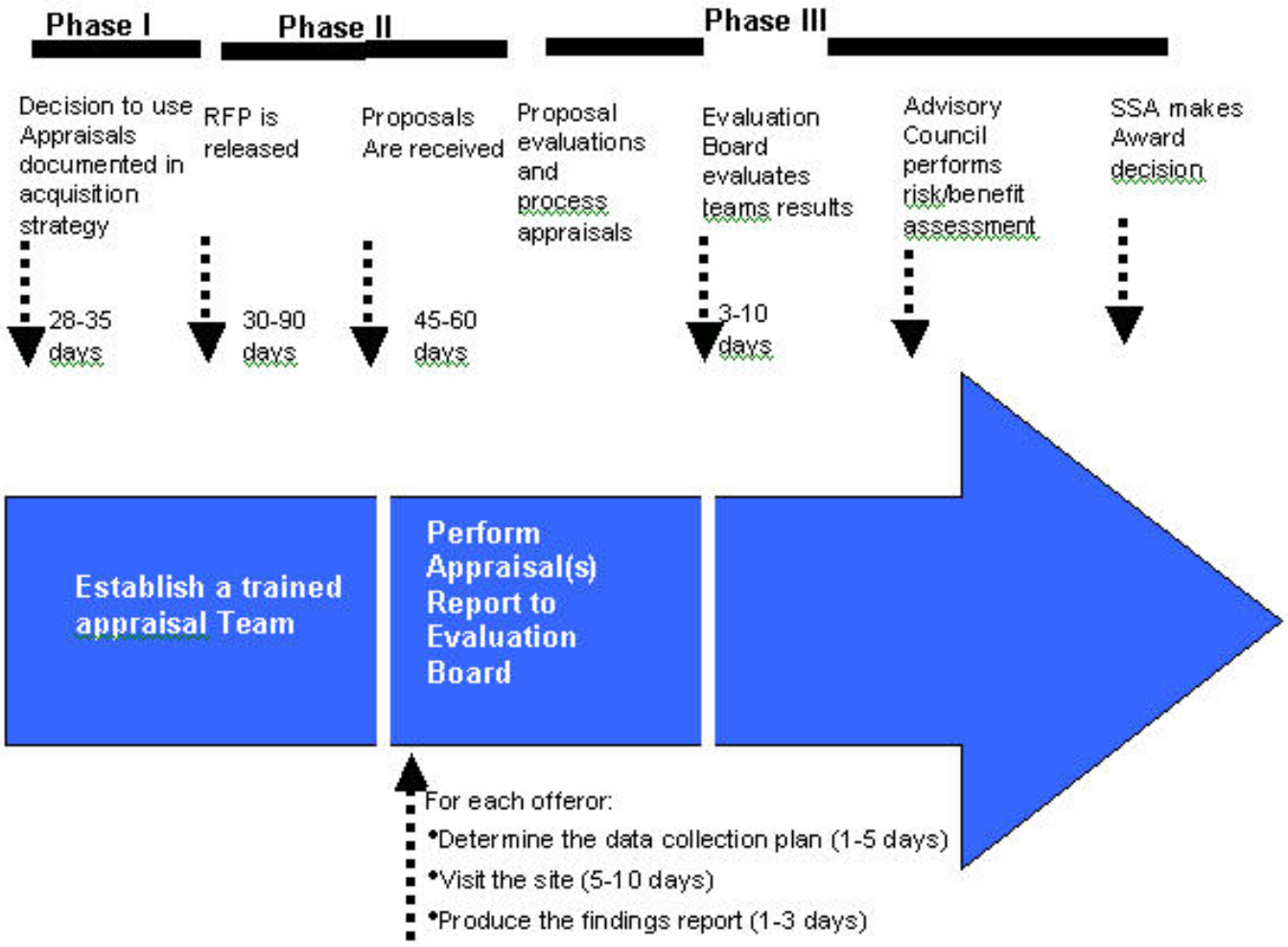
Requirements for External Appraisals



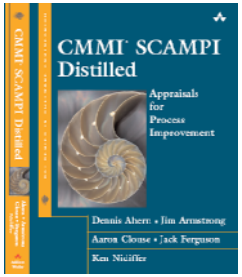
- The sponsor for an appraisal for source selection is normally the Source Selection Authority (SSA)
- The SCAMPI team is typically one of a number of teams involved in providing information to an Evaluation Board

