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Special Report

CMU/SEI-92-SR-13

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Carnegie Mellon University
Software Engineering Institute

**Software Engineering Process Groups:
Results of the 1992 SEPG Workshop
Event Evaluation and a First Report
on SEPG Status**

**Mark D. Miller
Dennis R. Goldenson**

August 1992

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Mark D. Miller

Dennis R. Goldenson

Empirical Methods Group

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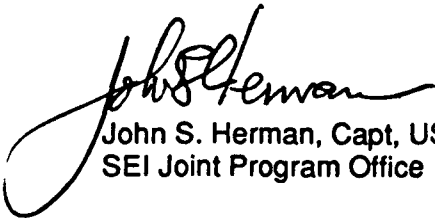
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This report has been reviewed and is approved for publication.

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The information in this report was obtained from a questionnaire completed by 169 individuals from the software industry who participated in the Software Engineering Process Group (SEPG) Workshop held in Tysons Corner, Virginia, in April of 1992. We thank them for sharing the knowledge and opinions that make this report possible.

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Software Engineering Process Groups: Results of the 1992 SEPG Workshop Event Evaluation and a First Report on SEPG Status

Abstract: This report contains a summary of the results from a questionnaire administered to participants in the Software Engineering Process Group (SEPG) Workshop held in Tysons Corner, Virginia, in April of 1992. The purpose of the questionnaire was twofold: (1) to ask the participants for their judgments about the quality of the week-long event, and (2) to begin collecting information comparing the experiences of existing SEPGs. The participants reported a generally high degree of satisfaction with the content and conduct of the event. Although descriptions about SEPG characteristics and activities apply only to the organizations whose representatives attended the workshop, our findings suggest recent and rapid growth in the SEPG community. Of the 169 responding participants, 72 percent stated that their organizations have SEPGs, and over three-quarters of the SEPGs have been established since 1990.

1 Introduction

On April 8 and 9, the Washington, D.C., Software Process Improvement Network (SPIN) and the Software Engineering Institute (SEI) jointly sponsored the 1992 Software Engineering Process Group (SEPG) Workshop. The workshop was held in conjunction with the SEI sponsored Capability Maturity Model (CMM) Workshop and a United States Department of Defense (DoD) Software Process Workshop, which were held in parallel on April 5 and 6. A related series of tutorials were held on April 10. A number of the participants attended one or more of the series of events. During the workshops the participants engaged in interactive panel discussions and working sessions, listened to keynote and lunchtime speakers, and discussed topics of mutual interest at "birds of a feather" sessions. The SEI provided participants with a notebook containing materials pertaining to the workshop(s) they attended.

This report is based on the *SEPG Workshop: Questionnaire & Event Evaluation* that was distributed on April 9, the last day of the SEPG Workshop. Participants were encouraged to complete the questionnaires and return them as they left one of the mid-afternoon general sessions. In all, 379 people attended the SEPG Workshop. We distributed questionnaires to 240 participants who remained at the workshop on the afternoon of April 9. Of the 240 people who received the questionnaires, 169 completed and returned them, representing approximately 70 percent of those who received the questionnaires.¹

¹ The participants who completed the survey constitute a good sample of those in attendance at the workshop, at least on its last day. However those who attended the workshop are self selected, and are not necessarily representative of all software process improvement efforts.

This report contains six chapters following this introduction. Chapter 2 summarizes the participants' judgements about the quality of the SEPG Workshop and, for comparative purposes, also contains some limited information about their ratings of the CMM Workshop. A description of the SEPGs currently functioning in the participants' home organizations is contained in Chapter 3, while the software process improvement efforts of those organizations are described in Chapter 4. Chapters 5 and 6 provide background information about the software development work done in the participants' organizations and about the participants themselves. A summary of the report findings is contained in Chapter 7. A copy of the questionnaire can be found in the appendix to this report.

2 Evaluation of the SEPG Workshop

This section provides a brief summary evaluation of the SEPG Workshop from the perspective of the participants who completed the *SEPG Workshop: Questionnaire & Event Evaluation*. Their evaluative judgments about the quality of the SEPG Workshop are based on both fixed response "closed-ended" and free format "open-ended" questions.

2.1 Ratings for the Workshop

The participants rated the overall workshop and six of its areas on a five point scale ranging from "inadequate" to "excellent." The areas reviewed include the:

- Workshop in general
- Keynote speakers
- Panels
- Working sessions
- Workshop notebook
- "Birds of a feather" sessions

The workshop in general received very favorable ratings. As shown in Figure 1, 54 percent of the participants rated the workshop in general on the "excellent" side of "OK." Only 15 percent gave it ratings on the "inadequate" side of "OK."

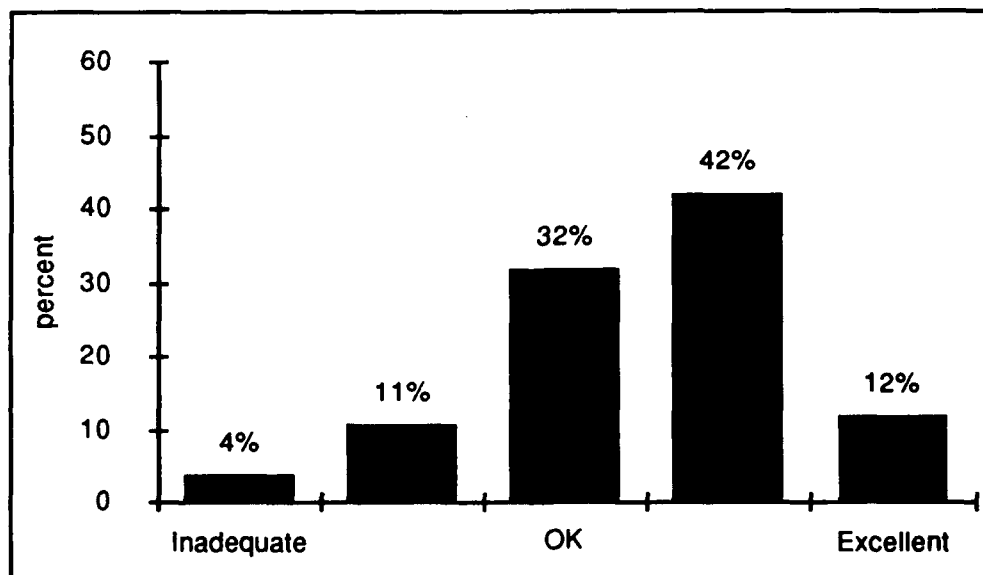


Figure 1. Evaluation of the Workshop In General (n=160)

Of the six areas reviewed by the participants, the keynote speakers received the most positive ratings. In all, 79 percent of those who replied rated the keynote speakers favorably while only 1 percent of those who replied found the keynote speakers to be inadequate. These results are displayed in Figure 2.

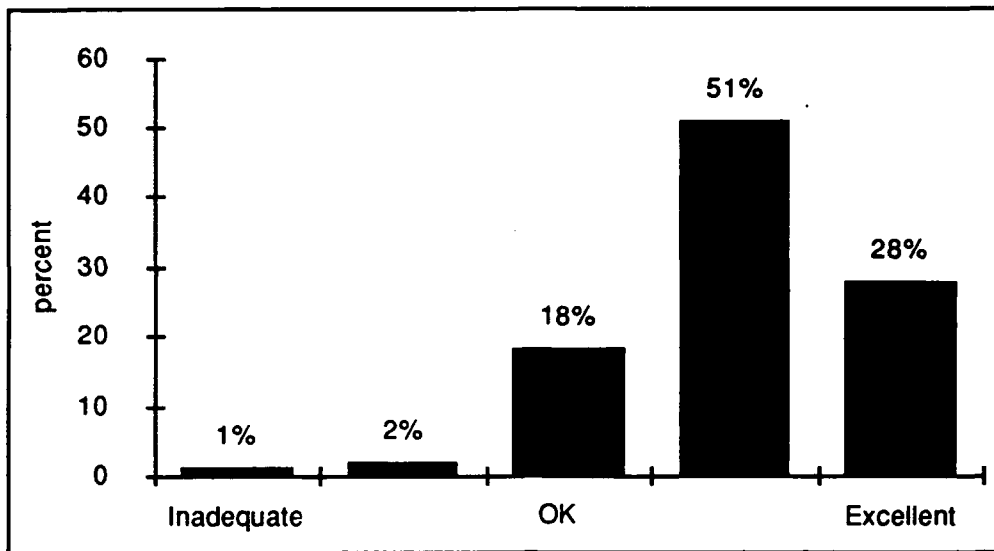


Figure 2. Evaluation of the Keynote Speakers (n=165)

The panels also received favorable reviews. However, the ratings for the panels center more closely around the "OK" choice. As shown in Figure 3, 39 percent of the participants gave the panels a favorable rating. Yet very few participants chose the more definite "excellent" category. Both the "inadequate" and "excellent" ratings received only about five percent of the responses.²

