Analysis of CMM®-Based Appraisal for Internal Process Improvement (CBA IPI) Assessment Feedback

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Michele Baker

November 2001

TECHNICAL REPORT
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Carnegie Mellon
Software Engineering Institute
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Software Engineering Process Management Program

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The ideas and findings in this report should not be construed as an official DoD position. It is published in the interest of scientific and technical information exchange.

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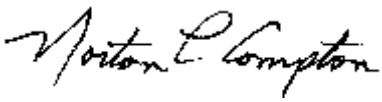

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Acknowledgements

Thanks to each of the Lead Assessors, sponsors, and assessment team members who provided this data. We hope that the information provides a useful tool for doing a better job of planning future CMM®-Based Appraisal for Internal Process Improvement (CBA IPI) assessments. The authors particularly want to thank Lauren Heinz of Technical Communications at the Software Engineering Institute (SEI), and Bill Peterson and Steve Masters of the Software Engineering Process Management Program, for their review and contributions to this report.

The Transition Partner Web Center: http://tpweb.sei.cmu.edu is under development. In the near future, participants will be able to complete feedback forms online.

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Executive Summary

As steward of the Capability Maturity Model® (CMM®) for Software (SW-CMM) and its related products, the Software Engineering Institute (SEI) collects information related to the use of the CMM and provides feedback to the user community. Information collected related to assessment findings and maturity level ratings are reported to the community in the Maturity Profile that is updated twice a year. The Maturity Profile provides a current status of the software community (reporting organizations' size and maturity levels), community trends (growth in number of assessments performed and shifts in the maturity profile over time), and organizational trends (analysis of key process area [KPA] satisfaction and time to move up in maturity). The Maturity Profile summarizes assessment data into industry aggregates and can be viewed on the SEI Web site: http://www.sei.cmu.edu/sema/profile.html. The August 2001 Maturity Profile represents data from 1,483 CMM-Based Appraisal for Internal Process Improvement (CBA IPI) assessments.

In addition to information that contributes to the Maturity Profile, data discussed in this report are collected to establish the usability and effectiveness of the CBA IPI assessment method in order to

- provide feedback to the community
- determine the user satisfaction (sponsors, assessment team members, and Lead Assessors) in the assessment method
- monitor the consistency of the use of the SEI's assessment materials

A high-level overview of the CBA IPI method is published in a technical report [Dunaway 96b] available from the SEI Web site. The report is intended for executives and managers who are evaluating or planning a CBA IPI assessment and need to know more about what the assessment entails. The report is also intended for potential assessment team members and organizational participants. Detailed guidance for conducting a CBA IPI is contained in the Lead Assessor's Guide V1.1 [Dunaway 96a] and is available to those persons who have been accepted into CBA Lead Assessor Training.

Panelists have presented their experiences using the CBA IPI assessment method at domestic and international conferences since 1996. Five of these panelists contributed to a technical report published in 1999 [Dunaway 99] available on the SEI Web site. The report focuses on the organizational perspective before, during, and after the assessment.

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To determine user satisfaction in the assessment method, feedback is collected at the conclusion of each assessment from assessment sponsors, assessment team members, and the assessment team leaders. Results from feedback were reported at the 1996 Software Engineering Process Group (SEPG) Conference [Dunaway 96c] and the 1998 SEPG Conference [Dunaway 98]. This current report contains the most recent information that has been collected from assessment participants and is a follow-up to an analysis published in April 2000 [Dunaway 00]. Details of questions and responses are in Appendices A, B, & C.

Assessment sponsors indicated the assessment findings were "very accurate" in reflecting the state of the software process in their organization. More than 85% rated the assessment team's performance to be "excellent." User satisfaction by those persons who requested and funded the assessment in their organizations is shown to be very good. Eighty-one percent of team leaders agreed with the sponsors that the assessment findings were "very accurate." Ninety-two percent of team leaders rated the assessment team's performance either "excellent" or "good." Team leaders and team members reported the most difficult aspects of the assessment were "maintaining a realistic schedule for the on-site period" and "consolidation of data."

To monitor the consistency of the use of the SEI's assessment materials, the Lead Assessor's Requirements Checklist is used. The form is intended to serve as a quality control instrument as well as to assist the Lead Assessor in keeping track of the implementation of each of the method's requirements. Results from this checklist provide metrics to the community for more effective planning for future assessments. Dunaway first reported these results [Dunaway 00]. This report contains the most recent information that has been collected from the Lead Assessor Requirements Checklists.

Sponsor participation in the Opening Meeting and Final Findings Briefing is shown to be very strong. The business goals of the assessment are being identified and articulated. Two-thirds of the assessed organizations have 200 or fewer people within the assessment scope, that is, those people with technical and managerial responsibilities for software development.

The Lead Assessor's Requirements Checklist has been reported to be useful for ensuring that a Lead Assessor follows the requirements of the method and that no activity is omitted or forgotten. The results from the data returned indicate a reliable adherence to the method requirements. The assessment team composition and training are being accomplished as required. Tailorability of the method regarding number and duration of interviews appears to be adequate while satisfying the minimum requirements.

Approximately 33 percent of the assessment on-site activities were conducted in 5 days. Forty-nine percent were conducted in 6 to 10 days. The *median* numbers of hours that the assessment teams worked together (i.e., clock hours) for the assessment activities are

- Pre-On-Site Activities: 37 hours
- On-Site Activities: 62 hours, which includes a median of 20 hours for consolidation of data
- Total: 96 hours

The SEI continues to collect this type of feedback to monitor user satisfaction and consistency of use of SEI products and materials. Additional reports will follow as additional data are collected and analyzed.

Abstract

As steward of the Capability Maturity Model® (CMM®) for Software (SW-CMM) and its related products, the Software Engineering Institute (SEI) collects information related to the use of the CMM and provides feedback to the user community. Assessment data are reported in industry aggregates by the SEI in the Maturity Profile, which provides characteristics of organizations using the CMM as well as information on findings and maturity levels. The main purpose of this report is to update the analysis of feedback from users of the CMM-Based Appraisal for Internal Process Improvement (CBA IPI) method [Dunaway 00]. The assessments for which data are contained in this report were conducted between July 1998 and December 2000. The audience for this document is the community of managers, executives, and developers who are planning or contemplating having a CBA IPI assessment in their organizations, assessment team members, and Lead Assessors who are interested in learning about other assessors' experiences in order to improve their own planning and use of the CBA IPI method.

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1 Background

Using the Capability Maturity Model® for Software V1.1 (CMM®) as a reference model [Paulk 93a, Paulk 93b], the Software Engineering Institute (SEI) developed the CMM-Based Appraisal for Internal Process Improvement (CBA IPI) for assessing an organization's software process capability. CBA IPI V1.0 was released in 1995 and updated to CBA IPI V1.1 in 1996 [Dunaway 96b].

The SEI has published reports that show a relationship between CMM-based improvement and organizational performance. Reports indicate improvements in cycle time, defect density, and productivity. Benefit-to-cost ratios presented range from 4.0:1 to 8.8:1 [Herbsleb 94]. Results show that, in general, increased process maturity results in better product quality, ability to meet schedule commitments, and other indicators of organizational performance [Goldenson 95].

From the early stages of assessment usage, the SEI has collected feedback from users to determine how well assessments are working and how to improve the assessment method. The CBA IPI product suite includes feedback forms to collect data from assessment sponsors, team members, and team leaders. Results from the feedback were reported at the 1996 Software Engineering Process Group (SEPG) Conference [Dunaway 96c] and the 1998 SEPG Conference [Dunaway 98].

Questions have sometimes been asked about the consistency of the usage of the CBA IPI method. Some felt that Lead Assessors were interpreting the method and the SW-CMM v1.1 model in different ways; for example, some were using more rigor than others in the interpretation of the model as well as execution of the method. In an effort to gather data on the consistency of assessment usage and results, an additional feedback form was created: the Lead Assessor Requirements Checklist. This form is intended to provide value to the Lead Assessor in planning the assessment as well as reporting results to the SEI. The form focuses a Lead Assessor's attention to a detailed level of requirements that are needed for a CBA IPI assessment. Results from the use of the Lead Assessor Requirements Checklist were first reported in a technical report [Dunaway 00].

Each SEI-authorized Lead Assessor who conducts a CBA IPI is required to return certain artifacts to the SEI at the conclusion of each assessment. These artifacts reflect assessment data

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that will be incorporated into the SEI Maturity Profile to provide the community with information on the state of the software community's maturity, and data that will assist in understanding how well the assessment method is working and provide a quality control mechanism to improve consistency of use.

Information collected related to assessment findings and maturity level ratings are reported to the community in the Maturity Profile. The Maturity Profile provides a current status of the software community (reporting organizations' size and maturity levels), community trends (growth in number of assessments performed and shifts in the maturity profile over time), and organizational trends (analysis of key process area [KPA] satisfaction and time to move up in maturity). The Maturity Profile, which is updated twice a year, summarizes assessment data into industry aggregates and can be viewed on the SEI Web site: http://www.sei.cmu.edu/sema/profile.html. The August 2001 Maturity Profile represents data from 1,483 CBA IPI assessments.

In addition to information that contributes to the Maturity Profile, data discussed in this report are collected to establish the usability and effectiveness of the CBA IPI assessment method to

- provide feedback to the community
- determine the user satisfaction (sponsors, assessment team members, and Lead Assessors) in the assessment method
- monitor the consistency of the use of the SEI's assessment materials

Data to help understand how well the assessment method is working are reflected in the following feedback forms:

- Sponsor Feedback Form; requested from the assessment sponsor
- Assessment Team Leader Feedback Form; required from the team leader
- Assessment Team Member Feedback Form; required from each team member
- Lead Assessor Requirements Checklist; required from each team leader to provide a quality control mechanism to ensure that each of the requirements of the method has been addressed

Data contained in this report are obtained from the following sources:

Type of Feedback Form	Number of Forms	Dates
Assessment Sponsor	72	Sept. 1999 – Oct 2000
Assessment Team Member	229	Dec. 1999 – Oct 2000
Assessment Team Leader	197	Nov. 1998 – Oct 2000
Requirements Checklist	260	July 1998 – Dec 2000

There were 780 CBA IPI assessment reports received by the SEI and incorporated into the Process Assessment Information System (PAIS) between July 1998 and December 2000. The Lead Assessor Requirements Checklist was a new requirement added in late 1998. Although the feedback forms are stated as a requirement to be returned within 30 days of the conclusion of each assessment, the return of these forms to date has been voluntary and not enforced as a firm requirement.

2 Assessment Feedback From Participants

Data from assessment sponsors, assessment team members, and assessment team leaders are reported in this document from CBA IPI assessments conducted from November 1998 to October 2000. Analysis of prior data resulted in the feedback forms to be updated [Dunaway 96c, Dunaway 98]. More questions were added to the forms for team members and team leaders in an attempt to identify the most troublesome areas of the assessment method. Data reported here are from the updated and expanded forms.

2.1 Sponsor Feedback Summary

The responses from assessment sponsors are detailed in Appendix A. Almost 78% of the respondents indicated that the assessment findings were "very accurate" in reflecting the state of the software process in their organization. More than 85% of respondents rated the assessment team's performance and the Lead Assessor's performance to be "excellent."

When asked how well the assessment findings provided guidance for planning follow-on process improvement activities, all of the responses were either "excellent" or "good." When asked how confident they are in being able to actively support the implementation of improvements based on the assessment findings, 82.6% said "very confident" and 17.4% said "some confidence."

2.2 Team Leader Feedback Summary

Responses from the assessment team leaders are detailed in Appendix B. Eighty-one percent of respondents indicated that the assessment findings were "very accurate" in reflecting the state of the software process in the organization. Nineteen percent indicated the findings were "mostly accurate."

Team leaders indicated that the interviewees were "always" forthcoming and honest in providing information to the assessment team in 65% of the responses. Thirty-four percent indicated the interviewees were "frequently" forthcoming and honest. Seventy-one percent of the respondents indicated the assessment team members were "always" objective in performing their responsibilities; 29% indicated "frequently" objective. Ninety-two percent rated the assessment team's performance as either "excellent" or "good."

Eighty-four percent indicated they were "very confident" that the organization would actively support the implementation of improvements based on the assessment findings.

The most difficult aspects of the assessment method were reported to be

- Maintaining a realistic schedule for the on-site period; 9.8% indicated "difficult" or "extremely difficult."
- Consolidation of data; 11.3% indicated "difficult" or "extremely difficult."
- Reviewing documents effectively; 7.9% indicated "difficult" or "extremely difficult."

Otherwise, the activities were reported to be "not difficult" or "challenging, but manageable."

2.3 Team Member Feedback Summary

Responses from assessment team members are detailed in Appendix C.

In prior feedback, team members expressed a need for greater understanding of the CMM. However, in Appendix C, the respondents report their CMM knowledge to be 44% "excellent," 37% "good." With 19% of respondents reporting their CMM knowledge is either "fair" or "poor," the team members are still expressing a need for greater understanding of the CMM. Although there has been anecdotal reporting of instances of inadequate team training provided for CBA IPI team members, responses indicate this is not a pervasive problem. Four percent of the assessments had no team training; 76% indicate the entire team was trained. Other responses show that abbreviated training was given in approximately 11% of the cases. When asked how well the team training prepared them to serve as an effective team member, replies were: 56% "excellent," 41% "good," and 3% "fair." For the most part, team members believe that team training prepares them to be effective team members.