Source Selection Timeline



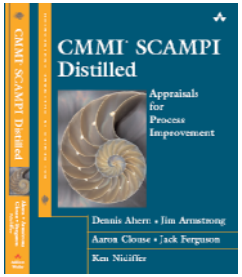


Preparation 1



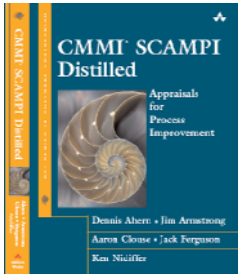
- Allow at least 4 to 5 weeks to determine the appraisal requirements
  - These requirements must be included in acquisition strategy documents, and the RFP
  - The *Federal Business Opportunity (FBO)/Commerce Business Daily (CBD)* announcement of the procurement must include notification of the intent to perform a SCAMPI appraisal

Preparation 2



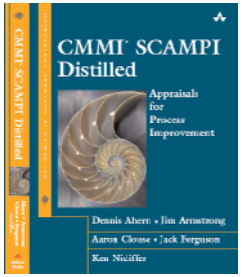
- The scope and form of the appraisal must be determined
- Specific objectives for the appraisal must be determined:
  - Determine discriminators between offerors to support source selection
  - Identify risks in process performance that might affect contract performance
  - Obtain contractual commitment to use mature processes
  - Satisfy policy or regulations applicable to the sponsoring acquisition organization
  - Address post-contract follow-on process improvement actions

Preparation 3



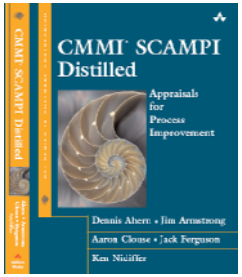
- Constraints on the appraisal have to be considered early during the planning phase, and may be revisited often during planning. These include:
  - Cost and schedule constraints – both for the sponsoring organization and the contractor organization(s)
  - discussion constraints – decisions must be made whether performing a SCAMPI appraisal will constitute discussions for the source selection
  - placement in the Evaluation Board structure – if the appraisal team is part of the board, there may be constraints on team membership, such as only government employees only
  - reporting constraints – what can be reported to the appraised organization for preliminary and final findings and when they can be presented must be determined during planning

The Appraisal Team



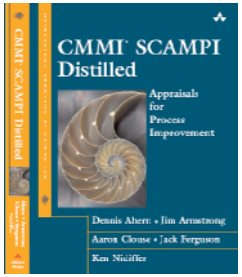
- There are a few team considerations for external appraisals different than for internal appraisals
  - Constraints
  - Relationship of the SCAMPI team and the Evaluation Board is another aspect of SCAMPI
- Common placements for the SCAMPI appraisal results:
  - As part of the Technical Evaluation
  - As part of the Management Evaluation
  - As part of the Past Performance Evaluation
- Use multiple appraisal teams or not

Issues For External Appraisals



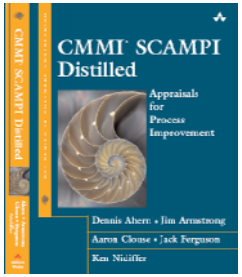
- **Source Selection**
- **Multiple contractors or single source**
- **Desired level of maturity**
- **Size of bidders**