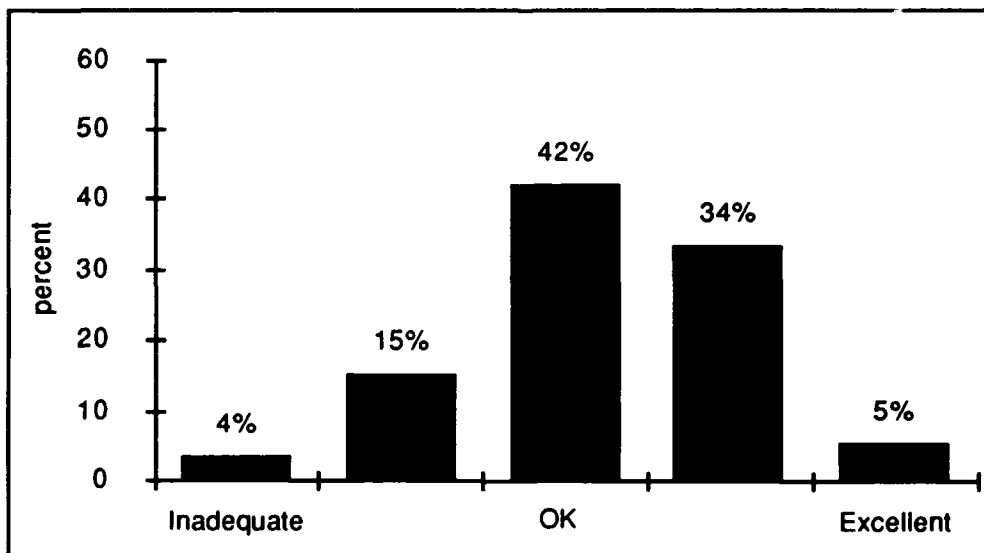


Figure 3. Evaluation of the Panels (n=164)

² The participants typically attended several panels, so it is likely that the responses are grouped towards the middle because people had mixed reactions, both positive and negative, to the different panels.

The working sessions received less favorable ratings than did the keynote speakers and panel sessions, receiving a combined favorable rating of 34 percent. As shown in Figure 4, a full 10 percent of those responding found the working sessions to be inadequate.

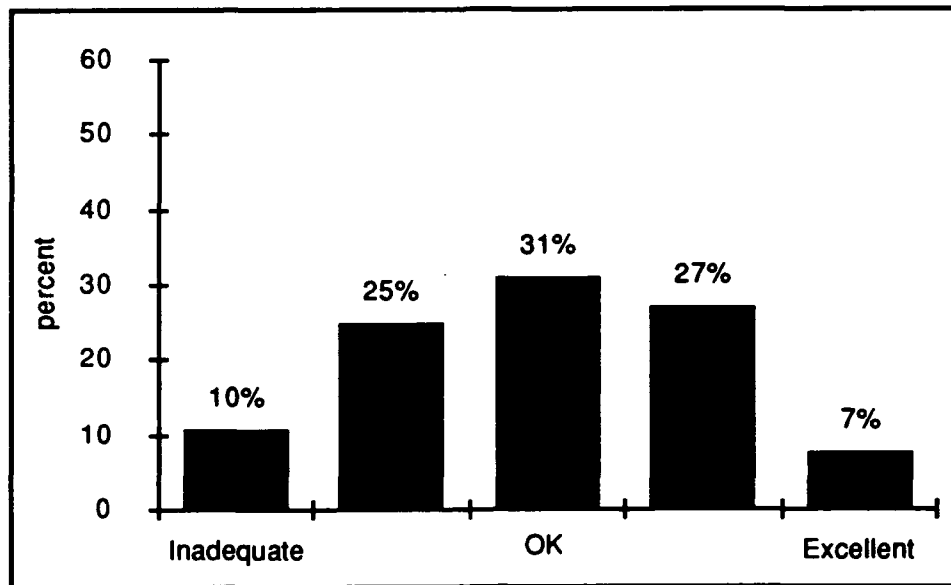


Figure 4. Evaluation of the Working Sessions (n=163)

As shown in Figure 5, the workshop notebook also received less favorable reviews than the other areas reviewed. Of those answering, 32 percent gave the notebook a favorable rating, while 34 percent found the notebook to be less than "OK." In response to the free format, open-ended responses summarized in Tables 2 and 6, participants stated the notebook was "incomplete," "disorganized and confusing," and "far too large, save a tree." The notebook is a major reference document representing the SEI, which the participants will return to their organizations. Therefore, the quality of the notebook needs to be addressed for future SEPG Workshops.

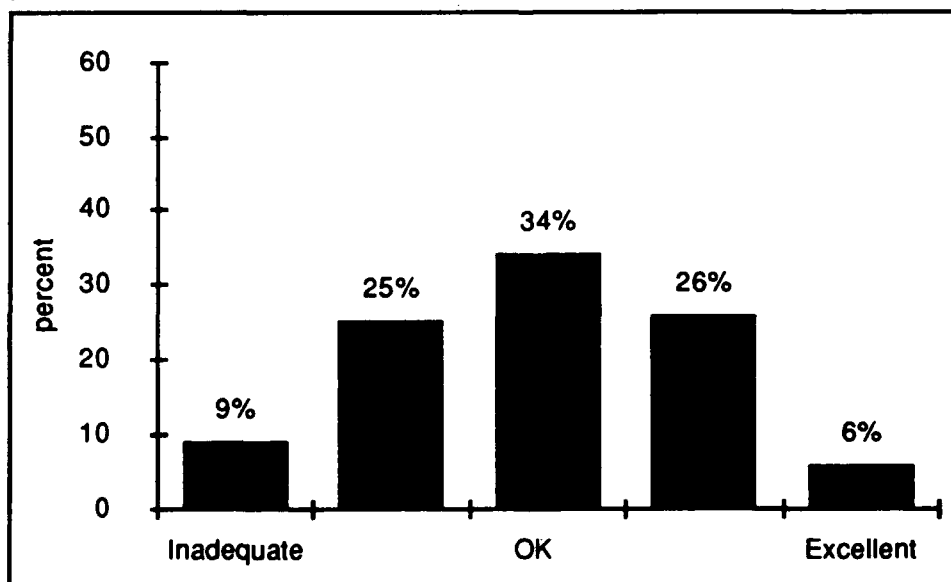


Figure 5. Evaluation of the Workshop Notebook (n=155)

Twenty-seven percent of the respondents gave the "birds of a feather" sessions a favorable rating. An equal number of participants (six percent) chose each of the two extreme responses. In fact, the participants are almost equally distributed across the rating scale, with 44 percent of the participants indicating that the "birds of a feather" sessions were "OK." The results are displayed in Figure 6. Notice that fewer participants attended these sessions than attended the other workshop events.³ This observation may be explained by the fact that the "birds of a feather" sessions were held in the evening. As seen in Table 3 on page 8, many of the participants stated that the days were too long. It is also worth noting that the "birds of a feather" sessions were not fully advertised in the workshop materials.

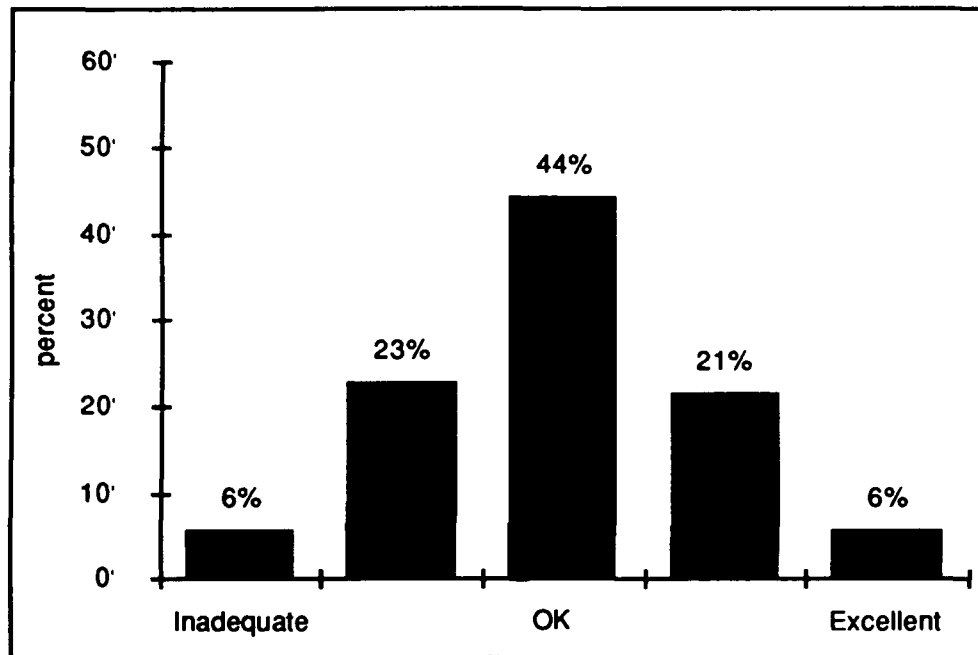


Figure 6. Evaluation of the "Birds of a Feather" Sessions (n=70)

2.2 Descriptions of the Workshop

The participants were asked to describe in their own words what they liked most and least about the workshop. The questions were open-ended, so people could list several different areas if they so chose. Table 1 summarizes their responses about what they liked most. Two areas clearly stood out in the minds of the participants: the "birds of a feather" sessions and the keynote speakers. Over 20 percent of the SEPG Workshop attendees mentioned each of these two areas as aspects of the workshop that they liked most.