Team members indicated that interviewees were "always" (69.6%) forthcoming and honest in providing information to the assessment team. However, 29.5% indicated that interviewees were "frequently" forthcoming and honest. This response could indicate that the team members suspect some gaming by the interviewees. When asked if the assessment team members were objective in performing their responsibilities, replies were: 80.9% "always" and 18.5% "frequently."

The most difficult aspects of the assessment method were reported to be

- Managing site logistics; 10% indicated "difficult" or "extremely difficult."
- Maintaining a realistic schedule for the on-site period; 12.9% indicated "difficult" or "extremely difficult."
- Consolidation of data; 12.8% indicated "difficult" or "extremely difficult."

- Preparing draft findings; 9.4% indicated “difficult” or “extremely difficult.”
- Reviewing documents effectively; 7.9% indicated “difficult” or “extremely difficult.”
- Abstracting from notes (low level of detail) to higher-level observations and findings; 8.7% indicated “difficult” or “extremely difficult.”

Otherwise, the activities listed in the table were reported to be “not difficult” or “challenging, but manageable.”

2.4 Prior Issues

In analyzing feedback from earlier reports, respondents requested further information about tailoring the assessment method for low maturity organizations and small organizations. Therefore, these issues were added to the team leader and team member feedback forms.

Responses from team members for difficulty in tailoring the method for small (fewer than 50 software developers) organizations were

- 22 responses: “not difficult”
- 13 responses: “challenging but manageable”
- 2 responses: “difficult”
- 1 response: “extremely difficult”
- 112 responses: “not applicable”

Responses from team leaders for difficulty in tailoring the method for small (fewer than 50 software developers) organizations were

- 35 responses: “not difficult”
- 28 responses: “challenging but manageable”
- 133 responses: “not applicable”

Seventy organizations out of the 246, or 28%, that responded to the question indicated the assessed organization consisted of 50 developers or fewer (which would explain the high number of “not applicable” responses).

Responses from team members for difficulty in tailoring the method for low maturity organizations (e.g., initial assessments) were

- 28 responses: “not difficult”
- 18 responses: “challenging but manageable”
- 3 responses: “difficult”
- 1 response: “extremely difficult”

- 100 responses: “not applicable”

Responses from team leaders for difficulty in tailoring the method for low maturity organizations (e.g., initial assessments) were

- 41 responses: “not difficult”
- 20 responses: “challenging but manageable”
- 1 response: “difficult”
- 134 responses: “not applicable”

Since a very small number of responses indicated that tailoring was “difficult” or “extremely difficult,” it appears that the method can be satisfactorily tailored for small organizations or for initial assessments.

2.5 Summary from Assessment Participants

When asked if the assessment findings accurately reflect the state of the software process in the assessed organization, sponsors indicated: 77.9% “very accurate,” 20.6% “mostly accurate;” assessment team leaders indicated: 81% “very accurate,” 19% “mostly accurate.” When asked if, in general, the CBA IPI method was well performed for the organization, assessment team members indicated: 71.4% “strongly agree,” 27.6% “agree,” 1% “disagree” or “strongly disagree.”

Over the past few years, we have seen improved assessment performance. There is a definite learning curve associated with being an assessment team leader or an assessment team member. Sponsors and their organizations are more familiar with the SW-CMM V1.1 and assessments, so their knowledge is greater and their expectations are more realistic.

One of the most effective improvements that Lead Assessors have accomplished is to refine the automated tools that they use during data collection and consolidation. Many have reported using Excel spreadsheets, Microsoft Word tables, and some commercially available tools. Automation is a great benefit in managing data collection. LCD projectors are an effective tool in displaying a team’s progress in building observations and findings.

3 Lead Assessor Requirements Checklist: Planning the Assessment

This part of the document is organized based on the format of the Lead Assessor Requirements Checklist. The major sections in the checklist correspond to the phases of the CBA IPI method:

- Planning the assessment
- Conducting the assessment
- Reporting results
- Additional questions

The CBA IPI requirement indicated in the checklist is shown, along with a question as to how this requirement was implemented. Responses for each requirement are summarized.

The first requirement for a CBA IPI is that an authorized SEI Lead Assessor must lead the assessment team. The Lead Assessor returns a Lead Assessor Requirements Checklist along with the other feedback forms to ensure that the minimum requirements for a CBA IPI are met.

3.1 Assessment Materials

Lead Assessors are required to use the most current SEI materials when conducting the CBA IPI method. The material may be obtained by the Lead Assessor in a single assessment kit to be used for one assessment, or, alternatively, in a quantity kit. A Lead Assessor in an organization that has multiple Lead Assessors may purchase a quantity kit. Each Lead Assessor within the organization may use the quantity kit as many times as needed within a 12-month period from the time of purchase.

CBA IPI Requirement	How This Assessment Was Implemented
Material for each assessment must be purchased from the SEI.	Material for this assessment was obtained via: • Single kit • Quantity kit

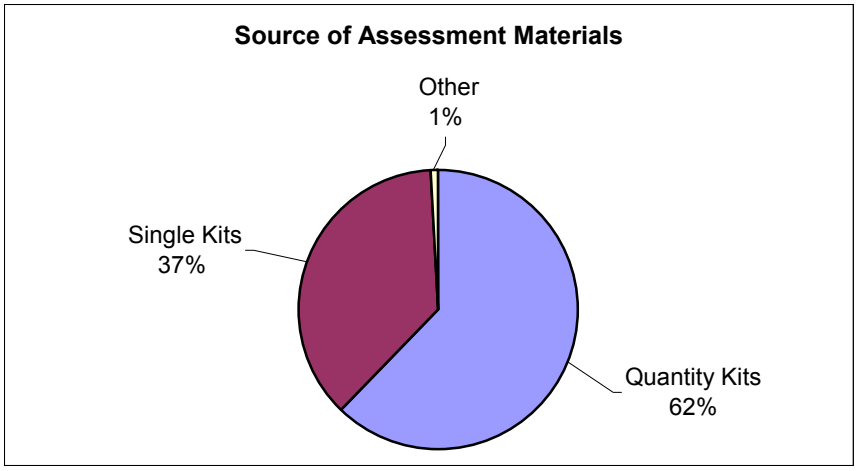


Figure 1: Source of Assessment Materials

Out of the 256 responses to this question, 159 indicated that a quantity kit was used, while 95 indicated that a single kit was purchased. Two entries indicated assessment materials were obtained through other contract mechanisms with the SEI.

3.2 Team Composition

The CBA IPI method uses a team of qualified persons to conduct an assessment. A team approach is used rather than using one or two individuals. It has been observed historically that a team of people can more effectively achieve the support, confidence, and buy-in within the assessed organization for the assessment results. Team members must sign a confidentiality agreement whereby each member guarantees that no information heard or seen during the assessment will be attributed to an individual or a particular project.

3.2.1 Team Size

The assessment team must have at least four members including the team leader.

CBA IPI Requirement	How This Assessment Was Implemented
The team shall have four to ten team members. At least one must be from the organization being assessed.	• Total number of team members • Number of team members from the assessed organization

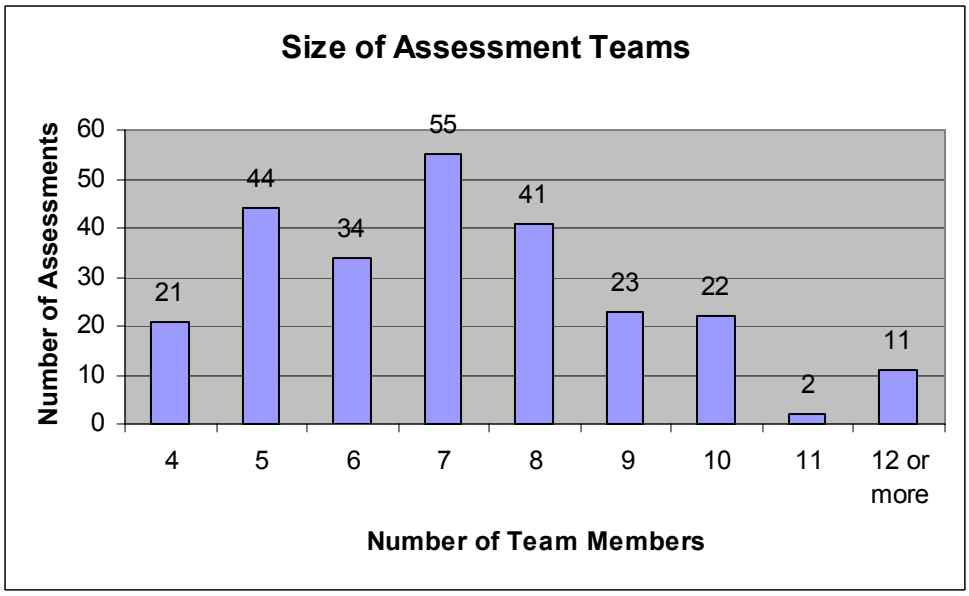


Figure 2: Size of Assessment Teams

The data indicate that the team size ranges from 4 to 16 members with 1 team having 16 team members. Out of 258 responses, 13 (~5%) did not correspond to the required team size of 4 to 10 members.

For assessments with fewer than the required number of four team members, the assessment is recognized in the PAIS database as an "Other Appraisal Method." The upper limit of ten team members is not considered to be as critical as the lower limit, although teams with more than ten members are more difficult to manage and bring to consensus than if they were limited to ten people.

At least one of the team members must be from the assessed organization; however, there are usually several team members selected from the organization. The organizational team members usually have the responsibility to effectively utilize the assessment results in the organization's follow-on activities in the process improvement program.

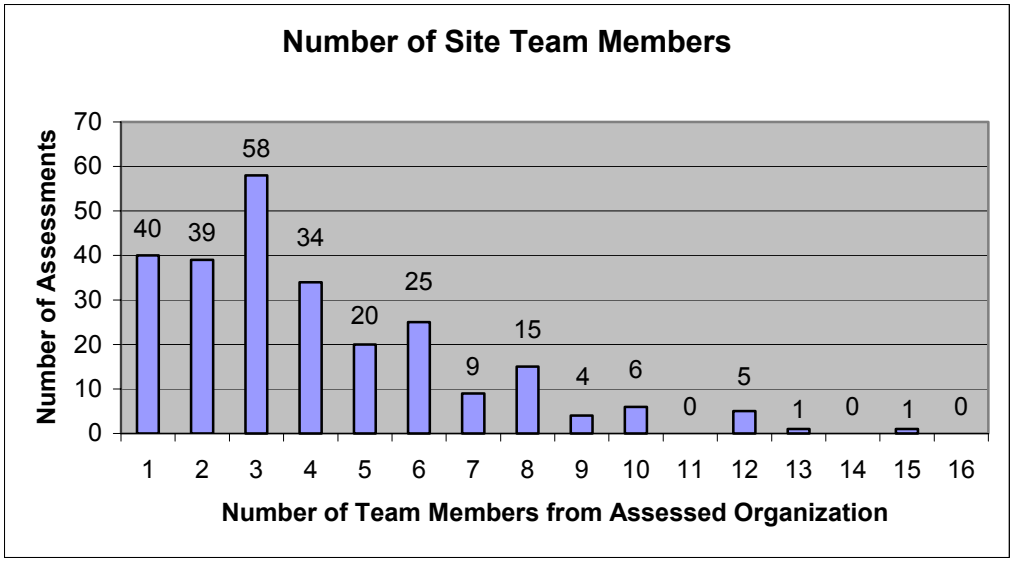


Figure 3: Number of Assessment Team Members from Assessed Organization

The teams did not appear to have difficulty in meeting the CBA IPI requirement to have at least one member of the team from the assessed organization. There are some teams comprised of all members from the assessed organization.

3.2.2 Team Member Selection Guidelines

The team members must satisfy criteria prescribed in the method to ensure that qualified, experienced people will serve on the team.