Contract Process Monitoring



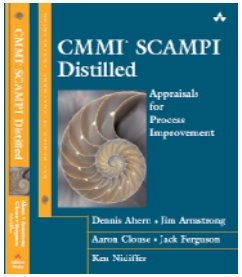
- SCAMPI appraisals can be used to:
  - Mitigate risks identified during source selection
  - Incentivize process improvement during the contract period
  - Track actual versus planned improvement activities
- The spectrum of use ranges from formal appraisals similar to those used in source selections, to the types of appraisals used during internal process improvement

Collaborative Appraisals



- Combine the best aspects of internal and external appraisals
- Government members are added as voting members to an internal appraisal team
- The team verifies the appraisal findings, which are sent to the SEI
- The SEI then, after verifying the team membership and appraisal method, records the results and the company can use the results in future external appraisals as more evidence of their maturity and capability

Agenda



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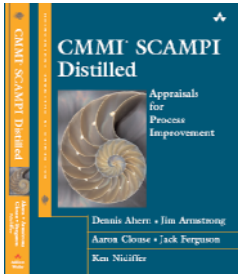
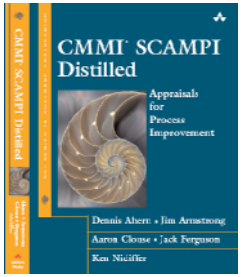
Important Considerations



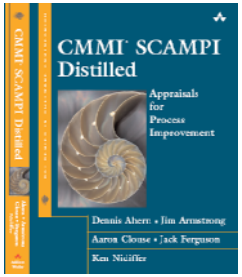
- SCAMPI is new
- SCAMPI method is model sensitive
- SCAMPI method is a diagnostic tool that supports, enables and encourages an organization's commitment to process improvement
- SCAMPI method is also the standard benchmarking tool for CMMI process area capability and maturity level profiles