It is interesting to note that the working sessions also received a significant number of responses with 12 percent indicating in their responses that they preferred these sessions the most. Contrary to the impression that the comparable closed-ended question may give about the working sessions in general, at least some of the working sessions were particularly well

³ How many sessions the participants attended is unclear from these data alone because different participants may be rating different sessions, rather than rating the same sessions as being uniformly middle ground.

received by some of the attendees.⁴ Indeed, one of the strongest indicators of whether a component of the workshop was successful is whether or not the respondents believe it should be a part of future SEPG Workshops. As seen in Table 2, almost two-thirds of the respondents believe that working sessions should remain a part of future SEPG Workshops.

Table 1. Areas That Participants Liked Most About the Workshop¹ (n=169)

	<u>Percent responding²</u>
Keynote speakers	23
"Birds of a feather" sessions	21
Informal working sessions	12
Meals	11
Exposure to broad set of experience	9
Helpful information	9
Interaction with people with common interest	9
Networking opportunities	7
Its organization	7
Did not respond	12

¹ Based on responses to the question: "What did you like the most about the workshop?"

² Multiple responses were possible. The table excludes entries for categories mentioned by fewer than ten workshop participants.

Table 2. Should Working Sessions Continue to Be Included?¹ (n=160)

	<u>Percent responding</u>
Yes	64%
No	17
Don't know	<u>19</u>
	100%

¹ Based on responses to the question: "Should future SEPG Workshops continue to be designed around working sessions?"

Table 3 summarizes the responses people gave when asked what they liked least about the workshop. Over 30 percent of all the workshop participants complained that the days were too long. This was by far the largest single complaint regarding the workshop. As would be expected from the responses to the comparable closed-ended question rating the workshop notebook, the notebook also was a major area of concern. For example, over 15 percent of

⁴ The closed-ended question requesting the participants to rate the working sessions requires people to express their summary judgements about all of the working sessions at once. Participants who found the sessions to vary in quality are likely to have chosen middle ground response categories, even though they may have liked certain individual working sessions.

the participants pointed out that information was missing from the notebook. This information coupled with the ratings reported in Figure 6 indicate a problem that should be addressed in future workshops.

Table 3. Areas That Participants Liked Least About the Workshop¹ (n=169)

	<u>Percent responding²</u>
Too long	31
Materials missing from notebook	16
Too crowded	13
Lack of substance in many talks	10
Lack of experience of presenters	8
Night sessions	7
Lack of organization	7
Did not respond	14

¹ Based on responses to the question: "What did you like the least about the workshop?"

² Multiple responses were possible. The table excludes entries for categories mentioned by fewer than ten workshop participants.

To gauge the overall quality of the event, the participants were also asked if they would attend an SEPG Workshop in the future. The assumption here is that people will willingly choose to repeat a good experience. As seen in Table 4, almost three-quarters of the participants said that they would choose to attend an SEPG Workshop in the future. More significantly, only three percent indicated that they would not attend another SEPG Workshop. Those participants expressing a preference to attend another SEPG Workshop also indicated that it should be held annually, with 79 percent of them saying that the next workshop should be held in 1993.

Table 4. Participants' Willingness to Attend Future SEPG Workshops¹ (n=169)

	<u>Percent responding²</u>
Yes	73%
No	3
Don't know	21
Did not respond	<u>2</u>
	99%

¹ Based on responses to the question: "Would you attend another SEPG workshop in the future?"

² The table does not total to 100% due to rounding error.

Participants were asked the open-ended question "What would you change for future workshops?" Once again some participants mentioned more than one thing, so the answers are categorized allowing for multiple responses. As can be seen in Table 5, there were

several areas that the participants felt required improvement in the future. The two most common sets of suggestions were to shorten the days and increase the substance/expertise of the presentations.

Table 5. Suggested Changes for Future Workshops¹ (n=131)

	<u>Percent responding²</u>
Limit work hours	12
Focus on a few key areas	9
More expert preparation	9
More substance	8
Present more personal experience	7
More expert lecturers	6
Provide materials needed	6
Did not respond	22

¹ Based on responses to the question "What would you change for future workshops?"

² Multiple responses were possible. The table excludes entries for categories mentioned by fewer than ten workshop participants.

The final question on the event evaluation asked the participants their primary reasons for attending the SEPG Workshop. The most common single answer categorized in Table 6 refers to interaction with participants from other companies. Not surprisingly, answers also commonly referred to gaining knowledge about SEPGs and the CMM.

Table 6. Primary Reason for Attending SEPG Workshop¹ (n=169)

	<u>Percent responding²</u>
Get help and ideas from other companies	21
Gather information on other SEPGs	15
Gain general knowledge	12
Learn more about CMM intent	12
Learn more about SEPGs	11
Learn more about software process improvement	11
Learn how to start an SEPG	7
Did not respond	8

¹ Based on responses to the question "What was your primary reason for attending the SEPG workshop?"

² Multiple responses were possible. The table excludes entries for categories mentioned by fewer than ten workshop participants.

2.3 Evaluation of the CMM Workshop

The event evaluation for the SEPG Workshop was our major concern, but we also included two specific questions about the CMM Workshop. The first question was included in the series asking for ratings about aspects of the week long event and asked the participants to rate the CMM disposition reviews. The second question asked those who said that they would attend another SEPG Workshop whether it should be held in conjunction with another CMM Workshop.

The CMM Workshop disposition reviews received favorable ratings, although they were not as strong as the general ratings for the SEPG Workshop. Fully half of those who replied rated the CMM Workshop disposition reviews towards the more favorable end of the continuum of possible responses.⁵ As shown in Figure 7, 16 percent rated the CMM Workshop disposition reviews as "excellent." However, 25 percent rated the reviews as being less than "OK," with 8 percent rating them as being "inadequate."

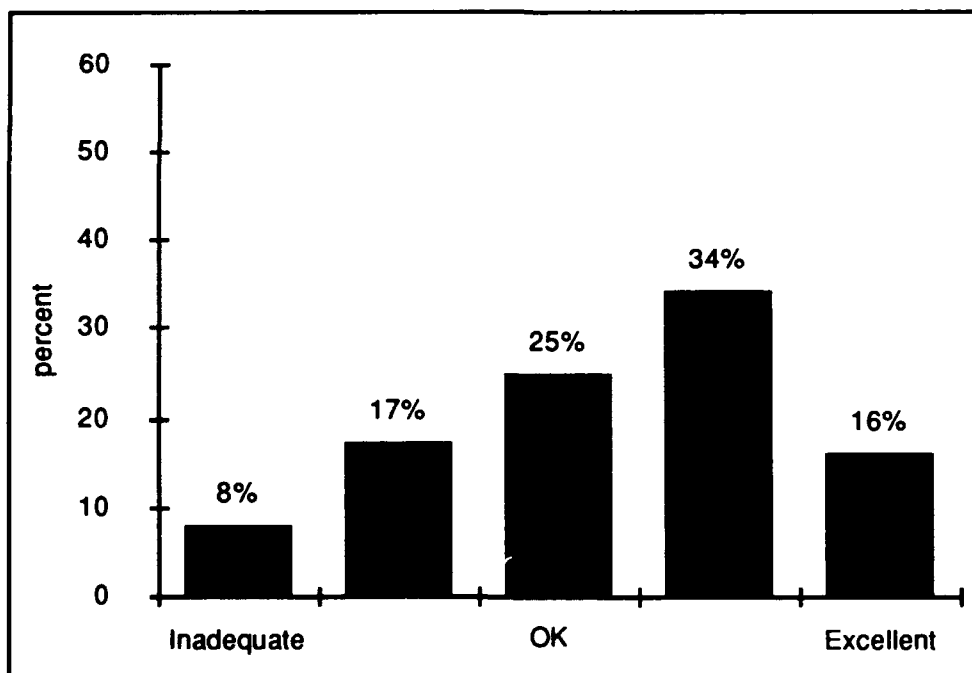


Figure 7. Evaluation of the CMM Workshop (n=88)

⁵ Fewer people answered this question since not all of those who attended the SEPG Workshop had also attended the CMM Workshop held earlier in the week.

Finally, the idea of combining the CMM and SEPG Workshops in a common event did receive support from those SEPG Workshop participants who expressed an interest in attending a future SEPG event. As seen in Table 7, over 60 percent indicated that the CMM Workshop should be held in conjunction with a future SEPG Workshop. While over a quarter of those responding were not sure, 13 percent said that the two events should not be held together.