CBA IPI Requirement	How This Assessment Was Implemented
Team members must meet the selection guidelines. (Selection guidelines are listed in the Lead Assessor's Guide v1.1.)	Upon checking credentials of assessment team members, how would you rate the team's experience level against the recommended guidelines? Rate on a scale from 1 to 5: (1-do not meet guidelines; 5-exceed the guidelines)

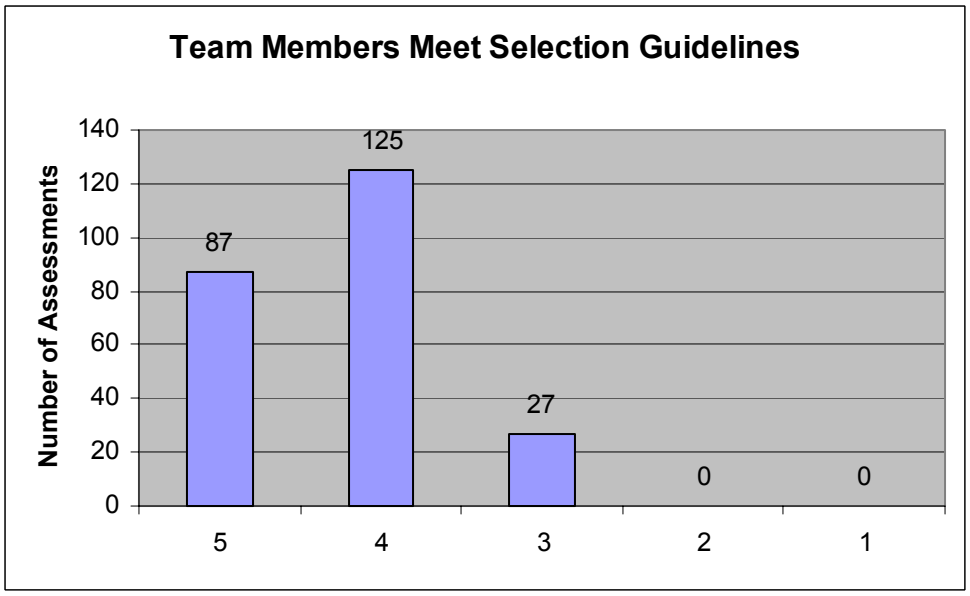


Figure 4: Rating of Team Members Based on Selection Guidelines

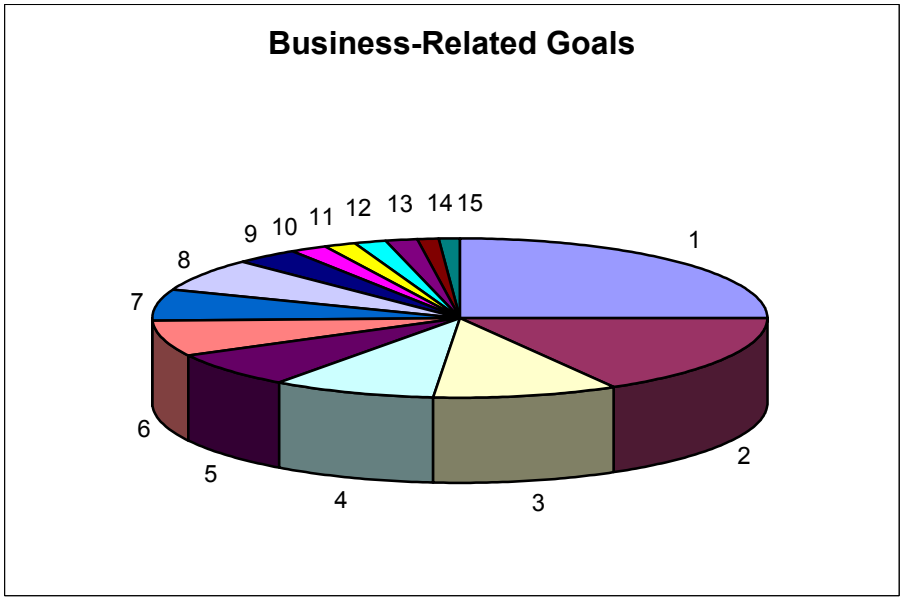
For this question, respondents are asked to rate on a scale from 1 to 5: (1—do not meet guidelines; 5—exceed the guidelines) as to whether the team members meet the selection guidelines. Most teams do not appear to have difficulty finding team members who meet the selection guidelines. About 36% of the responses indicate that the teams are comprised of members who exceed the guidelines (rating 5). No teams report that they have team members who do not meet the selection guidelines (rating 1 or 2).

3.3 Assessed Organization

3.3.1 Business Goals

Any process improvement initiative needs to be focused on the business goals of the organization in order to justify the amount of effort that is involved. When looking at the entire CMM, it is clear that business goals and measures established in the early maturity levels become even more important when quantitative management of development processes at maturity levels 4 and 5 is based on meeting the business goals.

CBA IPI Requirement	How This Assessment Was Implemented
The assessment is discussed with the sponsor to understand the business goals.	The business goals of the sponsor were determined to be: (please describe)

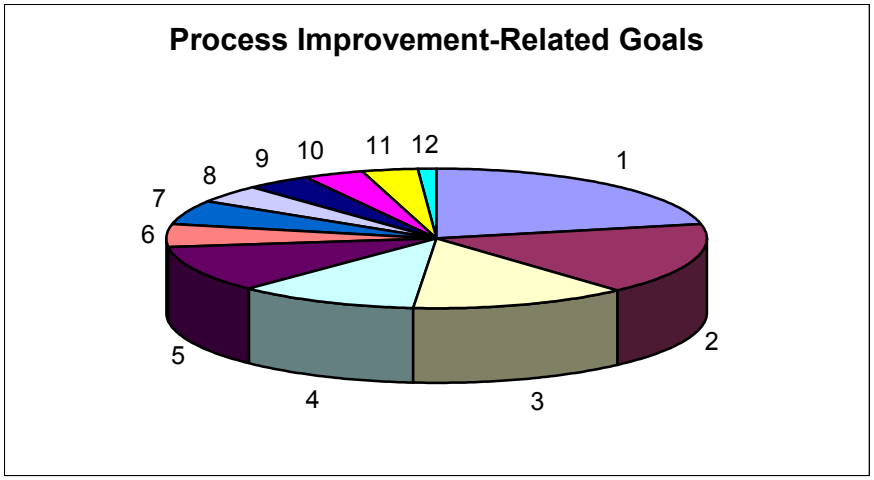


Business-Related Goals:	# Responses
1. Improve product quality and reliability	46
2. More efficient development processes; improve productivity, efficiency, effectiveness	30
3. Deliver on time; more predictable schedules	18
4. Improve time-to-market	16
5. Satisfy/meet customer quality needs and commitments	13
6. Reduce costs of developing software	13
7. Reduce costs of maintaining/support costs of software	12
8. Maintain/improve competitive position in market	12
9. Reduce defects	6
10. Improve risk management	4
11. Deliver on budget	3
12. Reduce cycle time	3
13. Improve quality of life in workplace	3
14. Improve subcontractor process	2
15. Reduce re-work	2
Total Responses	183

Figure 5: Business-Related Goals

Fifty percent of respondents indicated the first three of the above goals. Seventy-five percent of respondents indicated the first six goals.

About 50% of the responses to this question related to process improvement goals rather than the organization's business goals. Obviously, process improvement is expected to have a positive impact on the business, but it is encouraged that the business needs be explicitly stated so that process improvement does not appear to be an end unto itself.



Process Improvement-Related Goals:	# Responses
1. Validate/verify/achieve maturity level 2	40
2. Indicate areas of improvement to guide direction for future improvement	31
3. Determine/monitor progress/current state	24
4. Validate/verify/achieve maturity/capability level 3	20
5. Establish baseline for process improvement program	20
6. Acknowledge improvements achieved	10
7. Generate management and staff buy-in and support for process improvement	10
8. Establish best practices	8
9. Validate/verify/achieve maturity/capability level 4	7
10. Validate/verify/achieve the organization's maturity level	7
11. Satisfy corporate goals for process improvement	6
12. Validate/verify/achieve maturity/capability level 5	2
Total Responses	185

Figure 6: Process Improvement-Related Goals

Many organizations establish process improvement goals across the organization based on business needs and objectives. The business goals for establishing corporation-wide process improvement goals are communicated throughout the organization.

3.3.2 Organization Size

A very important aspect of an assessment is defining the scope of the organization to be assessed. For a large organization, the part of the organization that is undergoing process improvement under the auspices of a single senior manager is a likely candidate for an assessment due to management support and resources. Since an assessment is only one part of a process improvement initiative, the assessment results will impact the process improvement program and its progress. The sponsor of the assessment is usually the senior site manager who has the resources and authority not only to fund the assessment, but also to carry the process improvement program forward utilizing the assessment results.

CBA IPI Requirement	How This Assessment Was Implemented
The organization scope including selected projects and participants must be determined.	There are ____ persons in this organization with technical and managerial responsibilities for software development. The organization scope is determined to be:

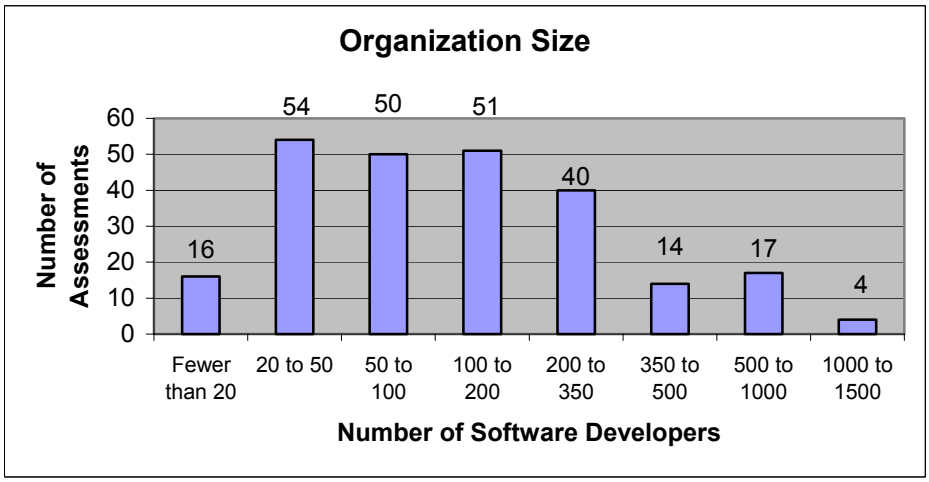


Figure 7: Organization Size

The number of persons in the assessed organization with technical and managerial responsibilities for software development range from a minimum of 5 people to a maximum of 1500 people in the 246 organizations who responded to this question. The above figure shows the number of organizations that fall into each range of organization size. One-third of the organizations have fewer than 100 people. Two-thirds of the assessed organizations have 200 or fewer people with technical and managerial responsibilities for software development. This is consistent with the August 2001 Maturity Profile that states: "Nearly half of the organizations reporting size have 100 or less software personnel."

3.3.3 CMM Scope

The second aspect of the assessment scope, beyond the organizational scope, is to identify the part of the SW-CMM V1.1 that is most relevant to the organization being assessed. If the sponsor is aiming for a maturity level, each KPA within a maturity level must be included in the scope, along with each maturity level below that level. If a maturity level is not desired, individual KPAs may be chosen for the assessment scope. The minimum CMM scope is one KPA. Although it is probably not a feasible business decision to have an organizational intervention as extensive as a CBA IPI for one KPA, it meets the minimum CBA IPI requirements.

CBA IPI Requirement	How This Assessment Was Implemented
The CMM scope (KPAs to be examined) must be determined.	The CMM scope (KPAs to be examined) is determined to be: Level 2: RM, SPP, SPTO, SSM, SQA, SCM Level 3: OPF, OPD, TP, ISM, SPE, IC, PR Level 4: QPM, SQM Level 5: DP, TCM, PCM

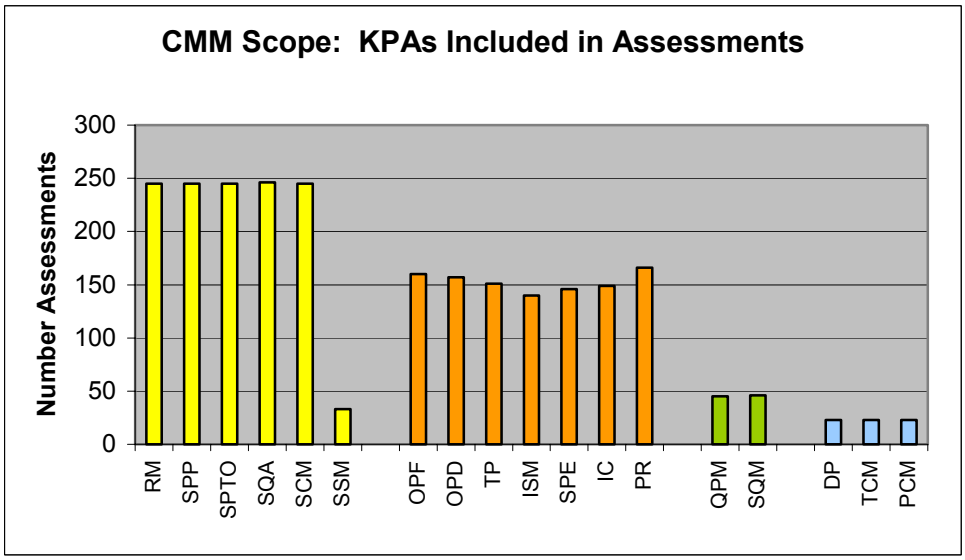


Figure 8: CMM Scope

Figure 8 indicates that Software Subcontract Management is the only KPA that is frequently designated as "not applicable" within maturity level 2. All other KPAs are investigated for maturity level 2 and 3 assessments. Approximately 19% of respondents indicated the addition of maturity level 4 KPAs, and 9% indicated the addition of maturity level 5 KPAs.

3.4 Training

The CBA IPI method requires that assessment team members receive training in the reference model, SW-CMM V1.1, prior to receiving the CBA IPI Team Training.

3.4.1 CMM Training

The SEI's Introduction to the CMM course is the preferred training method for assessment team members, although a Lead Assessor may substitute equivalent CMM training. A Lead Assessor who either offers his/her own CMM training course, or waives a team member's participation, must satisfy the Waiver Guidelines. It is at the Lead Assessor's discretion whether a team member should be excused from CMM training due to previous training.

Waivers should be used sparingly. It is important for the entire team to have consistent understanding of the CMM prior to an assessment.