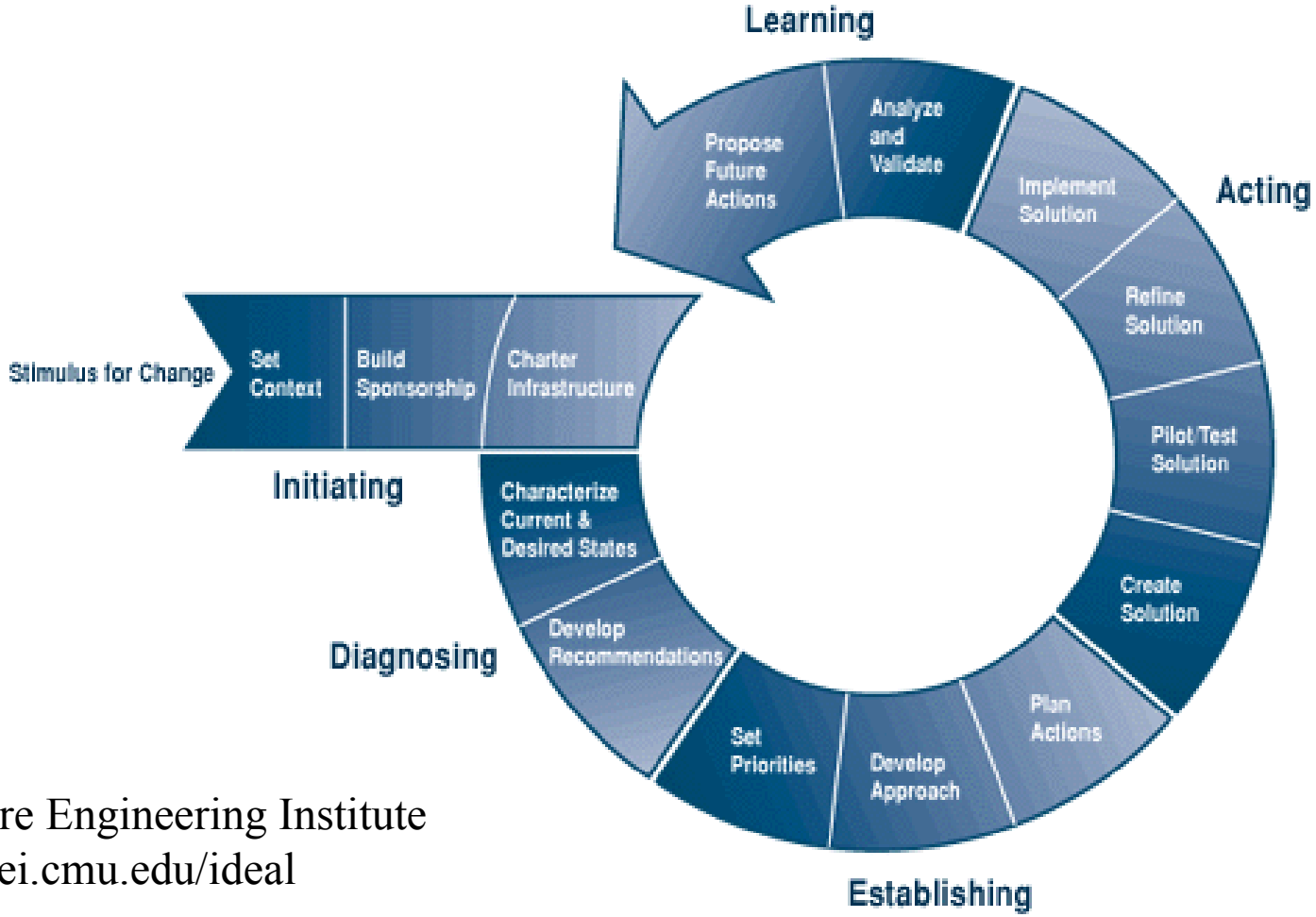
Deploying CMMI Compliant Processes



- The Process Management process areas in CMMI models the fundamental practices necessary to create and improve processes
- Several models for process improvement exist that satisfy the Process Management process areas
- IDEAL is one such model

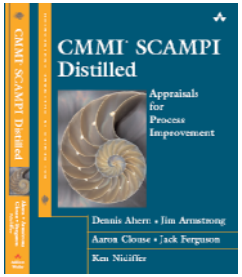
IDEAL Model





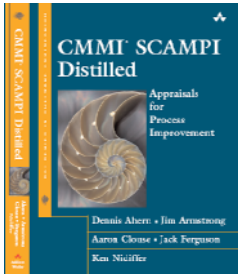
Software Engineering Institute
http://sei.cmu.edu/ideal

Using the Engineering PAs for Process Improvement



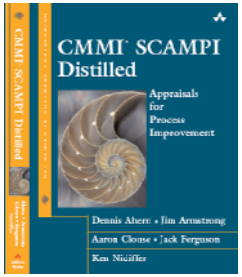
- "Products" include processes and services
- IDEAL comparison to Engineering Pas:
  - Initiating phase relates to Requirements Development (RD)
  - Diagnosing phase is closely related to the RD and Technical Solution (TS) goal 1
  - Establishing phase is closely related to TS goal 2
  - Acting phase relates to TS goal 3
  - Learning phase is related to Validation
  - All phases are related to Verification and Validation

Objective Evidence



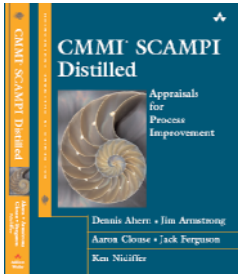
- Objective evidence is the single most critical aspect of an appraisal
- Three types of evidence:
  - Direct Evidence
  - Indirect Evidence
  - Affirmations
- Practice Implementation Indicator Descriptions (PIIDs)