Table 7. Should SEPG & CMM Workshops Be Held In Conjunction?¹ (n=133)

	<u>Percent responding</u>
Yes	61%
No	13
Don't know	<u>26</u>
	100%

¹ Based on responses to the question "Should it be held in conjunction with another CMM Workshop?"

3 Status of the SEPGs

The 1992 SEPG Workshop provided a unique opportunity to gather information about the nature of software engineering process groups and software process improvement efforts as they have been implemented thus far. The workshop participants are a self selected group and do not constitute a randomly selected sample of software development organizations. Nevertheless, the questionnaire responses can provide some useful insight, at least from the perspective of organizations who base their work on the approach of the SEI and CMM.

3.1 Characteristics

The first series of questions we asked about the SEPGs focused on their organization. Not surprisingly, almost three-quarters (121 of 169) of the workshop participants who completed a questionnaire reported that their organizations have an SEPG. Of those who have an SEPG, 48 percent indicated that it exists at the organization level, while 43 percent specified the division level.

Who in an organization demonstrates commitment to an SEPG can be crucial to the success of a software process improvement effort. Table 8 shows where commitment to the participants' SEPGs has been demonstrated. Note that only about a third (37 percent) of the participants indicated that their technical staffs had demonstrated a commitment to their SEPGs. This can be compared to three-quarters (67 percent) who indicated support from senior management, and 41 percent who checked the middle management category. This mix of commitment may indicate a potential hurdle that an SEPG must overcome once it has received management approval.

Table 8. Organizational Commitment to SEPGs¹ (n=121)

	<u>Percent responding²</u>
Senior management	67
Middle management	41
Technical staff	37

¹ Based on responses to the question: "Who in the organization has demonstrated their commitment to your SEPG?"

² Column totals to more than 100% due to multiple responses.

Most of these SEPGs were established after the SEI Technical Report SEI-TR-23 was issued in 1987.⁶ Only seven participants report groups that predate this report. The earliest starting date is 1961, with a 17-year hiatus before the second one. Seventy-eight percent were established since 1990, with forty percent being established in 1991 alone. Clearly these SEPGs are still relatively new.

⁶ Humphrey, W.S. and Sweet, W.L., *A Method for Assessing the Software Engineering Capability of Contractors*, CMU/SEI-87-TR-23, ADA187320, Software Engineering Institute, September 1987.

The participants' SEPGs vary in size as well. To gauge typical staff size, the participants were asked to record the number of people who work in their SEPGs. As seen in Figure 8, the majority of the SEPGs described have eight or fewer full-time and/or part-time staff members. Half of the SEPGs have a maximum of three full-time and/or four part-time staff members. A small number of SEPGs (three) have 25 or more full- or part-time staff members.

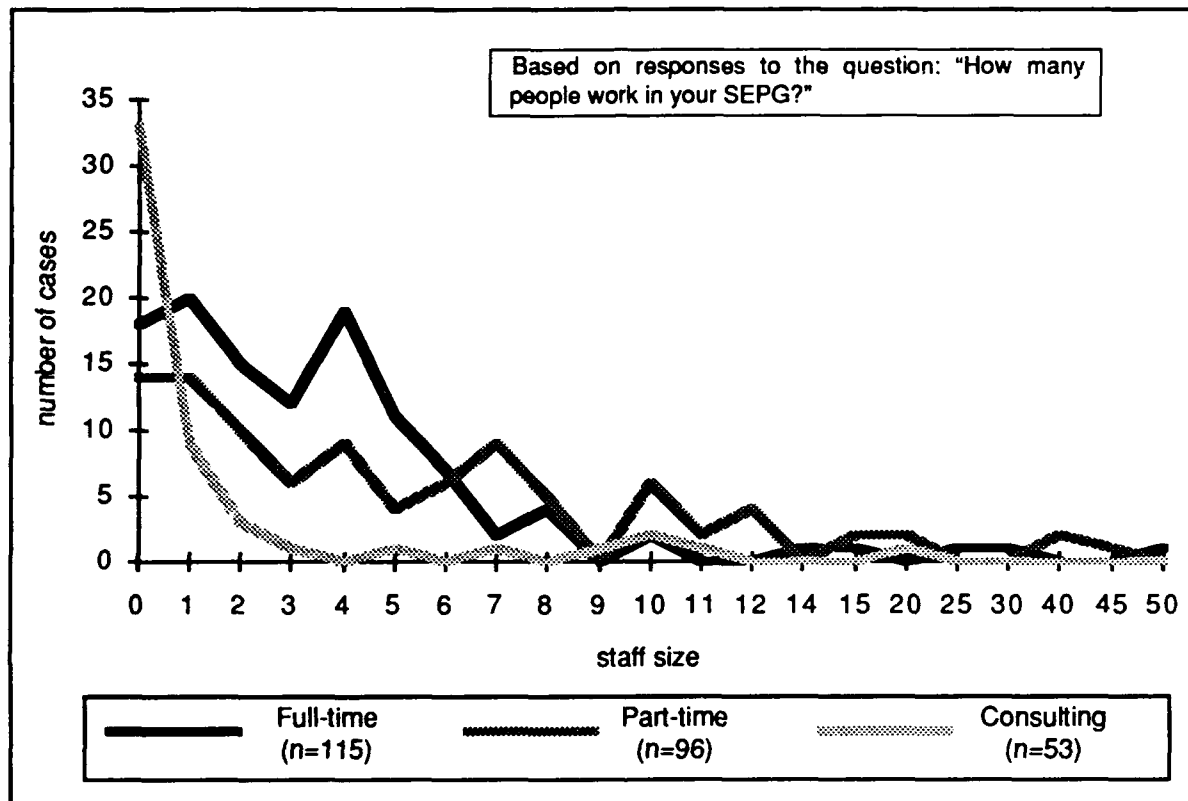


Figure 8. SEPG Staff Size

3.2 Activities

The workshop participants who indicated that their organizations had SEPGs were asked four free response "open-ended" questions about their SEPGs. Similar responses were classified as described below. These answers provide needed insight into the history and activities of SEPGs.

The first question asked the participants to describe the functions performed by their SEPGs. Notice in Table 9 that references to "coordination" activities are most common. These include general comments about intergroup coordination, as well as mentions of newsletters, related communications activities, consulting, and change management. The next most common category includes references to "process improvement," which also tend to be general in nature. However, some of these comments do mention responsibilities for implementing specific recommendations based on software process assessments.

Table 9. SEPG Functions¹ (n=121)

	<u>Percent performing function²</u>
Coordination	60
Process improvement	45
Software support function(s)	44
Training / Education	29
Facilities ³	19
Metrics	15
Software quality assurance	3
Process definition	37
Assessments / Evaluations	29
Action plan execution	17
Standards	15
Improvement of CMM Level	4
Other ⁴	7
Don't know	1
Does not apply - SEPG too new	4
Did not respond	7

¹ "Based on responses to the question: "What functions does your SEPG perform?"

² Column totals to more than 100% due to multiple responses.

³ Includes configuration management, software engineering environments (SEE), CASE, and reuse.

⁴ Includes references to writing and reviewing proposals (2), reviewing requirements (2), staffing software related initiatives, project planning and requirements management, collecting lessons learned, and "Not much at the current time."

Not surprisingly many SEPGs (44 percent) perform traditional software support functions, with responsibility for formal training programs being most common. As seen in Table 9, SEPG functions also commonly include CMM based process definition activities, and conduct of process assessments or participation in capability evaluations.

The second open-ended question asked the participants to identify their SEPGs' primary responsibilities. As shown in Table 10, their answers differ from those in response to the more general question about SEPG functions. When answering the general question, people often enumerate several functions. However, they typically mention fewer activities as primary responsibilities for their SEPGs. Thus, other things being equal, the individual percentage entries should be expected to be lower in Table 10 than in Table 9.

The response patterns in the two tables differ in other ways as well. Mentions of process improvement overtake coordination as the most common category of SEPG primary responsibilities. In fact, more people (53 percent) mentioned process improvement as a

primary responsibility than as an SEPG function in general (45 percent). While many (44 percent) of the SEPGs do perform traditional software support functions, considerably fewer (11 percent) claim such functions as their primary responsibilities.

Table 10. SEPG Primary Responsibilities¹ (n=121)

	<u>Percent performing function²</u>
Process improvement	53
Coordination	42
Process definition	19
Improvement of CMM level	14
Support function(s)	11
Training / Education	2
Facilities ³	8
Metrics	5
Action plan execution	11
Standards	10
Assessments / Evaluations	5
Other ⁴	4
Don't know	1
Does not apply - SEPG too new	2
Did not respond	9

¹ Based on responses to the question: "What is your SEPG's primary responsibility?"

² Column totals to more than 100% due to multiple responses.

³ Includes configuration management, software engineering environments (SEE), CASE, and reuse.

⁴ Includes references to collecting "lessons learned," improving software product quality and time to market, "general question => general answer," "Not much at the current time...", and "Good Question."