CBA IPI Requirement	How This Assessment Was Implemented
All team members must receive the SEI's Intro to CMM course or equivalent.	Was the SEI's Intro to CMM course used in its entirety? ___ yes ___ no If not, what CMM course was used? (e.g., source, instructor, date) _____

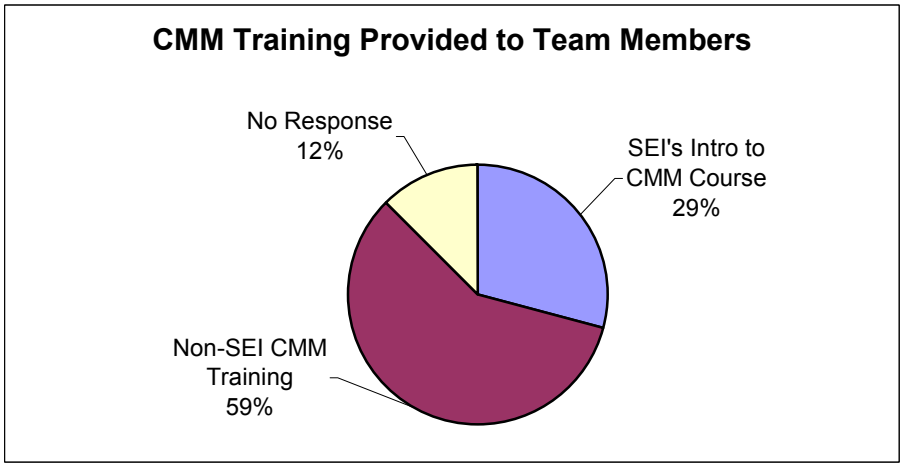


Figure 9: CMM Training Provided to Team Members

The chart above shows the distribution of teams that received the SEI's CMM training versus those who received equivalent training. For the teams with SEI training, the assessment team members attended the three-day licensed Introduction to the CMM, or an abbreviated two-day course using a CD that is provided by the SEI. For the teams with non-SEI training, the type of CMM training provided is typically a corporate course that was developed in-house. Otherwise, the training may come in the form of third-party courses, or from courses developed and taught by the Lead Assessor.

It is acknowledged that the quantity of training hours does not determine the quality of training, or the quality of students' understanding. If a reliable examination were available, a student's knowledge could be more accurately evaluated. However, no such accepted examination exists at this time. As the chart below indicates, there are wide variations of durations of CMM training courses provided. Where CMM training is indicated to be so brief that "equivalence" is questionable, the Lead Assessor is contacted. The assessment is subject to be classified as "Other Appraisal Method" if it does not meet the requirement of providing CMM training to the assessment team members.

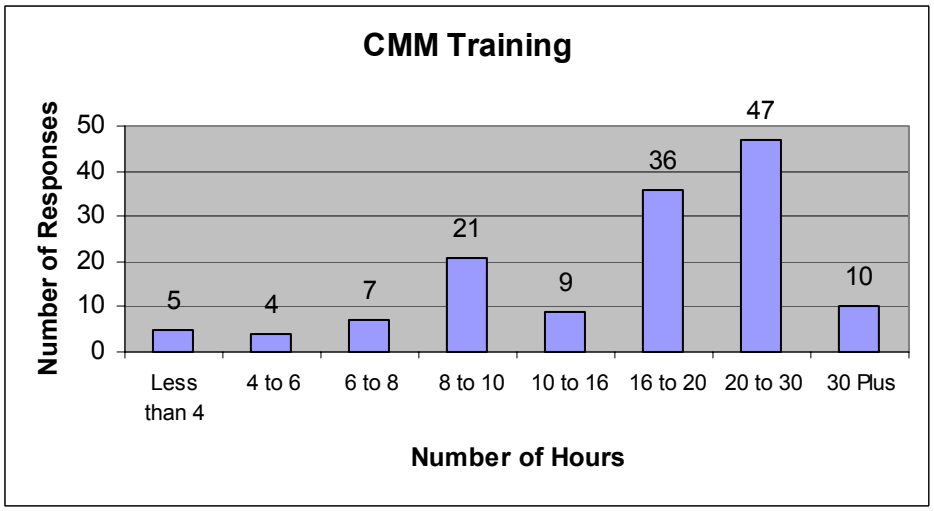


Figure 10: Duration of CMM Training for Team Members

CMM training that is fewer than 10 hours in duration will cause the Lead Assessor to be contacted for further information regarding the satisfaction of the Waiver Guidelines.

3.4.2 CBA IPI Team Training

The CBA IPI Team Training provided by the Lead Assessor is to be presented in a minimum of 2.5 days, or approximately 20 classroom hours. Lead Assessors are permitted to add their own material to enhance the course or expand the exercises beyond those provided.

CBA IPI Requirement	How This Assessment Was Implemented
All team members must receive the SEI's CBA IPI Team Training course.	Was the SEI's CBA IPI Team Training used in its entirety? ___ yes ___ no. If no, describe modifications: Dates and time (number of hours) allocated for Team Training: Planned: _____ Actual: _____ Did you supplement the Team Training with your own material? ___ yes ___no. If yes, what areas did you supplement? How many team members participated in CBA IPI Team Training? _____ If any team members were waived from team training, please indicate the Lead Assessor and the dates that this team member received prior CBA IPI Team Training: Team members waived (names, prior training, instructor & dates):

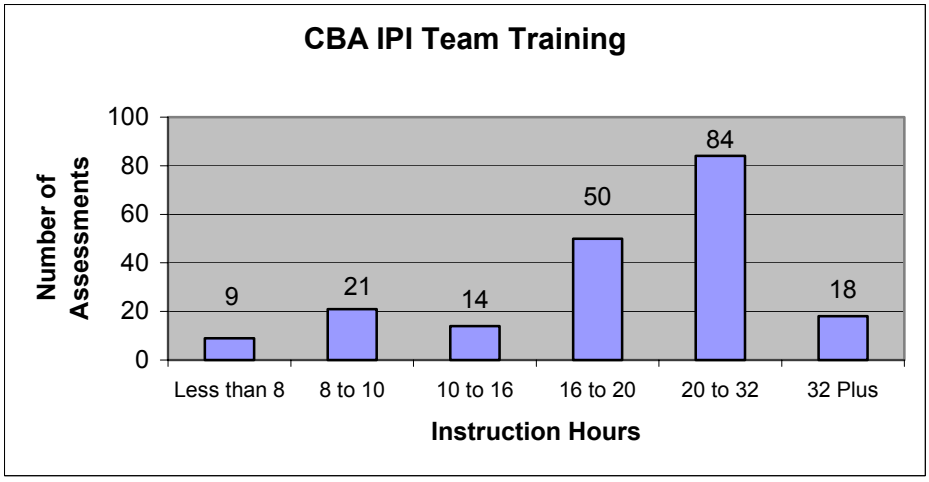


Figure 11: Instruction Time for CBA IPI Team Training

Lead Assessors are given discretion to waive a team member from all or part of Team Training if the team member has completed this training within the past few months. In addition to understanding the mechanics of the assessment method, Team Training provides an opportunity to establish rapport among the team members. This rapport must be accomplished some other way if an assessment team member is waived from Team Training.

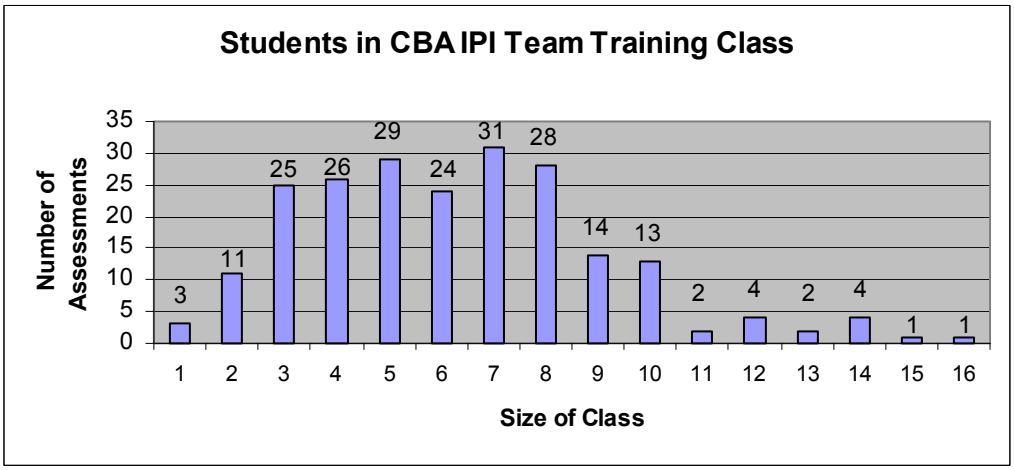


Figure 12: Students in CBA IPI Team Training Class

Some organizations train multiple assessment teams at the same time if they are preparing for multiple assessments in the same time frame. A pool of assessment team members may be prepared together if they will participate in an assessment within the next few months following training.

4 Lead Assessor Requirements Checklist: Conducting The Assessment

There are four data collection sources used in the CBA IPI method:

1. Instruments; maturity questionnaires, project and organization questionnaires
2. Documents; policies, procedures and work products
3. Interviews; individuals and groups
4. Presentations; draft findings presentations

4.1 Maturity Questionnaires

Maturity questionnaires are administered prior to the on-site period of the assessment. Responses to the maturity questionnaires provide guidance to the assessment team for the focus of interviews and document review. The maturity questionnaire is usually tailored to include questions related to the KPAs within the assessment's CMM scope. According to the CBA IPI requirement, maturity questionnaires must be administered to at least the project leaders from the projects being investigated in depth. A sponsor may choose to have the maturity questionnaire administered to additional people in the organization to enhance organizational participation and buy-in.

CBA IPI Requirement	How This Assessment Was Implemented
Administer maturity questionnaires for at least the project leaders from the selected projects.	How many questionnaires were administered?

The histogram below shows the range in the number of maturity questionnaires that were administered in the 260 organizations that responded to this question. For most assessments, 5 to 10 questionnaires are administered.

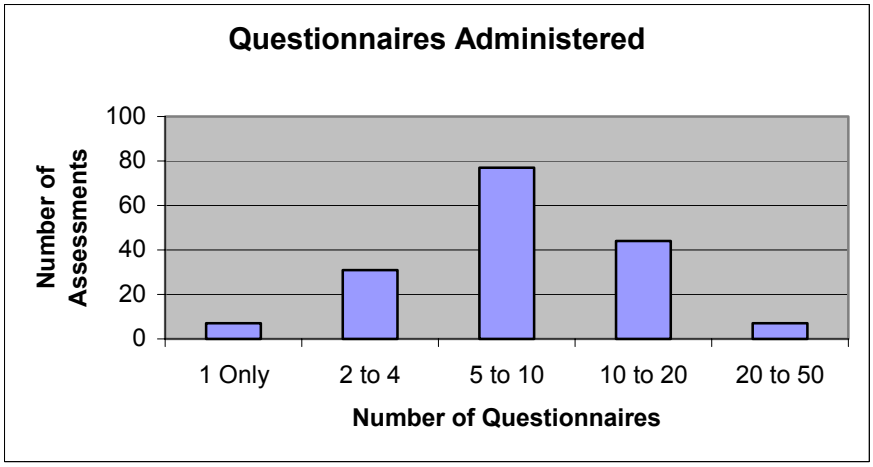


Figure 13: Number of Questionnaires Administered

4.2 Interviews

CBA IPI Requirement	How This Assessment Was Implemented
Conduct interviews: - project leaders (individual interviews) - middle managers (group interviews) - functional area representatives (group interviews)	Indicate number and duration of each type of interview: - project leaders: - middle managers: - functional area representatives: Total number of interviewees:

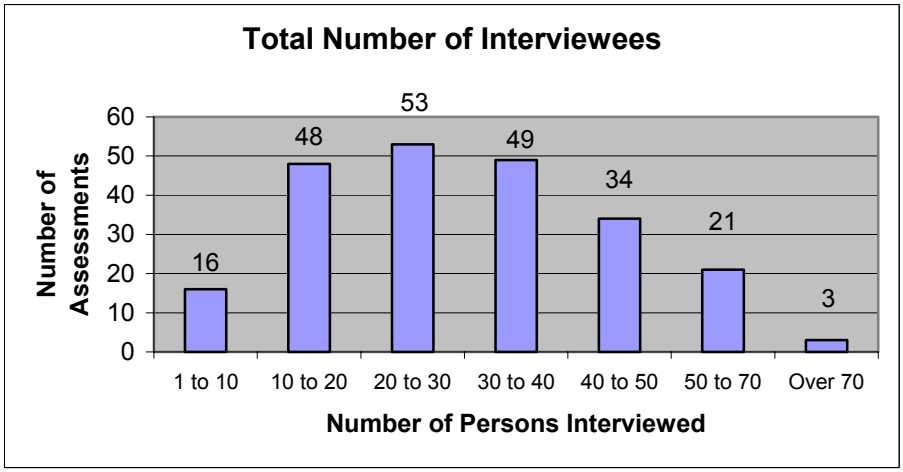


Figure 14: Total Number of Interviewees

4.2.1 Project Leader Interviews

The assessment team interviews project leaders individually to receive independent information on specific representative projects being investigated in depth. The recommended number of project leader interviews is four.