Example PIID



Goal ID	REQM SG 1 Requirements are managed and inconsistencies with project plans and work products are identified.		
Practice ID	REQM SP 1.4-2 *Maintain bi-directional traceability among the requirements and the project plans and work products.*		
PII Type	Example Direct Artifacts	Example Indirect Artifacts	Affirmations
Example Evidence (Look Fors / Listen Fors)	[1. Requirements traceability matrix] • Reports or database indicating traceability of requirements to/from project plans and work products, at each applicable level of system decomposition.	[2. Requirements tracking system] • Criteria and completed checklists and minutes for review of requirements traceability. • Requirements tracking logs. • Revision and maintenance of requirements traceability across the lifecycle. • Listings of allocated requirements included in reviews of project plans and work products across the lifecycle. • Requirements mappings used to support impact assessments.	
Assessment Considerations	• Ensure that both vertical and horizontal traceability are included (e.g., across functions and/or interfaces) • (How do we assess traceability of requirements to "project plans"? This is probably more implicit than explicit, and applies to plans such as test plans, V&V plans, etc. See PP PA for project plans that might be affected. The assessment team must reach consensus on how this is to be assessed for the organization.) NO – How does the project go forward if the requirements are not driving the project tasks and activities?		
Organizational Implementation Evidence			
Appraisal Team Notes			

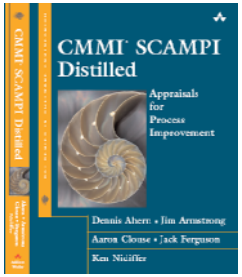
Practice Implementation Indicator Descriptions



- Each PIID lists the goal statement and the practice statement for reference
- They show the example direct, indirect, and affirmations for each practice
- These are starting places for the organization's PIIDs

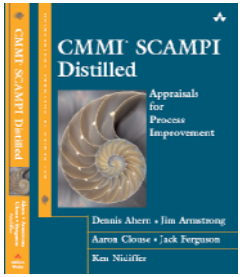
The organization should develop PIIDs based on their processes before starting the appraisal data collection