Finally, several people (14 percent) report that improving their organizations' maturity levels is a primary SEPG responsibility mandated by their management. Such references do not necessarily indicate an uncritical attempt to reach "level 2 in '92" (or level 3 in '93). Indeed some of them may be shorthand among those familiar with the CMM for a commitment to real process improvement. However, such responses do raise a legitimate concern about the degree of sophistication in the community about the CMM and its application.

3.3 Initiation

A third open-ended question asked the respondents to describe the planning and related activities that it took to start their SEPGs. Their responses are summarized in Table 11. Well over a third of those responding highlighted the importance of support from managers who can be made to appreciate the need for process improvement. Of course, those who would like

to see viable SEPGs established cannot necessarily choose their own enlightened organizational management. However, the references to the importance of individual champions (23 percent) and steering committees and related working groups (21 percent) indicate that the workshop participants feel that hard work can pay off. In a related vein, close to 30 percent of these individuals stressed the importance of having done a software process assessment as a precursor to establishing their SEPGs.⁷

Table 11. Activities Required to Start SEPGs¹ (n=121)

	Percent responding ²
Management sign-on	37
Senior management	29
Middle management	16
Conducted assessments and/or evaluations	27
A dedicated champion	23
Group - Committee work	21
Secured needed resources	8
Threat of SCE directives	6
Help from the SEI	6
Enhancement to existing organization	4
Sign-on of technical staff	3
Other ³	4
Don't know	11
Does not apply - SEPG too new	2
Did not respond	12

¹Based on responses to the question: "What kind of planning and related activities did it take to get your SEPG started?"

² Column totals to more than 100% due to multiple responses.

³ Responses include references to "recognition...[of] need...", "Stupid question. Not near enough room or time to discuss here," "Identify needs...", "Ad-hoc start (hallway discussion)," and help from a consultant.

3.4 Accomplishments

The final open-ended question in this series asked about the major accomplishments attributable thus far to the participants' SEPGs. Their answers are summarized in Table 12. Notice there that a large majority described planning oriented activities. Those classified as "CMM based" include references to development of new action plans, process definitions, and

⁷ Most of these references were explicitly to SEI assessments or self-assessments. A few references were made to capability evaluations (SCEs); however they mentioned positive experiences rather than the compulsion of having to do the SCEs.

important software development standards. The "communication and education" category includes references to activities meant to improve organizational commitment to process improvement.⁸

Table 12. Major SEPG Accomplishments¹ (n=121)

	<u>Percent responding²</u>
Process planning	70
CMM based activities	57
Communication - Education	35
Secured staff - Management commitment	9
Process implementation	59
Action plans	36
New assessments	25
Metrics programs	12
Organizational infrastructure	9
Methods and tools ³	9
Testing program	1
SQA	1
Other ⁴	4
Don't know	1
Does not apply - SEPG too new	7
Did not respond	8

¹ Based on responses to the question: "What are the major accomplishments of your SEPG thus far?"

² Column totals to more than 100% due to multiple responses.

³ Includes references to the establishment of configuration management, SEE, CASE, and reuse facilities.

⁴ Includes references to "survival" (2) and "nothing as yet" (2).

However, major SEPG accomplishments described by the respondents are not limited to planning efforts. Notice also in Table 12 that close to 60 percent of the respondents described at least some changes in their organizations' normal way of doing business. Participants had to mention tangible changes for a response to be classified as "process implementation." Planning alone was not enough. For example, participants had to claim actual plan implementation to be included in the "action plans" category. Similarly, the "organizational infrastructure" category includes references to the establishment of organizational entities and resources meant to maintain long-term process improvement activities.

⁸ These include a few specific references to newly instituted training programs, which might better be classified as actual implementation rather than planning only.

4 Status of Process Improvement Efforts

4.1 Improvement Plans

The participants were asked if their organizations have developed software process improvement plans. As seen in Table 13, 63 percent stated that they did have some type of software process improvement plans.

Table 13. Existence of a Software Process Improvement Plan¹ (n=169)

	<u>Percent responding²</u>
Yes	63%
For the organization	35
For my division	26
Elsewhere	15
No	34
Did not respond	<u>3</u>
	100%

¹ Based on responses to the question: "Has your organization developed a software process improvement plan?"

² The "yes" sub-column totals to more than 63% due to multiple responses.

Those who reported that their organizations have a software process improvement plan were asked to describe the method(s) on which the plans are based. The responses are summarized in Table 14. The large majority (81 percent) reported that their plans were based on SEI methods, specifically either the CMM and/or TR-23. Over 60 percent reported reliance on TR-23 while over one half indicated that they were currently basing their work at least partly on the CMM. Moreover, much of the "other process improvement work" was based on SEI methods.

Table 14. Basis for Software Process Improvement Plan (n=107)

	<u>Percent responding¹</u>
SEI Methods	81
TR-23	61
The CMM	54
Other process improvement work	48
SEI-style self assessments	18
SEI & non-SEI mixed methods	7
Other methods ²	26

¹ Both columns total to more than 100% due to multiple responses.

² Includes references to general knowledge (11), TQM (3), Deming (4), Joiner (2), Crosby (2), Jones (1), Juran (1), Radice (1), 2167a and 2168 (1). Two respondents expressed confusion, while several did not clarify their choice.

4.2 Obstacles to and Facilitators of Process Improvement

All of the respondents to the questionnaire were asked to describe any major obstacles to software process improvement in their organizations, regardless of whether or not they have an SEPG. A companion question asked what facilitated their process improvement efforts.

4.2.1 Obstacles

Notice in Table 15 that management is the most commonly mentioned obstacle to software process improvement. People's comments include references to management resistance, lack of support from management, and misunderstanding of the importance of process improvement. Consider, for example, the following response.

Management does not want the general guidelines we have given them. They want the Cliff Notes. They do not want guidelines and assessments. They want processes and rules.

Given the number of people who mention lack of support from management, it is not surprising that shortages of staff and other SEPG resources are the next most commonly mentioned obstacle to process improvement. These are followed by references to inadequacies of the current organizational structure and "culture."

The "organizational culture" category includes vague references to cultural resistance and skepticism about process improvement and total quality management (TQM). On the other hand, responses classified as "organizational structure" refer to specific problems in the current organization that inhibit change. It may be difficult for supporters of process improvement to do much about corporate culture as evidenced by the following comment.

[Our] culture is not data-oriented. [The] organization/culture is proud of being non-DoD and non-standardized.

However, structural references to "imposed schedules from marketing" or "differences in approaches in software development and support" are more tangible and possibly amenable to change.

Some of the "culture" comments clearly are indicative of substantial impediments to change. For example, a "hardware based culture" will not change quickly. However, even some of the "culture" comments are tangible enough to provide direction for change (for example, "Establishing a culture of analysis and planning prior to commitment").

While references to management commitment are much more common, notice in Table 15 that quite a few respondents (12 percent) also mention the importance of gaining commitment from the engineering and technical staff. Recall from Table 11 that support from the technical staff was mentioned relatively infrequently (three percent) as being important in establishing SEPGs. Unlike management support, widespread technical support does not appear to be a necessary condition for establishing an SEPG as an organizational entity. However, a lack of

active support from technical people is more likely to be mentioned as an obstacle to the success of a broader software process improvement effort.

Although the percentage is relatively low (six percent), it is also worth emphasizing that some individuals discussed the lack of evidence about return on investment as a major obstacle to software process improvement. Many or most of the people who attend a function like the SEPG Workshop are themselves likely to believe that a software process improvement effort clearly is a worthwhile endeavor. It is noteworthy that even some of these "believers" mentioned return on investment as an obstacle.

Table 15. Major Obstacles to Software Process Improvement¹ (n=157)²

	<u>Percent responding³</u>
Management ⁴	43
Inadequate SEPG resources	22
Organizational structure	17
Organizational culture	13
Engineering / Technical staff	12
No Evidence of return on investment	6
Too early to tell	4
Other ⁵	7
Don't know	1
Did not respond	22
Does have an SEPG	18
Also did not answer companion (facilitation) question	5
Did answer companion (facilitation) question	17

¹ Based on responses to the question: "What major obstacles must a software process improvement effort overcome in your organization and/or division?"

² There are people who attended the workshops and filled out the questionnaire who are consultants or who come from organizations that do not themselves do software development work. Twelve individuals indicated in response to either this question and/or the one about facilitators that the question does not apply to them for those reasons, and they are excluded from the figures reported.

³ Column totals to more than 100% due to multiple responses.

⁴ Senior and middle management references are combined because it is difficult to distinguish between the two in many of these responses. Senior management, however, seems to be implied more often.

⁵ Responses include reference to an organizational emphasis on reaching "an SEI maturity level by a given date," the failure to have done a process assessment, the need for a "usable process definition," the "inertia of existing methods," the idea that "SQA will not be separate in the Air Force," the need for "how to" education for action planning, the existence of past failures, the need to demonstrate successes (2), and comments that we were unable to interpret (3).