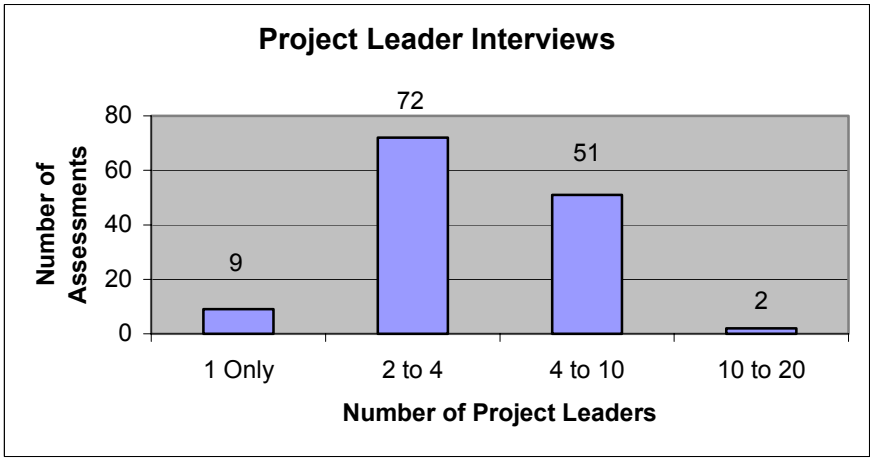


Figure 15: Number of Project Leader Interviews

It is recommended that a typical project leader interview be scheduled for 1.0 to 1.5 hours. In Figure 16 below, data indicating that project leader interviews were 2.5 hours or greater could represent a misunderstanding of the question and may represent the total time spent in project leader interviews.

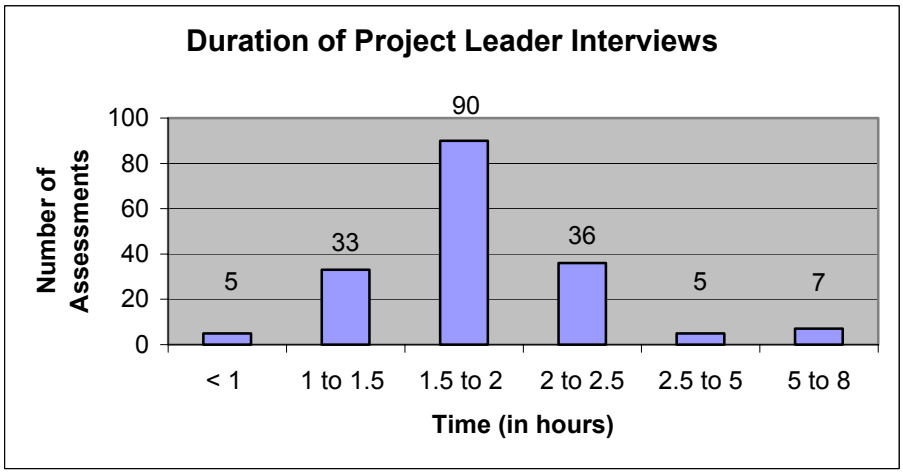


Figure 16: Duration of Project Leader Interviews

4.2.2 Middle Manager Interviews

Middle managers are interviewed as a group as long as there are no people in the interview with reporting authority to another member of the group.

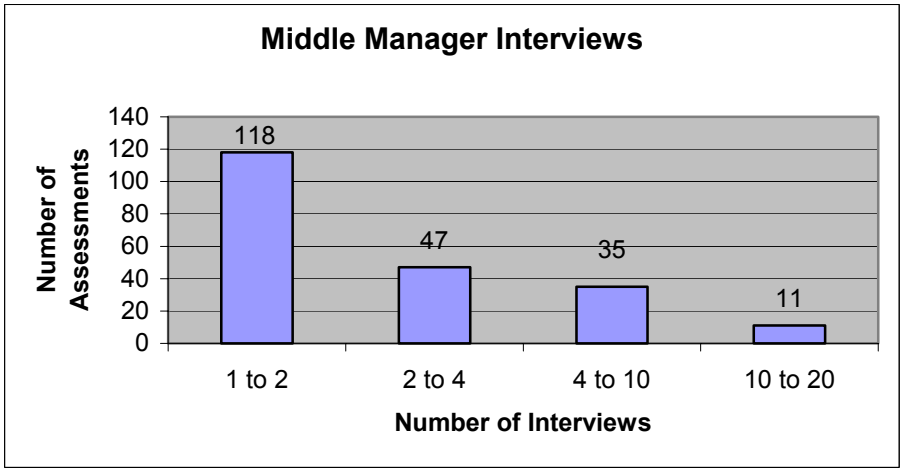


Figure 17: Number of Middle Manager Interviews

It is recommended that a middle manager interview be 1.0 to 2 hours in length. As shown in Figure 18 below, it is unlikely that a middle manager interview extends past two hours. For two hours or greater, the respondent may have given cumulative time for multiple interviews.

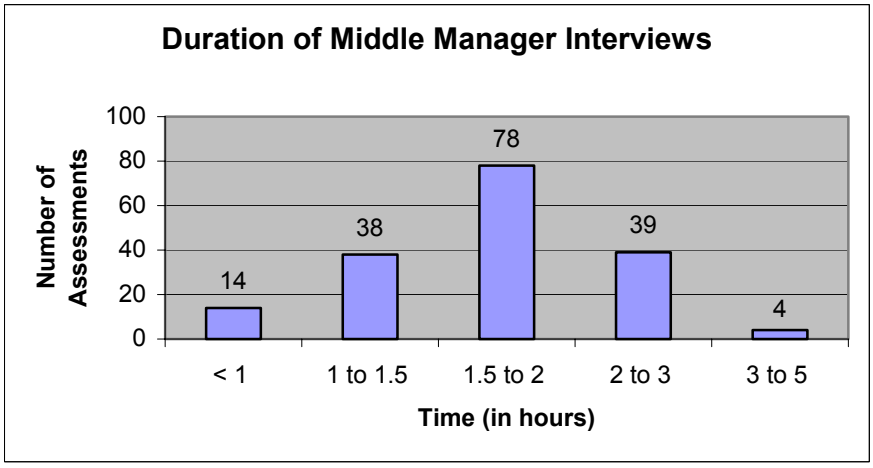


Figure 18: Duration of Middle Manager Interviews

4.2.3 Functional Area Representative Interviews

Functional area representatives (FARs), or software practitioners, are interviewed in a group of typically 6-10 persons whose job responsibilities have some relationship to each other. No one with reporting authority to any other member of the group is permitted in the same interview.

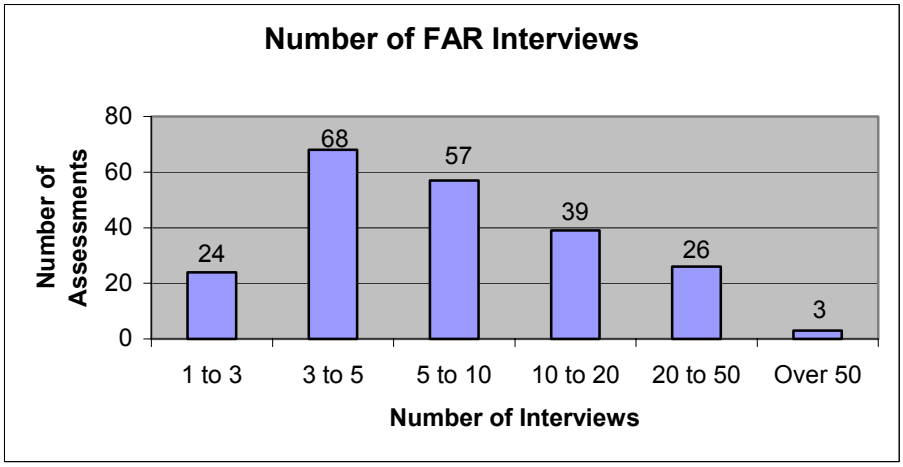


Figure 19: Number of FAR Interviews

As shown in the figure below, FAR group interviews are typically 1.5 to 2 hours in duration.

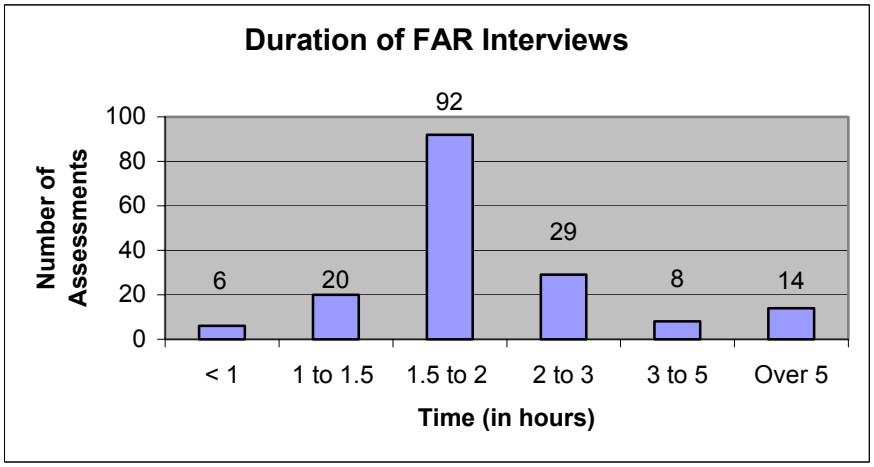


Figure 20: Duration of FAR Interviews

4.3 Documents Reviewed

CBA IPI Requirement	How This Assessment Was Implemented
Conduct document review at a minimum for each KPA goal within the assessment scope.	Approx. how many documents have been reviewed?
Documentation must be examined at least for each goal for each KPA within the assessment.	Documentation was examined for: • each key practice • each goal

The first question is intended to get an indication of the amount of documentation that was reviewed during the assessment. This is a difficult measure to evaluate since there are many

ways to count documents. However, in spite of the wide variation, it is clear that document review is a major source of data for the CBA IPI method.

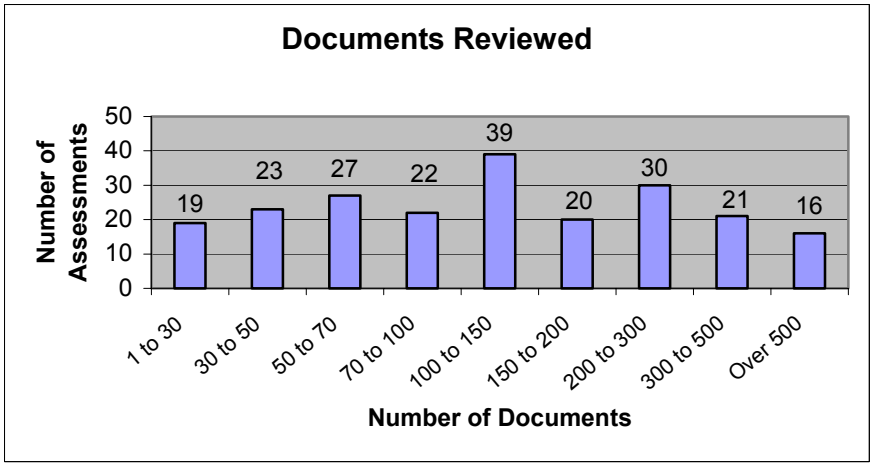


Figure 21: Number of Documents Reviewed

The second question related to documentation is to determine if sufficient documentation was examined to satisfy the minimum requirement of having at least one document for each goal. Ninety-one percent of respondents indicated that documents were reviewed for each key practice. Nine percent indicated that documents were reviewed for each goal and "most key practices."

4.4 Level of Data Collection

CBA IPI Requirement	How This Assessment Was Implemented
Collect data for each key practice for each KPA within the assessment scope.	___ Data was collected only at the goal level. ___ Data was collected for each key practice. ___ Data was collected for each subpractice.

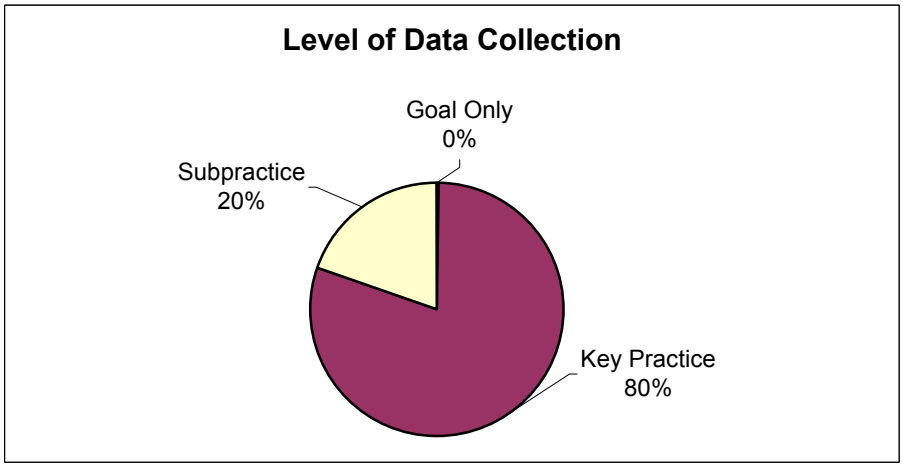


Figure 22: Level of Detail of Data Collection

The CBA IPI method requires that data be collected for each key practice within the assessment scope. This verifies that the data obtained are at a sufficient level of detail. Some respondents indicated multiple levels of data collection. Collection of data at the subpractice level is permitted; however, goal ratings are based on decisions made on data at the key practice level. Only one assessment respondent indicated that data had been collected only at the goal level. This does not provide adequate detail for the purposes of the assessment method and is a violation of the CBA IPI minimum requirements.

4.5 Data Corroboration

CBA IPI Requirement	How This Assessment Was Implemented
Data was corroborated coming from at least two, independent sources at different sessions.	The entire assessment team determined that each observation was valid (accurate, corroborated, consistent).

The method requires that all data be corroborated by at least two, independent sources obtained in different data gathering sessions. For this question, the response was "yes" for all 260 assessments.