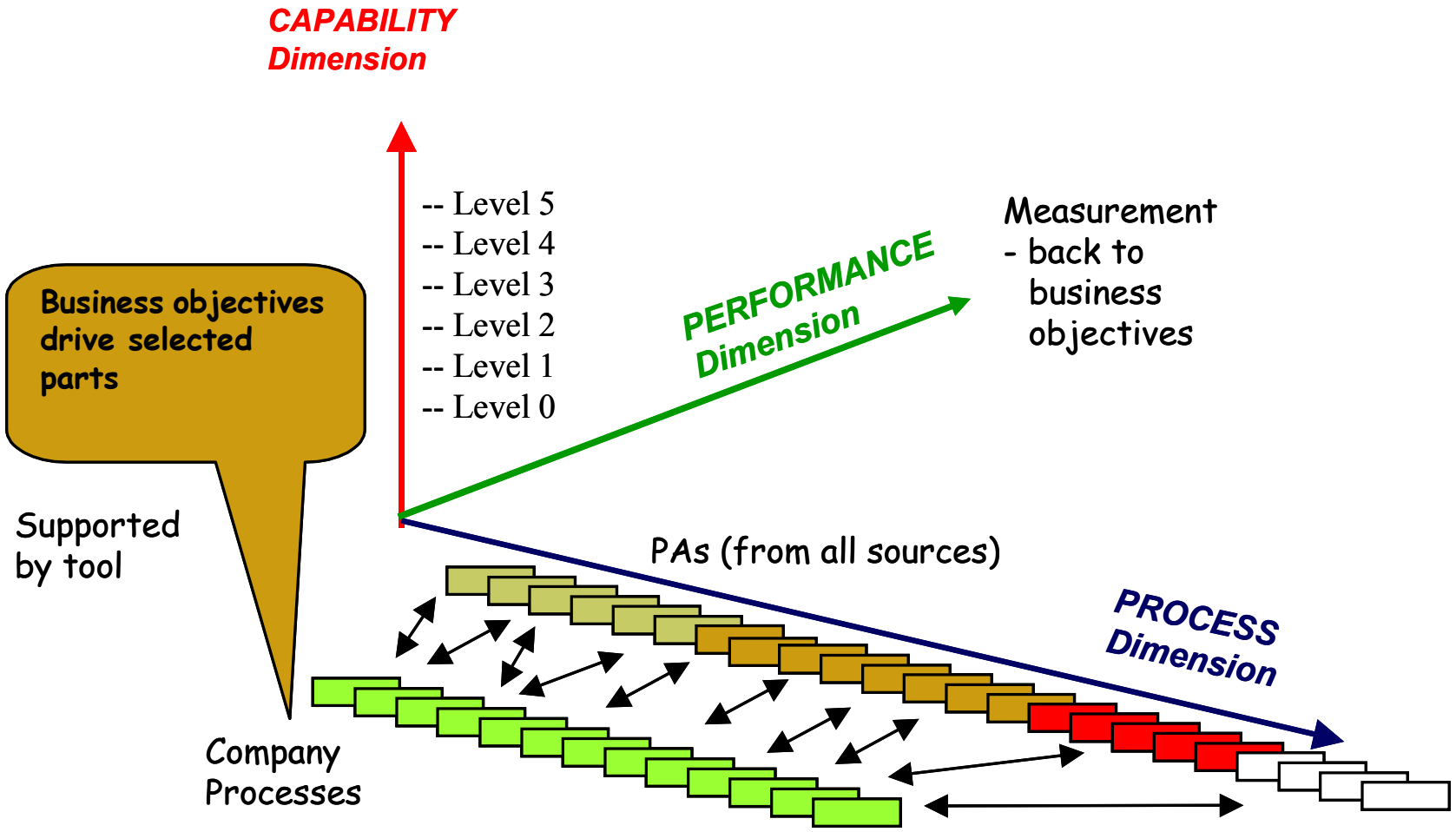
Appraisal Strategies Across Disciplines



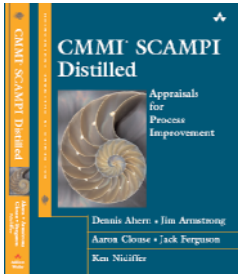
- Appraisal factors
  - Coverage is a measure of the extent of examination
    - Systems
    - Software
    - Integrated product development processes
  - Business objectives drive selected parts of the organization objectives to be selected

Context for Discipline Coverage



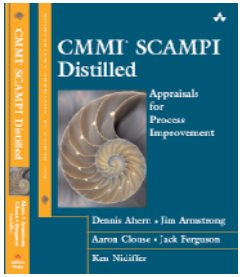


Coverage



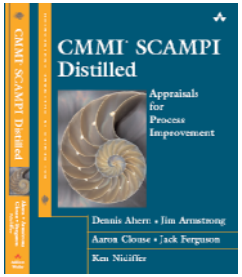
- A key to appropriate discipline coverage across dimensions of capability, process and measurement is an understanding of the business issues, process integration, and stakeholder involvement and expectations

Coverage Considerations



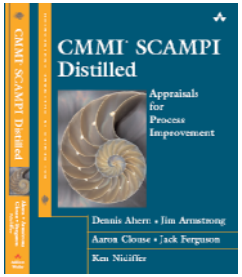
- The model probably will not exactly map to some of the organizational, engineering, and program business issues facing the firm in meeting its goals
- A major consideration is the stakeholder and associated work products
  - The issues are how to:
    - Select the appropriate stakeholders
    - Ensure appropriate work products are available to demonstrate the processes are being followed

Initial Process Improvement Efforts



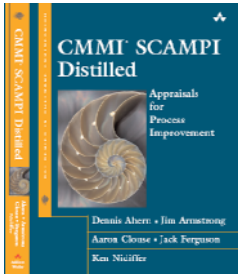
- Concerns and issues that are most commonly raised by organizations in the earlier stages of integrated process improvement
  - Complexity
  - Size
  - Applicability of Certain Process Areas and Practices