The number of people who failed to answer this question is considerably higher than the number of people who did not answer the questions asking about the SEPGs. However, notice in the table that a large proportion of those who failed to answer the question about obstacles did answer the companion question about facilitators. Only five percent answered

neither question. Similarly, a large proportion of those who failed to answer are also those who report having SEPGs in their organizations. At least some of these people may have failed to answer the question because they could not think of any particular obstacles to software process improvement.

4.2.2 Facilitators

As mentioned earlier, we also asked people to identify what in particular has facilitated their process improvement efforts. Once again, the most common answers emphasized the importance of management "signing on" and/or making top-level command decisions. Notice in Table 16 that responses classified as "demand" are the next most common facilitators. These responses include references to SCE directives and other customer demands for process improvement. Answers classified as referring to "organizational incentives" include a desire to enhance corporate market share, the existence of other quality initiatives such as TQM, and mention of executive bonuses.

Since the CMM emphasizes management, it is not surprising that more references are made to the importance of management than of technical staff. However, a substantial minority (15 percent) did respond to this general, open-ended question by discussing the importance of the technical staff in facilitating process improvement

Table 16. Major Facilitators of Software Process Improvement¹ (n=157)²

	<u>Percent responding³</u>
Management	48
Senior management	35
Middle management	23
Demand	22
Organizational incentives	15
Engineering / Technical staff	15
Dedicated champion	11
Help from the SEI	9
SEPG efforts	8
Assessments / Evaluations	5
Group - Committee work	4
Secured needed resources	4
Consultants	2
Other ⁴	6
Don't know	1
Did not respond	15
Does have an SEPG	8
Also did not answer companion question (obstacles)	5
Did answer companion question (obstacles)	10

¹ Based on responses to the question: "What in particular has facilitated the software process improvement effort in your organization and/or division?"

² There are people who attended the workshops and filled out the questionnaire who are consultants or who come from organizations that do not themselves do software development work. Twelve individuals indicated in response to either this question and/or the one about obstacles that the question does not apply to them for those reasons, and they are excluded from the figures reported.

³ Column totals to more than 100% due to multiple responses.

⁴ Responses include reference to pre-existing organization, "pilot project success," "proven success....," "nothing in particular," "core competency in software engineering program," "still struggling with this," and unable to interpret (4).

5 Characteristics of the Organizations

To characterize the size of the organizations represented at the SEPG Workshop the questionnaire requested information regarding the number of individuals working in software development or maintenance. Most of the workshop participants come from moderate to large sized software development or maintenance organizations. Note in Figure 9 that three-quarters of the participants report that their divisions have 50 or more technical staff members, and half have 210 or more.⁹ As seen in Figure 10 on the next page, the numbers of managerial staff also vary considerably. Three-quarters of the organizations have 10 or more managerial personnel, half have at least 25 managers, and one-fourth have at least 56.¹⁰ In general, there is roughly a ten to one difference between the numbers of technical and managerial personnel.

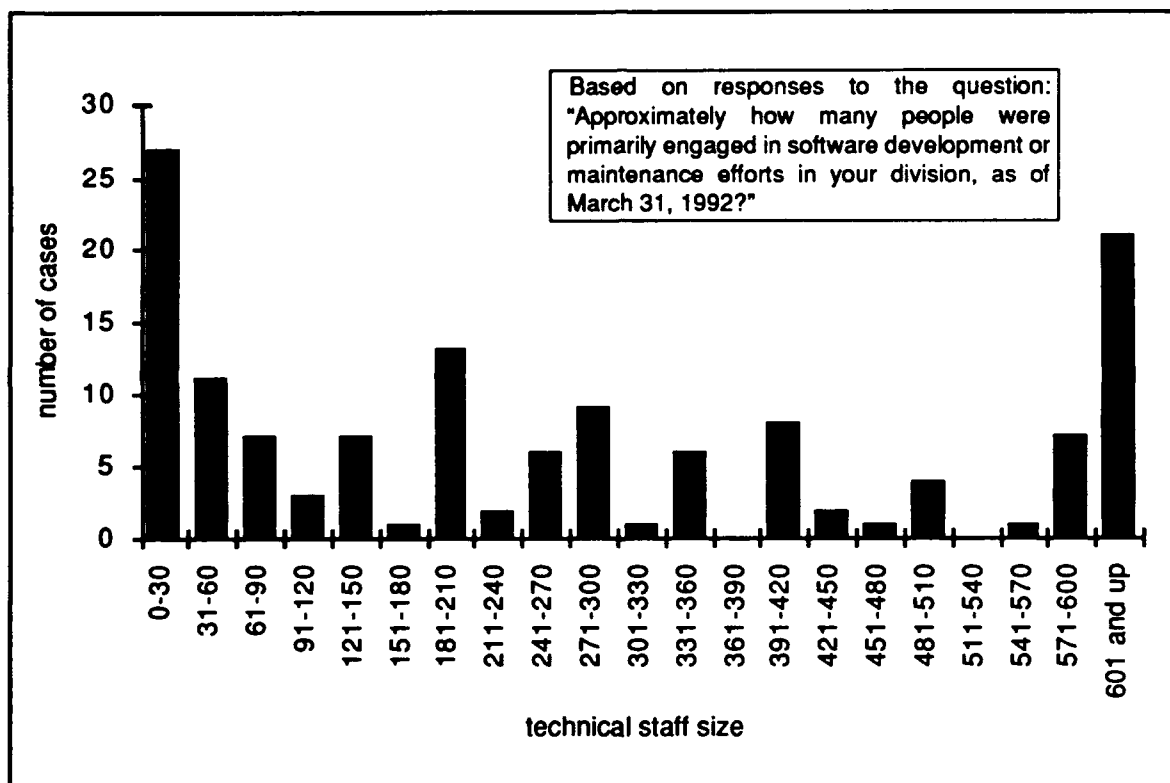


Figure 9. Size of the Organization's Technical Staff (n=137)

Figure 11 includes a summary of the number of software development or maintenance projects at the divisional level. As seen in the figure, the most common number of projects is 10. The median number of projects is 20, and the largest number of projects reported by a workshop participant is 500 projects. Note, though, that one-fourth of the participants report coming from organizational entities that supported eight or fewer projects.

⁹ The maximum number of technical staff reported is 20,000.

¹⁰ The maximum number of managerial personnel reported is 2,000.

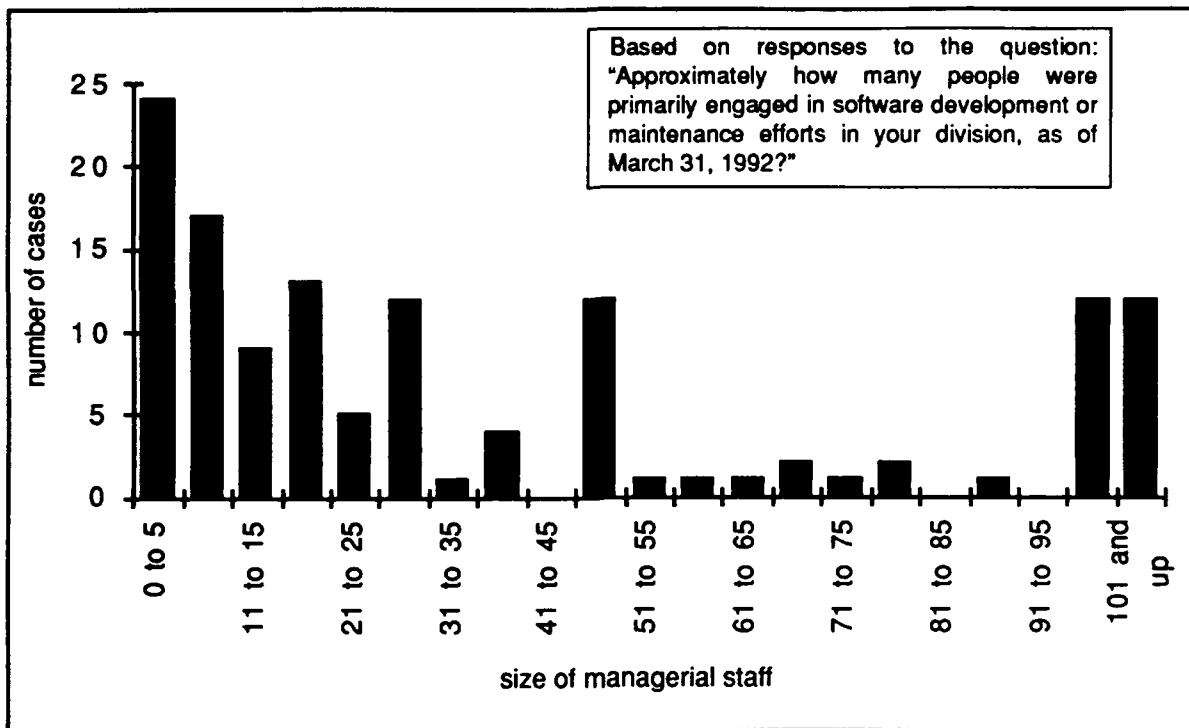


Figure 10. Size of the Organization's Managerial Staff (n=130)