4.6 Observations

CBA IPI Requirement	How This Assessment Was Implemented
Each key practice for each KPA within the assessment scope must be determined to be sufficiently covered with observations crafted from data collected.	___ number of observations were recorded (total). The assessment team determined sufficient coverage for each key practice for each KPA within the assessment scope. ___ yes ___ no. If not, please explain.

Data collected from each data gathering session is consolidated into observations related to a specific key practice.

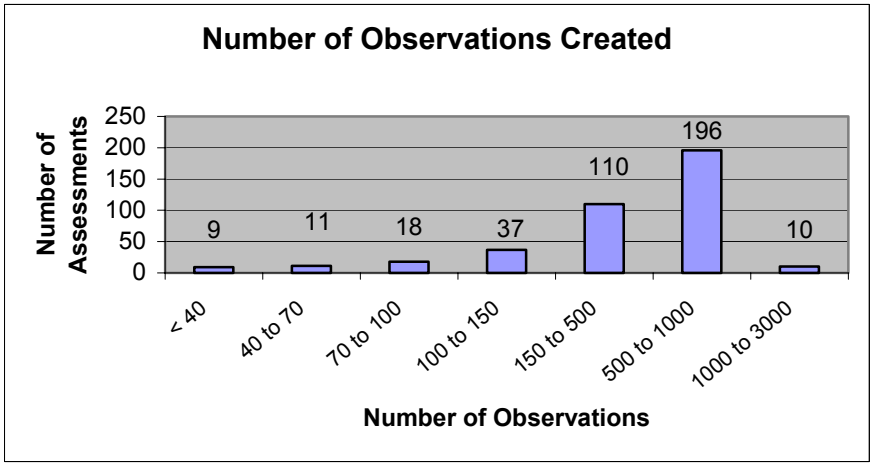


Figure 23: Number of Observations

Each key practice within the assessment scope must be sufficiently covered with information related to the key practice's implementation, the organization, and the development life cycle.

The wide variation in number of observations could represent different scopes for the assessment (number of KPAs being investigated) as well as different styles and preferences of Lead Assessors and assessment teams.

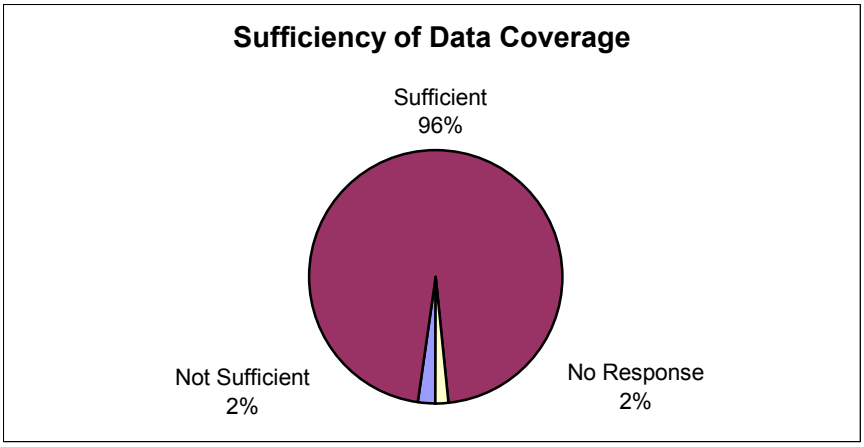


Figure 24: Sufficiency of Coverage

4.7 Draft Findings

CBA IPI Requirement	How This Assessment Was Implemented
Conduct draft finding presentations.	___ number of draft findings were presented ___ (how many) draft finding presentations

Draft findings are crafted from observations and are based on a KPA's strengths and weaknesses.

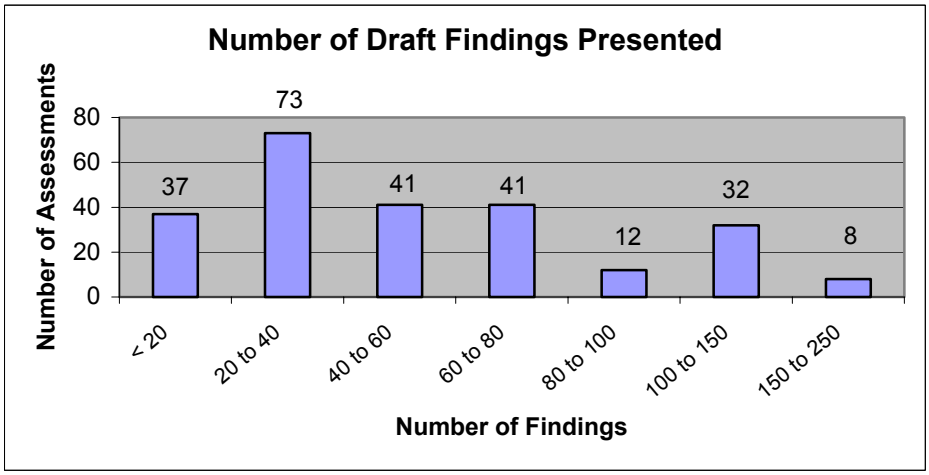


Figure 25: Number of Draft Findings Presented

Draft findings are presented to those persons who have been interviewed in order for them to validate the correctness of the information that the assessment team has heard and seen. Draft

findings are usually presented to three groups of persons who have been interviewed, typically: project leaders, middle managers, and FARs. However, the Lead Assessor has latitude to vary the number of draft finding presentations according to the organizational needs. Draft findings presentations are additional data gathering sessions, and attendees are encouraged to comment upon the accuracy of the draft findings at this point in the assessment.

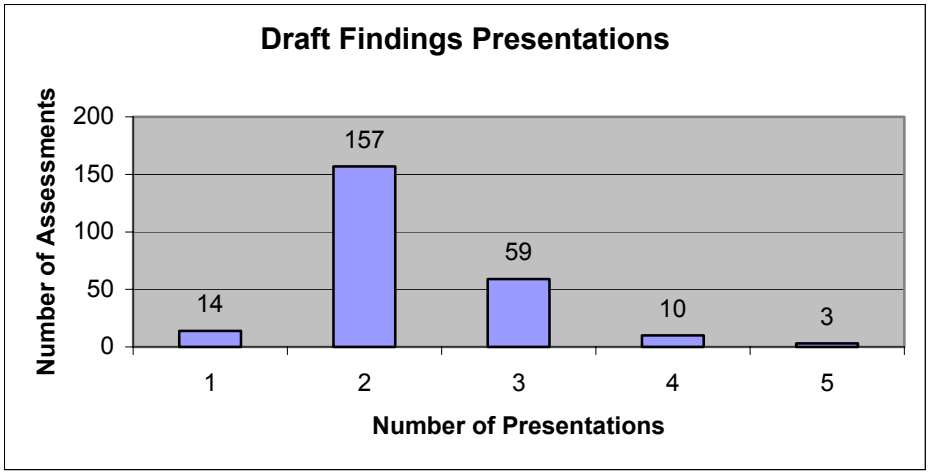


Figure 26: Number of Draft Finding Presentations

4.8 Type of Ratings

CBA IPI Requirement	How This Assessment Was Implemented
Ratings must be made based on sufficiently covered key practices mapped to the KPA goals. (maturity level rating is optional)	Ratings were done by the assessment team for: ___ maturity level ___ all KPAs within the scope ___ except (KPAs not rated): _____ ___ each goal for each of the above KPAs ___ each key practice within each of the above KPAs (tailoring option)

Ratings are made for each goal for each KPA within the assessment scope. Goal ratings are based on weaknesses that have been found relative to each key practice related to the goal being rated. Maturity level ratings are optional. Rating of key practices is also optional. Goal ratings are made independent of key practice ratings.

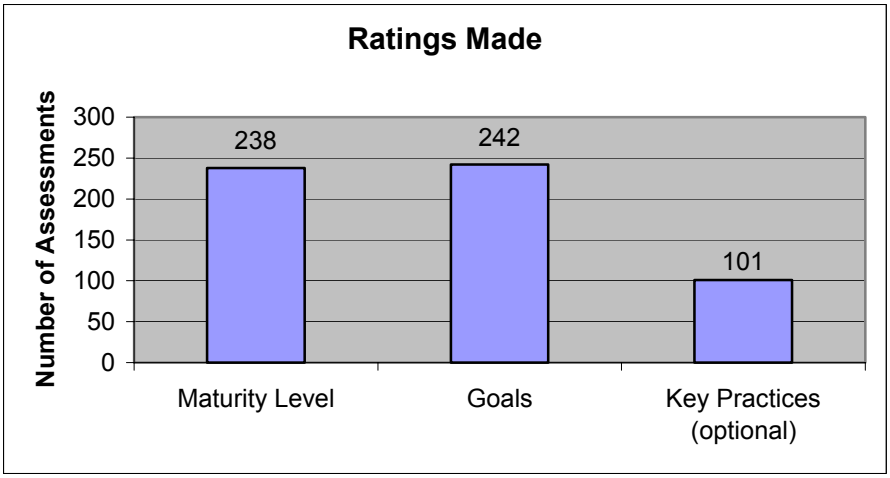


Figure 27: Level of Ratings Performed

4.9 Decision-Making Strategy

CBA IPI Requirement	How This Assessment Was Implemented
Consensus is the decision-making strategy of an assessment team.	Decisions were made by consensus of the assessment team.

All respondents indicated that the teams used consensus as their decision-making strategy.

5 Lead Assessor Requirements Checklist: Reporting Results

5.1 Sponsor Participation

CBA IPI Requirement	How This Assessment Was Implemented
A final findings briefing must be given to the sponsor.	The sponsor attended the: ___ Opening Meeting ___ Final Findings Briefing ___ Executive Session

The assessment sponsor is encouraged to attend the Opening Meeting and express his/her encouragement for interviewees to view the assessment as the organization's own and to be forthright and honest in providing information to the assessment team. The assessment sponsor owns the assessment results, so it is mandatory for the sponsor to attend the Final Findings Briefing to hear the assessment findings. During the Final Findings Briefing, the sponsor usually thanks the assessment team for its participation, time, and hard work, thanks the organization for its participation, candor, and cooperation, and gives an indication of how the assessment findings will be used for the process improvement initiative. The Executive Session usually includes the sponsor and his/her direct reports and is used as a session to answer any questions relative to the assessment findings and to discuss follow-on activities. Confidentiality and non-attribution continue to be in effect.

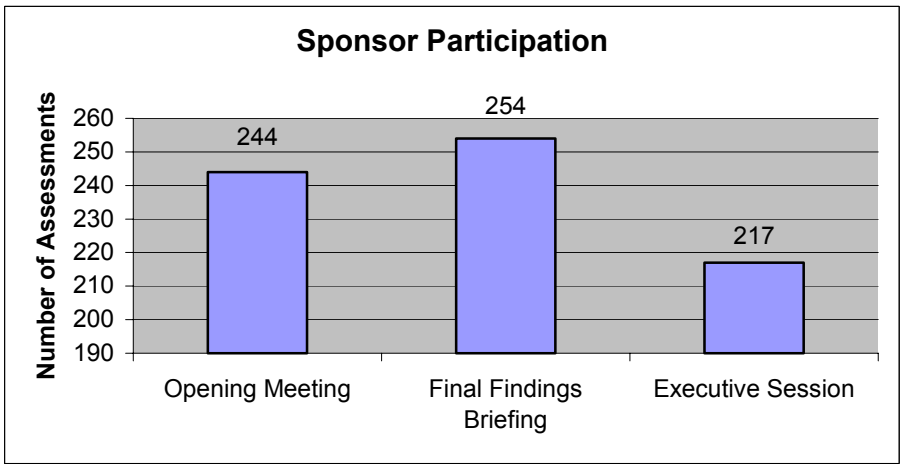


Figure 28: Sponsor Participation

5.2 Reports Submitted

CBA IPI Requirement	How This Assessment Was Implemented
The final findings briefing along with the KPA profile must be submitted to the SEI within 30 days of the conclusion of the assessment.	The following are being submitted to the SEI: ___ PAIS report with Organization and Project Questionnaires ___ Final findings briefing with KPA profile ___ Required feedback forms (including this checklist) ___ Assessment plan

The CBA IPI requirement states that the Final Findings Briefing along with the KPA profile must be submitted to the SEI. The responses from the 260 assessments indicated that the information was returned to the SEI for all of the 260 assessments. Fourteen out of the 260 assessments indicated that they did not submit the assessment plan.

6 Lead Assessor Requirements Checklist: Additional Questions

6.1 Length of Assessments

In the beginning of the Lead Assessor Requirements Checklist, the start and end dates of the assessment are recorded. Based on these dates, the number of days for each assessment can be calculated (ignoring any weekends or holidays). The following histogram shows the distribution of the number of assessment days for the 260 assessments.

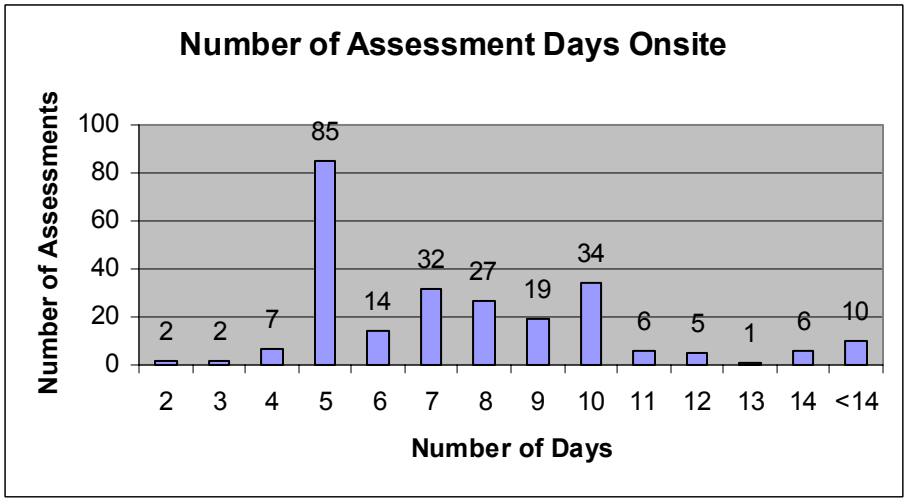


Figure 29: Number of Assessment Days On-Site

Out of 260 assessments, 85 or 32.7%, conducted the on-site activities in 5 days. Only 28, or 10.8%, indicated that more than 10 days were used for the on-site period.