Overlaps in CMMI



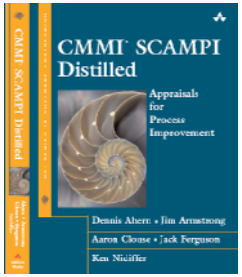
- Specific Practice and Generic Practice Overlap
- Base and Advanced practices
- Base and Advanced Process Areas
- Process Area Dependencies

Importance of Documentation



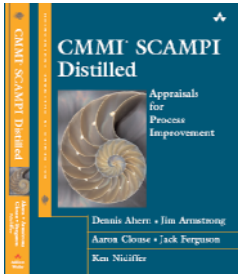
- CMMI makes greater documentation demands than do the source models
- It is important to recognize that such documentation is important to your organization, even without the threat of upcoming appraisals

Appraisal Sponsor Considerations

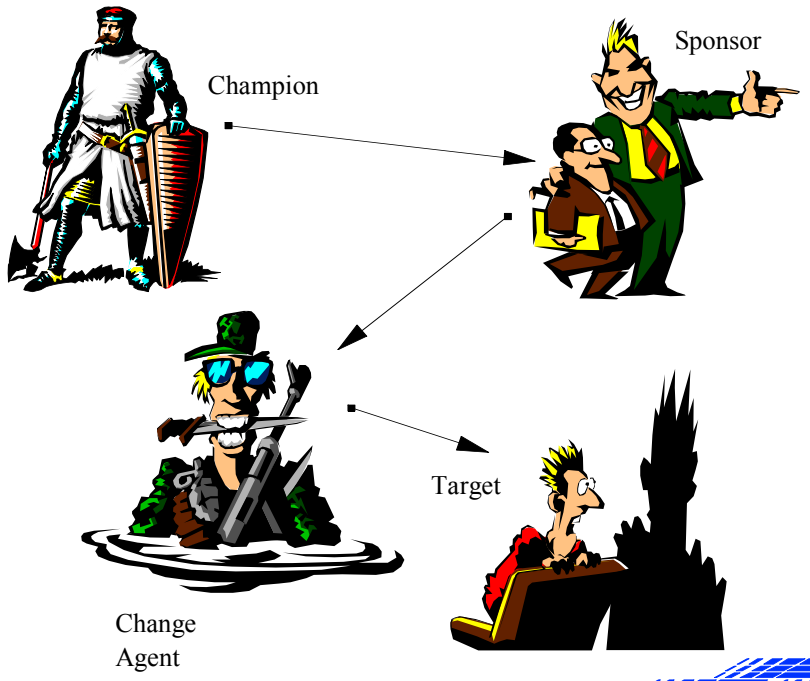


- There are different types of actors, so to speak, that are important to any systematic process improvement effort
  - The champion, often the CEO, COO or equivalent government representative
  - The sponsor, who is often the vice president of engineering or a significant division

One of the most important (and difficult) planning challenges is to establish realistic expectations with the appraisal sponsor



Key Roles in The Change Process



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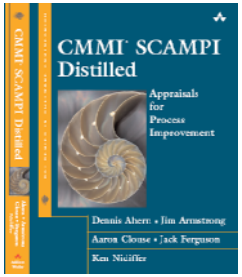
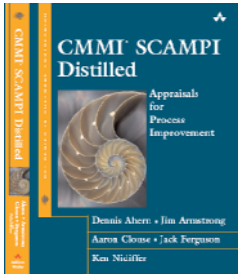
Few Role References



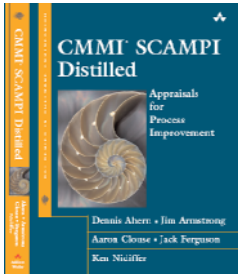
- Many of the practices in the CMMI do not explicitly state the role of the individual or group that is expected to perform the activity
- This allows maximum flexibility for assigning the responsibility for the activity
- The lack of role definition can also be an issue given that the activity may not get done