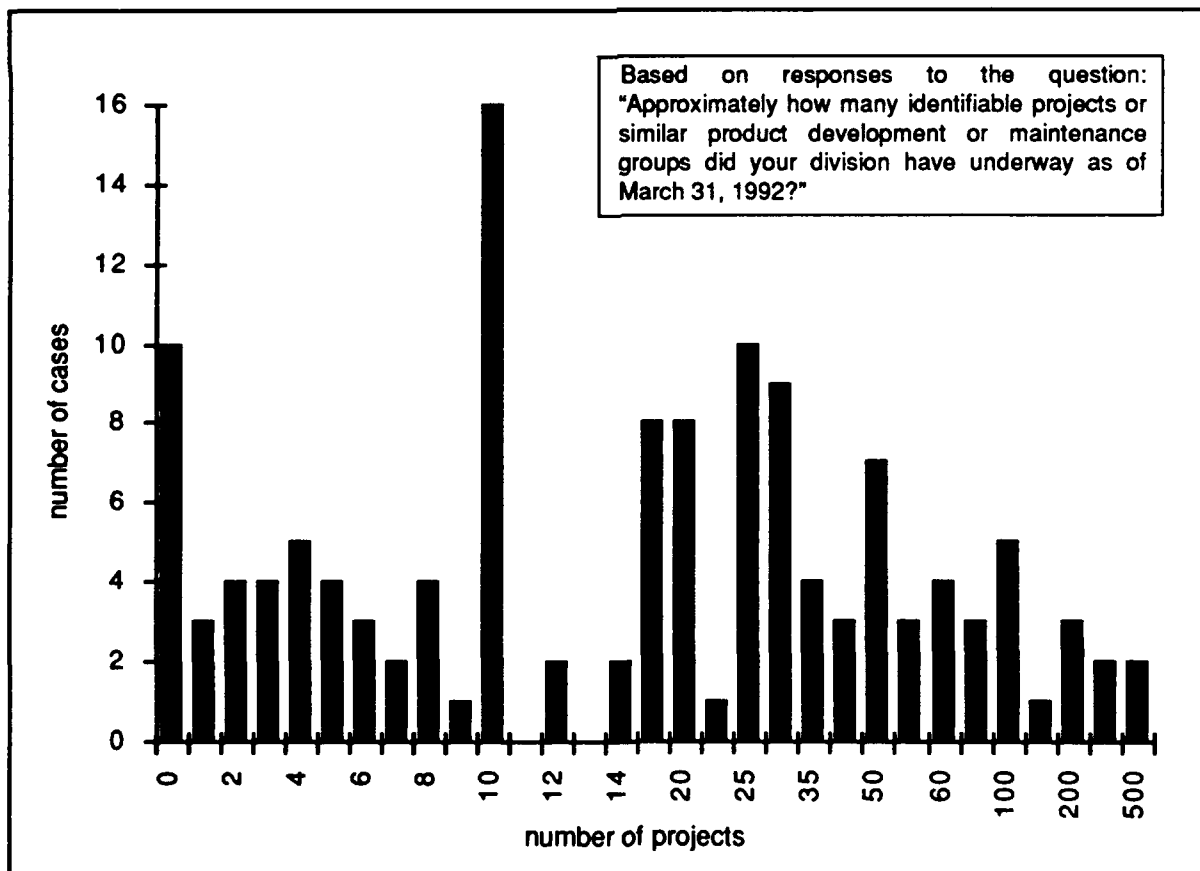


Figure 11. Number of Software Development or Maintenance Projects (n=133)

Tables 17 and 18 describe the amount of control that the participants report their divisions maintain over important operational and functional areas. Table 17 shows that 78 percent claim some type of direct control over the establishment of standard operating procedures (SOPs). Almost one third indicate that they can set their procedures independently, without required higher level review. On the other hand, as seen in Table 18, fewer workshop participants (56 percent) report any type of control over the funding of their software improvement efforts. Only 21 percent stated that they had complete independence in allocating funding for process improvement.

Table 17. Control over Standard Operating Procedures¹ (n=169)

	<u>Percent responding</u>
Without organizational review	32%
Subject to organizational approval	46
No direct control	8
Other responses	9
Did not respond	<u>5</u>
	100%

¹ Based on responses to the question: "Does your division have direct control over the establishment of its standard operating procedures?"

Table 18. Control over Funding¹ (n=169)

	<u>Percent responding</u>
Without organizational review	21%
Subject to organizational approval	35
No direct control	31
Other responses	5
Did not respond	<u>8</u>
	100%

¹ Based on responses to the question: "Does your division have direct control over funding for its software improvement efforts?"

6 Characteristics of the Participants

6.1 Background

The questionnaire contains several questions about the workshop participants' backgrounds in software engineering. Job titles provide one way to characterize that background. Notice in Table 19 that over 40 percent of the participants have job titles that imply technical responsibilities; about half of these individuals (20 percent of all of the participants) identify themselves specifically as "software engineers." The management category is next most common; over three quarters of the people in this category (22 percent of all of the participants) identified themselves as "manager."

Table 19. Current Job Title¹ (n=169)

	<u>Percent responding²</u>
Technical	42 %
Management	28
Process	15
Other ³	12
Did not respond	<u>5</u>
	102 %

¹ Based on responses to the question: "What is your current job title?"

² The responses do not total to 100% due to rounding error.

³ Includes specialist (8), consultant (3), operation research analyst (2), business planning (2), and resident affiliate (1).

Because the same people can have both technical and managerial responsibilities and job titles alone can be misleading, we also asked the participants to classify themselves following the categories presented in Table 20. The participants were allowed to check as many classification areas as they felt were appropriate. Notice in particular that almost 70 percent of the participants chose the software process improvement category as an important descriptor of their work responsibilities.

The participants were also asked to identify the highest educational degrees they have earned. As shown in Table 21, almost as many of the participants hold an advanced (master's or doctoral) degree as have an associate's or bachelor's degree. Those responding to the "other" category described course work they are in the process of completing.

The participants also provided information regarding the major fields of their degrees. The results in Table 22 show that most of the participants received degrees in science and engineering related fields. However, over 20 percent have management degrees. As seen in the table, there is a good deal of diversity in their educational backgrounds.

Table 20. Self-Classification of Position¹ (n=169)

	<u>Percent responding²</u>
Senior managerial	8
Middle or line managerial	27
Senior or lead technical	34
Other technical	6
Software process improvement	69
Product development	10
Software quality assurance	13
Configuration management	7
Technical support or training	14
Other	11

¹ Based on responses to the question: "What sort of a position is it?"

² Column totals to more than 100% due to multiple responses.

Table 21. Highest Degree Earned¹ (n=169)

	<u>Percent responding</u>
Associate's	2%
Bachelor's	46
Master's	40
Doctoral	6
Other	4
Did not respond	<u>2</u>
	100%

¹ Based on responses to the question: "What is the highest degree you have earned?"

The participants were asked to state when their most recent degrees were awarded. The dates range between 1946 and expected in 1994. One-fourth of the participants received their degrees by 1971, half of them earned their most recent degree by 1977, and three-quarters by 1983. As seen in the following section, the workshop participants have a substantial amount of software employment experience, so it is not surprising that most of them completed their formal education some time ago.

Table 22. Major Field¹ (n=169)

	<u>Percent responding²</u>
Mathematics and Science	51
Mathematics	24
Computer Science	20
Physics	8
Other ³	1
Engineering	30
Electrical ⁴	18
Other ⁵	15
Business and Management	21
Management ⁶	13
Information Systems	8
Other ⁷	4
Other ⁸	8
Did not respond	2

¹ Based on responses to the question: "What was your major field?"

² Both columns and some "other" categories total to more than 100% due to multiple responses. Multiple responses exist for some individuals with double majors or more than one degree.

³ Chemistry (1), and Physical Science (1).

⁴ Includes one "electronics" major.

⁵ Computer (5), Software (4), Industrial (4), Aeronautical (2), Civil (2), Engineering (2), Mechanical (2), Biomedical (1), Chemical (1), and Structural (1).

⁶ Business Administration (6), Business (6), MBA (4), Systems Management (3), Engineering Management (1), Industrial Management (1), Management (1), and Management Science (1).

⁷ Accounting (3), Ergonomics (1), Finance (1), Human Resource Development (1), Marketing (1), and Quantitative Analysis (1).

⁸ Economics (2), Psychology (2), Sociology (2), Statistics (2), Anthropology (1), Architecture (1), Decision Sciences (1), Music Education (1), Philosophy of Science (1), and Political Science (1).

6.2 Software Experience

The workshop participants provided information regarding their experience in several key areas. They were asked about both length of experience in years and breadth of experience based on the number of software projects on which they have worked. As shown in Table 23, these individuals as a group possess a good deal of software related experience. Their median length of overall software experience is 15 years. Similarly, half of the participants have worked on at least 11 software projects.