There is an inclination to attempt to complete the on-site activities during a 5-day period of time due to resource availability. This is satisfactory when only a portion of the reference model is being investigated, for example, KPAs for maturity level 2. However, when the model scope exceeds the maturity level 2 KPAs, it is usually necessary to extend the on-site period. The Lead Assessor and the assessment team schedule the on-site period based on several variables:

- Scope of the organization being assessed, for example, number of interviews planned

- Scope of the CMM included in the assessment, for example, number of KPAs to be investigated
- Assessment experience of the team members
- Other organizational considerations that might affect the schedule

6.2 Team Hours

CBA IPI Requirement	How This Assessment Was Implemented
How many team-hours (total number of hours the team worked together) were spent in pre-on-site activities (e.g., team training, document review, scripting questions)?	
How many team-hours were spent in on-site activities (e.g., interviews, data consolidation, findings preparation and presentation)?	
How many team-hours were spent in data consolidation activities?	

In an effort to identify how time was used during the assessment activities, the above questions were asked. The responses for these questions had a very wide variance. We inquired about the variance from a large sample of Lead Assessors who responded with on-site activity hours greater than 180, which would represent more than 20, 8-hour days for on-site, since this seemed unlikely. One reason for this wide variance is that there are different interpretations of the term "team-hours." Most responded that they had submitted total time spent rather than elapsed time. Some Lead Assessors interpreted "team-hours" to mean total person-hours, and multiplied the number of team members by the time spent by each team member. The intention of these questions was that team-hours refer to the total amount of time that the entire team works together on team activities in the particular phase (pre-on-site, on-site). Due to this possible ambiguity in the data, the charts in this section represent data where on-site hours greater than 180 have been omitted or recalculated at the Lead Assessor's direction.

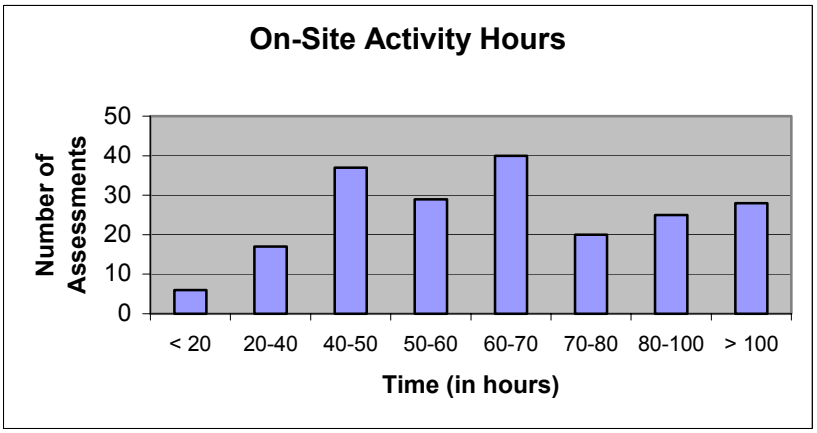


Figure 30: On-Site Activity Hours

Consolidation time was tracked and reported. Since consolidation is an on-site activity, we compared on-site hours to consolidation hours. For each of the ranges of on-site periods above, an average of 31% of time was spent performing consolidation. The median value was 33% for consolidation as a part of the total time for on-site activities.

The figure below shows the time periods to perform the pre-on-site and the on-site activities, as well as time spent in consolidation that is a subset of the on-site activities. The chart shows the largest observed value that is not an outlier, the smallest observed value that is not an outlier, the median value, and the 25th and 75th percentiles.

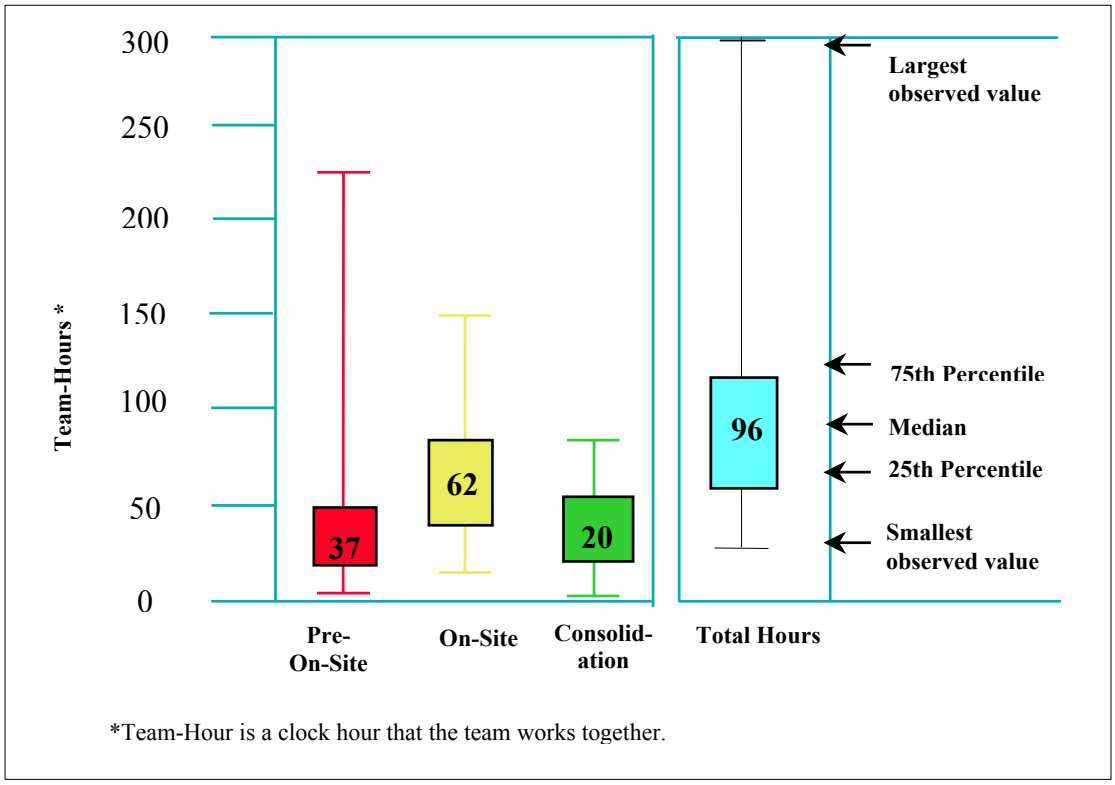


Figure 31: Hours to Perform CBA IPI Activities

7 Conclusion

7.1 Summary

When asked if the assessment findings accurately reflect the state of the software process in the assessed organization, sponsors indicated: 77.9% "very accurate," 20.6% "mostly accurate;" assessment team leaders indicated: 81% "very accurate," 19% "mostly accurate." When asked if, in general, the CBA IPI method was well performed for the organization, assessment team members indicated: 71.4% "strongly agree," 27.6% "agree," 1% "disagree" or "strongly disagree."

To monitor the consistency of the use of the SEI's assessment materials, the Lead Assessor's Requirements Checklist data is reported. Sponsor participation in the Opening Meeting and Final Findings Briefing is shown to be very strong. The business goals of the assessment are being identified and articulated. The assessment team composition and training are being accomplished as required. The results from the data indicate a reliable adherence to the method requirements.

Approximately 33 percent of the assessment on-site activities were conducted in 5 days. Forty-nine percent were conducted in 6 to 10 days. The *median* numbers of hours that the assessment teams worked together (i.e., clock hours) for the assessment activities are

- Pre-On-Site Activities: 37 hours
- On-Site Activities: 62 hours, which includes a median of 20 hours for consolidation of data
- Total: 96 hours

The SEI continues to collect this type of feedback to monitor user satisfaction and consistency of use of SEI products and materials. Additional reports will follow as additional data are collected and analyzed.

7.2 Key Findings

The following table summarizes some of the key findings in this document that may be useful references for Lead Assessors:

Table 1: Key Findings

Item	Findings
Planning the Assessment	
Team size	60% responses range from 5 - 8 team members
Business goals	Top 3: Improve product quality and reliability More efficient development processes/improve productivity, efficiency, effectiveness Deliver on time; more predictable schedules
Process improvement goals	Top 3: Validate/verify/achieve maturity/capability level 2 Indicate areas of improvement to guide direction for future improvement Determine/monitor progress/current state
Organization size	66% with fewer than 200 software developers Less than 2% over 1000 software developers
CMM training	29% SEI's Intro to CMM; 59% other CMM training
CBA IPI training	Range of most frequent delivery times: 16-32 hours
Conducting the Assessment	
Maturity questionnaires	Range of most frequent number of questionnaires administered: 5 - 10
Interviewees	Range of most frequent number of interviewees: 10 – 40
Documents reviewed	Range of most frequent number of documents reviewed: 100 - 150
Observations	Range of most frequent number of observations created: 150 - 1000
Draft findings	Range of most frequent number of draft findings presented: 20 - 40 Range of most frequent number of draft finding presentations: 2
Length of assessments	Most frequent on-site length: 5 days
Team-hours	Pre-on-site: 37 median On-site: 62 median Consolidation: 20 median Total team-hours: 96 median

References

[Dunaway 96a] Dunaway, Donna K. *CMM®-Based Appraisal for Internal Process Improvement (CBA IPI) Lead Assessor's Guide V1.1* (CMU/SEI-96-HB-003). Pittsburgh, Pa.: Software Engineering Institute, Carnegie Mellon University, March 1996.

[Dunaway 96b] Dunaway, Donna K. & Masters, S. *CMM-Based Appraisal for Internal Process Improvement (CBA IPI): Method Description* (CMU/SEI-96-TR-007, ADA307934). Pittsburgh, Pa.: Software Engineering Institute, Carnegie Mellon University, April 1996. Available WWW: <http://www.sei.cmu.edu/publications/documents/96.reports/96.tr.007html>.

[Dunaway 96c] Dunaway, Donna K. & Zubrow, Dave. *Feedback from Users of the CMM-Based Appraisal for Internal Process Improvement (CBA IPI).* Presented at the Software Engineering Process Group Conference 1996, Atlantic City, New Jersey, May 21, 1996.

[Dunaway 98] Dunaway, Donna K.; Goldenson, Dennis R.; Monarch, Ira A.; & White, David M. *How Well is CBA IPI Working?* User feedback presented at the Software Engineering Process Group Conference 1998, Chicago, Illinois, March 1998.

[Dunaway 99] Dunaway, Donna K.; Berggren, Ruth; des Rochettes, Gilles; Iredale, Paul; Lavi, Itzhak; & Taylor, Guy. *Why Do Organizations Have Assessments? Do They Pay Off?* (CMU/SEI-99-TR-012 ADA366095). Pittsburgh, Pa.: Software Engineering Institute, Carnegie Mellon University, July 1999. Available WWW: <http://www.sei.cmu.edu/publications/documents/99.reports/99tr012/99tr012abstract.html>.

[Dunaway 00] Dunaway, Donna K.; Seow, Mui Leng; & Baker, Michele. *Analysis of Lead Assessor Feedback for CBA IPI Assessments Conducted July 1998-October 1999* (CMU/SEI-2000-TR-005, ADA377438). Pittsburgh, Pa.: Software Engineering Institute, Carnegie Mellon University, 2000. Available WWW: <http://www.sei.cmu.edu/publications/documents/00.reports/00tr005.html>.

[Goldenson 95] Goldenson, D. & Herbsleb, J. *After the Appraisal: A Systematic Survey of Process Improvement, its Benefits and Factors that Influence Success* (CMU/SEI-95-TR-009, ADA300225). Pittsburgh, Pa.: Software Engineering Institute, Carnegie Mellon University, August 1995. Available WWW: <http://www.sei.cmu.edu/publications/documents/95.reports/95.tr.009.html>.

[Herbsleb 94] Herbsleb, J; Carleton, A; Rozum, J; Siegel, J; & Zubrow, D. *Benefits of CMM-Based Software Process Improvement: Initial Results* (CMU/SEI-94-TR-013, ADA283848). Pittsburgh, Pa.: Software Engineering Institute, Carnegie Mellon University, August 1994. Available WWW: <http://www.sei.cmu.edu/publications/documents/94.reports/94.tr.013.html>.

[Paulk 93a] Paulk, Mark; Curtis, B; Chrissis, M.; & Weber, C. *Capability Maturity Model for Software (V1.1)* (CMU/SEI-93-TR-024, ADA 263403). Pittsburgh, Pa.: Software Engineering Institute, Carnegie Mellon University, February 1993. Available WWW: <http://www.sei.cmu.edu/publications/documents/93.reports/93.tr.024.html>.