High Maturity Organizations



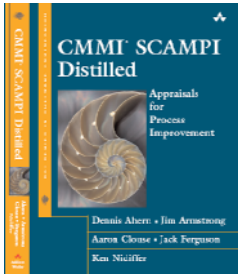
- For organizations at Level 3 and especially 4 and 5 maturity/capability, the business processes themselves are what should be rated, rather than the process areas of the model
- The rating process consists of two steps:
  - Verifying that the processes cover the base practices
  - Rating the maturity of the processes

ML 4 & 5 Unique Assessment Issues



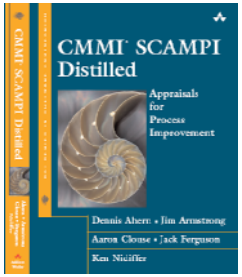
- High Level of Abstraction
- Need for Socialization
- The CMMI is not a process or standard
- Organizational processes may not align with CMMI process areas
- CMMI need not be implemented to the letter
- CMMI does apply to organizations that do not develop software or systems
- CMMI may not be the only quality framework model an organization will ever need
- In general, higher-level capability/maturity assessments cost more
- Organizational Structure of the Organizational Process Group

Tool Considerations



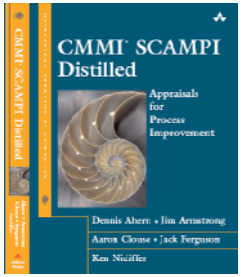
- Ability to hyperlink to all sources of documents
- Ability to add notes on practice instantiations by the programs
- Ability to add reviewer or verifier notes
- Ability to status instantiations
- Ability to capture appraiser mini-team comments
- Ability to capture appraisal team comments
- Ability to status each practice instantiation
- Ability to status each practice
- Ability to status each goal
- Ability to status each process area
- Ability to generate reports for multiple uses such as program, verifier, and appraisal team

Multi-organization Program Appraisals 1



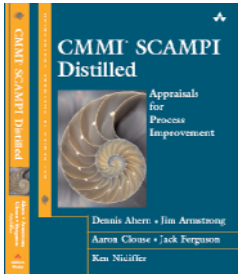
- Maturity models are based on the assumption that a single organization 'owns' the projects
- Programs that cost billions of dollars and involve several large corporations don't fit this model
  - Such a program starts at level 1, even if all the participants are at level 5
  - This is because there is no common process even at the program level
  - The lead organization must define an overall approach.
  - The other participants must then tailor their own standards to integrate into the program approach
  - The lead program should establish a program process infrastructure and organization

Multi-organization Program Appraisals 2



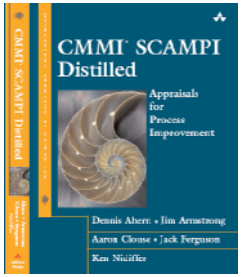
- The impact on a SCAMPI assessment is multifaceted
  - The appraisal team must understand that the usual meaning of organization, level, and tailoring, will not directly apply
  - The sheer size of the appraisal
- The challenge is to integrate the results to reach an overall conclusion

Summary 1



- The CMMI models are appraisal method independent
- The CMMI has three major appraisal documents
  - Appraisal Requirements for CMMI (ARC)
  - Standard CMMI Appraisal Method for Process Improvement (SCAMPISM) Method Definition Document
  - SCAMPI Version 1.1: Method Implementation Guidance for Government Source Selection and Contract Process Monitoring. Assessment
- There are three classes of appraisals
  - Class B & C
  - Class A (SCAMPI)

Summary 2



- Class B & C appraisals will be presented as a tutorial this afternoon
- SCAMPI appraisals are expensive to prepare for
  - Data collection is usually the most expensive part of the appraisal
- Appraisals provide valuable improvement information to the organization