[Paulk 93b] Paulk, M.; Weber, C.; Garcia, S.; Chrissis, M.; & Bush, M. *Key Practices of the Capability Maturity Model V1.1* (CMU/SEI-93-TR-025, ADA263432). Pittsburgh, Pa.: Software Engineering Institute, Carnegie Mellon University, February 1993. Available WWW: <http://www.sei.cmu.edu/publications/documents/93.reports/93.tr.025.html>.

Appendix A Assessment Sponsor Feedback Data

Each Lead Assessor is required to provide the assessment sponsor with a feedback form. The sponsor is asked to complete the form and return it either to the Lead Assessor or directly to the SEI. The following responses represent data from 72 forms that were returned by assessment sponsors.

- How important are the following to process improvement in your organization?

	Importance Great ←----------→Little			
To reduce the number of software defects found after software is released	56	13	-	1
To schedule and plan a software project more effectively	58	11		1
To estimate needed resources more accurately	40	26	2	2
To satisfy corporate requirements for process improvement	19	29	15	7

(The above table indicates number of responses, not percentages.)

- How important were the following objectives to your assessment? Were they achieved?

	Importance Great ←----------→Little				Achieved?	
					Yes	No
To initiate a software process improvement program	28	15	8	15	57	2
To monitor progress in the software process improvement program	51	11	4	4	63	1
To validate the organization's capability maturity level	49	12	4	4	65	1
To prepare for an upcoming Software Capability Evaluation (SCE)	10	16	8	27	35	12

(The above table indicates the number of responses, not percentages.)

- Do you think the assessment findings accurately reflect the state of the software process in your organization?

77.9%	Very accurate
20.6%	Mostly accurate
1.5%	Somewhat accurate
-	Poor reflection

- How well did the Lead Assessor set your expectations for the assessment?

	Excellent	Good	Fair	Poor
Time required of team members	81.4%	17.1%	1.4%	-
Time required of organization participants, (e.g., interviewees)	81.4%	18.6%	-	-
Organization disruption	70.0%	25.7%	4.3%	-
Context of results, (e.g., KPA strengths and weaknesses)	84.3%	15.7%	-	-

- How would you rate the **assessment team's performance** for this assessment?

85.5%	Excellent
14.5%	Good
-	Adequate
-	Fair
-	Poor

- How would you rate the **Lead Assessor's performance** for this assessment?

85.7%	Excellent
12.9%	Good
1.4%	Adequate
-	Fair
-	Poor

- How much involvement did you have in determining the assessment scope, (both the organization scope and the CMM scope)?

12.9%	I left it to the discretion of the Lead Assessor and/or assessment team members.
7.1%	I delegated the activities to another person.
24.3%	I participated some.
55.7%	I was very involved.

- How well do you expect the assessment findings to provide guidance for planning follow-on process improvement activities?

68.1%	Excellent
31.9%	Good
-	Adequate
-	Fair
-	Poor

- How confident are you that you will be able to actively support the implementation of improvements based on the assessment findings?

82.6%	Very confident
17.4%	Some confidence
-	Little confidence
-	No confidence

Appendix B Assessment Team Leader Feedback Data

The following set of data contains information returned for 229 assessments. Assessment team leaders are asked to complete the following questions, and the following data were received in the responses:

- Do you think the assessment findings accurately reflect the state of the software process in the organization?

81%	Very accurate
19%	Mostly accurate
-	Somewhat accurate
-	Poor reflection

- Were the interviewees forthcoming and honest in providing information to the assessment team?

65%	Always
34%	Frequently
1%	Sometimes
-	Rarely

- Were the assessment team members unbiased in performing their responsibilities?

71%	Always
29%	Frequently
1%	Sometimes
-	Rarely

- How would you rate the assessment team's performance for this assessment?

55%	Excellent
37%	Good
7%	Adequate
1%	Fair
-	Poor

- How confident are you that the organization will actively support the implementation of improvements based on the assessment findings?

84%	Very confident
15.5%	Some confidence
0.5%	Little confidence
-	No confidence

- In general, the CBA IPI method was well performed for this organization.

82%	Strongly agree
17.6%	Agree
-	No opinion
0.4%	Disagree
-	Strongly Disagree

- Some areas of difficulty had been reported [Dunaway 98]. The feedback form was expanded to seek more specifics on where the difficulties occurred. The following table reports the responses.

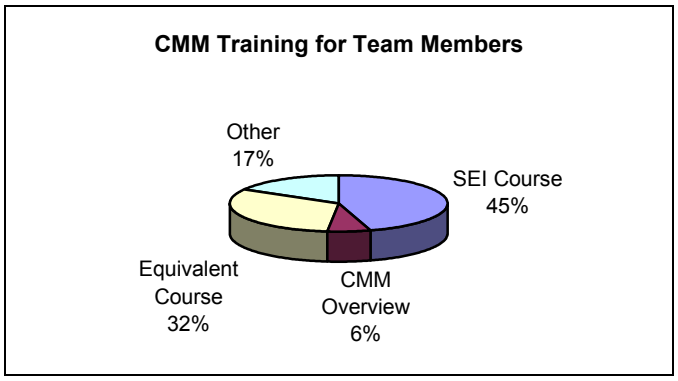
Table 2: Team Leader Feedback

Activity	Not difficult	Challenging, but manageable	Difficult	Extremely difficult	Not applicable
Team Member Training/Knowledge:					
Understanding the CMM for maturity levels 2 and 3	76.4%	19.0%	3.2%	-	1.4%
Understanding the CMM for maturity levels 4 and 5	23.3%	10.5%	1.4%	0.5%	64.3%
Understanding the CBA IPI method	80.2%	16.1%	0.9%	-	2.8%
Planning:					
Managing site logistics (e.g., facilities, schedule)	61.6%	32.4%	4.6%	0.9%	0.5%
Maintaining a realistic schedule for the on-site period	46.5%	42.8%	8.4%	1.4%	0.9%
Obtaining team members who meet selection criteria	60.5%	28.8%	8.4%	0.5%	1.9%
Time Management:					
Conducting interviews	76.0%	23.1%	0.9%	-	-
Consolidation of data	47.9%	40.6%	8.8%	2.3%	0.5%
Preparing draft findings	59.4%	36.4%	3.2%	0.5%	0.5%
Preparing final findings	78.3%	18.0%	2.8%	0.5%	0.5%
On-Site Activities:					
Reviewing documents effectively	50.5%	41.2%	7.4%	0.5%	0.5%
Achieving consensus with team members	59.4%	33.6%	5.5%	1.4%	-
Identifying the appropriate persons in the assessed organization for interviews	75.9%	20.8%	3.2%	-	-
Developing interview scripts	71.8%	26.3%	1.4%	-	0.5%
Abstracting from notes (low-level of detail) to higher-level observations and findings	57.1%	40.1%	2.3%	0.5%	-
Mapping the organization's practices to the CMM	75.0%	22.7%	1.9%	0.5%	-
Tailoring the Method:					
For small (<50 software developers) organization	17.9%	14.3%	-	-	67.9%
For low maturity organizations (e.g., initial assessment)	20.9%	10.2%	0.5%	-	68.4%

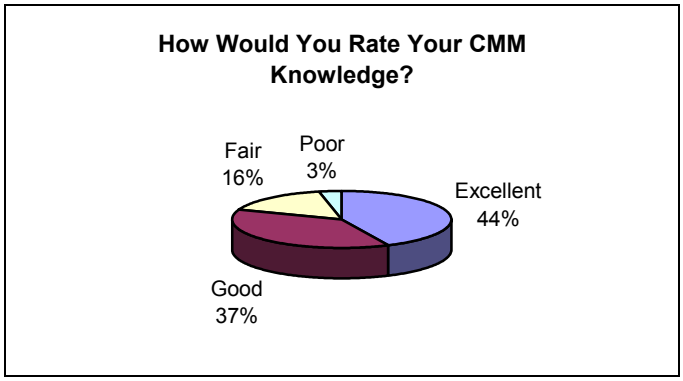
Appendix C Assessment Team Member Feedback Data

Assessment team members are asked by their team leader to complete the team member feedback form supplied in assessment kits. One of the team members is asked to collect the forms and send them to the SEI instead of giving them to the Lead Assessor. This is to preserve confidentiality of the responses and to encourage team members to be objective about their assessment experience. The following set of data reflects 197 team member feedback responses:

- What CMM training did the Lead Assessor provide for you prior to the assessment?

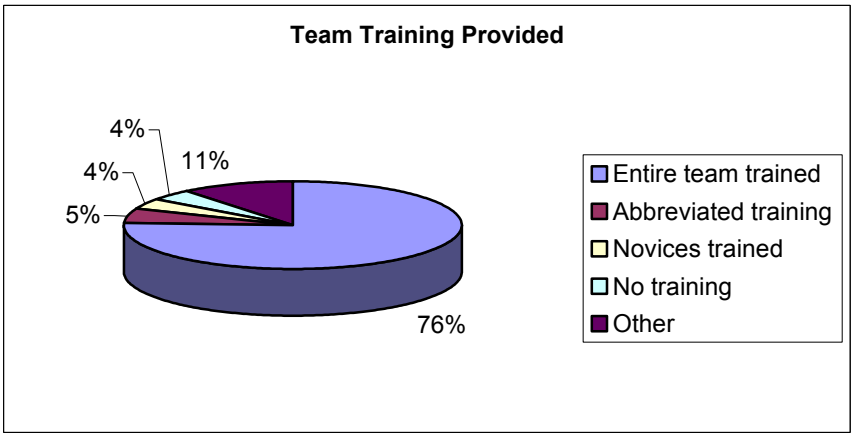


- How would you rate your CMM knowledge?



- Did your software experience meet the team member selection criteria? A response of "yes" was provided by 169 respondents, and "no" was given by 2 respondents.

- Did the Lead Assessor provide CBA IPI Team Training for you?



- How well did team training prepare you to serve as an effective assessment team member?

- Were the **interviewees** forthcoming and honest in providing information to the assessment team?

69.9%	Always
29.5%	Frequently
0.6%	Sometimes
-	Rarely

- Were the **assessment team members** objective in performing their responsibilities?

80.9%	Always
18.5%	Frequently
0.6%	Sometimes
-	Rarely

- How would you rate the assessment team's performance for this assessment?

74.1%	Excellent
24.7%	Good
1.1%	Adequate
-	Fair
-	Poor

- How would you rate the Lead Assessor's performance for this assessment?

81.6%	Excellent
16.7%	Good
0.6%	Adequate
0.6%	Fair
-	Poor

- Some areas of difficulty had been reported [Dunaway 98]. The feedback form was expanded to seek more specifics on where the difficulties occurred. The following table reports the responses.

Table 3: Team Member Feedback

Activity	Not difficult	Challenging, but manageable	Difficult	Extremely difficult	Not applicable
Team Member Training/Knowledge:					
Understanding the CMM for maturity levels 2 and 3	60.7%	35.8%	2.3%	0.6%	0.6%
Understanding the CMM for maturity levels 4 and 5	26.9%	19.9%	2.3%	1.2%	49.7%
Understanding the CBA IPI method	66.3%	33.1%	0.6%	-	-
Planning:					
Managing site logistics (e.g., facilities, schedule)	45.0%	25.7%	8.2%	1.8%	19.3%
Maintaining a realistic schedule for the on-site period	40.9%	35.1%	11.1$	1.8%	11.1%
Obtaining team members who meet selection criteria	58.0%	15.4%	3.0%	0.6%	23.1%
Time Management:					
Conducting interviews	58.7%	34.3%	7.0%	-	-
Consolidation of data	34.9%	52.3%	12.2%	0.6%	-
Preparing draft findings	49.1%	41.5$	7.6%	1.8%	-
Preparing final findings	62.7%	33.1%	3.6%	0.6%	-
On-Site Activities:					
Reviewing documents effectively	47.1%	42.4%	9.3%	1.2%	-
Achieving consensus with team members	56.4%	37.8%	5.8%		
Identifying the appropriate persons in the assessed organization for interviews	54.5%	24.0%	5.3%	1.2%	15.2%
Developing interview scripts	46.5%	42.4%	5.8%	1.2%	4.1%
Abstracting from notes (low-level of detail) to higher-level observations and findings	46.8%	43.9%	8.1%	0.6%	-
Mapping the organization's practices to the CMM	54.7%	40.7%	3.5%	1.2%	-
Tailoring the Method:					
For small (<50 software developers) organization	14.7%	8.7%	1.3%	0.7%	74.7%
For low maturity organizations (e.g., initial assessment)	18.7%	12.0%	2.0%	0.7%	66.7%

- In general, the CBA IPI method was well performed for this organization.

71.4%	Strongly agree
27.6%	Agree
-	No opinion
0.5%	Disagree
0.5%	Strongly Disagree

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13. ABSTRACT (MAXIMUM 200 WORDS)

As steward of the Capability Maturity Model® (CMM®) for Software (SW-CMM) and its related products, the Software Engineering Institute (SEI) collects information related to the use of the CMM and provides feedback to the user community. Assessment data are reported in industry aggregates by the SEI in the Maturity Profile, which provides characteristics of organizations using the CMM as well as information on findings and maturity levels. The main purpose of this report is to update the analysis of feedback from users of the CMM-Based Appraisal for Internal Process Improvement (CBA IPI) method [Dunaway 00]. The assessments for which data are contained in this report were conducted between July 1998 and December 2000. The audience for this document is the community of managers, executives, and developers who are planning or contemplating having a CBA IPI assessment in their organizations, assessment team members, and Lead Assessors who are interested in learning about other assessors' experiences in order to improve their own planning and use of the CBA IPI method.

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