The participants generally have spent more time in technical than in managerial positions. The median figures for software technical experience are 10 years and 6 or 7 projects. However, the participants' median software management experience is five years and four

projects. Given the relative recency of software process improvement efforts, it is not surprising that they have less experience in process improvement work. The median number of years spent on process improvement is two, as is the median number of projects.

Table 23. Software Experience¹

	<u>Number of years</u>	<u>Number of projects</u>
Present organization		
Median	7.5	5
Number responding	166	136
Present division		
Median	4	4
Number responding	163	130
Present position		
Median	2	2
Number responding	165	125
Overall software experience		
Median	15	11
Number responding	167	135
Software technical experience		
Median	10	6.5
Number responding	162	128
Software management experience		
Median	5	4
Number responding	155	122
Software process improvement experience		
Median	2	2
Number responding	162	118

¹ Based on responses to the question: "What is your experience in..."

7 Summary

The data described in this report are based on the responses to a self-administered questionnaire received from 169 individuals who participated in the Software Engineering Process Group (SEPG) Workshop held in Tysons Corner, Virginia, in April of 1992. These workshop participants constitute approximately 70 percent of those who received a copy of the questionnaire. The questionnaire, a copy of which is appended to this report, asked the participants for their judgments about the quality of the workshop and for information about SEPGs and process improvement activities in their home organizations.

Most of the workshop participants come from moderate- to large-sized software development or maintenance organizations. Three-quarters of the participants report that their divisions have 50 or more technical staff; half have 210 or more. Half of the participants report that their divisions currently staff at least 20 projects; one quarter have 40 or more projects underway.

The workshop participants bring a substantial amount of software experience, having both technical and managerial experience. On average, they have 15 years of overall software experience. Their software process improvement experience is substantially shorter, on average only two years.

7.1 Evaluation of the Workshop

In general, the participants rated the SEPG Workshop highly. They were particularly impressed by the quality of the keynote speakers, and most of the participants (73 percent) indicated that they would attend a future SEPG Workshop. Only three percent said they definitely would not attend another SEPG Workshop. The workshop notebook, however, received less favorable reviews, indicating an area that should be addressed for future SEPG Workshops.

The participants expressed similar views about the Capability Maturity Model (CMM) Workshop held in conjunction with the SEPG Workshop. Half of those responding to a question about the CMM disposition reviews chose the two most favorable of five response categories. Sixteen percent rated the reviews as "excellent" while only eight percent called them "inadequate." Moreover, 61 percent of those responding said that the next SEPG and CMM Workshops should also be held concurrently.

7.2 Status of SEPGs and Process Improvement

The establishment of SEPGs has been a relatively recent and rapidly growing phenomenon in the software improvement community. Seventy-two percent of the workshop participants (121 of 169 polled) responded that they come from organizations that maintain SEPGs. Most SEPGs are rather new. Few were established prior to 1990, and three-quarters have five or fewer full-time staff members.

The workshop participants report that they have had substantial management support for their efforts. However, there has been less commitment among the technical staff thus far.

Most SEPGs have focused their efforts on planning oriented activities. However, some workshop participants claim that their SEPGs have already instigated changes in their organizations' software processes.

Almost two-thirds of the workshop participants indicate that their organizations have a software process improvement plan in place. Over 80 percent of those who have a process improvement plan base it on SEI methods.

Finally, the workshop participants report that their organizations permit a substantial degree of management autonomy at the division level; 78 percent of the participants report some degree of division level control over standard operating procedures, with almost a third indicating that the control is not subject to further organizational review. There is somewhat less division level control over funding for software improvement efforts. However, 56 percent of the participants report that they can allocate funds subject to approval by the organization, and 21 percent can approve funding without required organizational review.

Appendix. *SEPG Workshop: Questionnaire & Event Evaluation*



SEPG Workshop: Questionnaire & Event Evaluation

April 9, 1992

This document contains questions asking for your judgements about this week's SEPG workshop. To help us better interpret your answers about the workshop, the document also contains questions about your software organization, its SEPG and your own software experience. Your answers will help us to improve future workshops, and provide useful information about the functioning of SEPGs in general.

In order to ensure meaningful results, everyone who is attending the workshop should complete one of these forms. As an incentive for you to do so, everyone who completes a form will receive a summary report based on the data we collect.

Please read and answer all of the questions. If you wish to comment on any questions or qualify your answers, please use the comment spaces provided. We will be using optical scanning technology to enter the data, so please print or write neatly throughout the questionnaire.

Your answers will be held in strict confidence. Any information identifying you will be kept separate from your answers, which will be reported in combination with those of other individuals. Specific answers will not be identified in any manner.

Thank you for your help.

Jonathan Addelston, PRC Inc., McLean, VA
Miguel A. Carrio, Jr., MTM Engineering, McLean, VA
Don O'Neill, Consultant, Gaithersburg, MD
Stan Rifkin, Master Systems, Inc., McLean, VA
Joan Wieszka, IBM Federal Sector Division, Bethesda, MD
SPIN
Software Process Improvement Network
Washington, D.C.

Eugene C. Bounds
Bill Curtis
Helen Joyce
Mike Konrad
Dave McKeehan
Mark Paulk
Rich Pethia
Software Engineering Institute
Carnegie Mellon University
Pittsburgh, Pennsylvania

Completing the Questionnaire

1. Please use the following conventions to specify numeric answers:

0 1 2 3 4 5 6 7 8 9

2. Please keep your marks within the check boxes. Any mark will do: ☐ ☒ ☐
3. Please also keep your written answers within the free format answer boxes. Use the margins if you need more space, but please don't write over the check or answer boxes.
4. You may use pencil or pen.

Part I Here are some questions about your background in software engineering.

- 1 What is your current job title? *Please Specify*

- 1.1 What sort of a position is it? (*Mark As Many Boxes As Apply*)

- ☐ SENIOR MANAGERIAL
- ☐ MIDDLE OR LINE MANAGERIAL
- ☐ SENIOR OR LEAD TECHNICAL
- ☐ OTHER TECHNICAL

- ☐ SOFTWARE PROCESS IMPROVEMENT (*for example, in an SEPG*)
- ☐ PRODUCT DEVELOPMENT OR MAINTENANCE
- ☐ SOFTWARE QUALITY ASSURANCE
- ☐ CONFIGURATION MANAGEMENT
- ☐ TECHNICAL SUPPORT OR TRAINING
- ☐ OTHER *Please Describe Briefly*

Part II Here are some questions about software development/maintenance in your organization.

1 First of all, does your organization or the division in which you work have an SEPG?
(Mark One Box)

☐ NO → If not, skip to question 2 on page 6

☐ YES ↓

1.1
(If you do have one)

Where in the organization does the SEPG exist? (Mark One Box)

☐ THE ORGANIZATION

☐ MY DIVISION

☐ OTHER Please Describe Briefly

1.2
Who in the organization has demonstrated their commitment to your SEPG?
(Mark As Many Boxes As Apply)

☐ SENIOR MANAGEMENT (e.g., at the organization or division level)

☐ MIDDLE MANAGEMENT (e.g., at the program or project level)

☐ TECHNICAL STAFF

☐ OTHERS Please Describe Briefly

1.3
When was the SEPG established? (Please Specify 0 1 2 3 4 5 6 7 8 9)

MONTH YEAR

⬜ ⬜ / ⬜ ⬜

1.4
How many people work in your SEPG?
(Please Specify For Each Category 0 1 2 3 4 5 6 7 8 9)

⬜ ⬜ FULL TIME

⬜ ⬜ PART TIME

⬜ ⬜ CONSULTANTS

1.5

What functions does your SEPG perform? *(Please Describe Briefly)*

1.6

What is your SEPG's primary responsibility? *(Please Describe Briefly)*

1.7

What kind of planning and related activities did it take to get your SEPG started? *(Please Describe Briefly)*

1.8

What are the major accomplishments of your SEPG thus far?
(Please Describe Briefly)

- 2 Has your organization developed a software process improvement plan?
(Mark As Many Boxes As Apply)

- ☐ NO
- ☐ YES -- FOR THE ORGANIZATION
- ☐ YES -- FOR MY DIVISION
- ☐ YES -- ELSEWHERE →

Please Describe Briefly

2.1

Is it based on: (Mark One Box For Each Category)

	YES	NO	I DON'T KNOW
The CMM (CMU/SEI-91-TR-24 and CMU/SEI-91-TR-25, released at the 1991 SEI Affiliates Symposium)	☐	☐	☐
Earlier SEI work (CMU/SEI-87-TR-23)	☐	☐	☐
Other process improvement work →	☐	☐	☐

Please Describe Briefly

- 3 What major obstacles must a software process improvement effort overcome in your organization and/or division? (Please Describe Briefly)

- 4 What in particular has facilitated the software process improvement effort in your organization and/or division? *(Please Describe Briefly)*

--

- 5 Approximately how many people were primarily engaged in software development or maintenance efforts in your division, as of March 31, 1992?
(Please Specify For Each Category 0:123456789)

:	:	:	:	:
---	---	---	---	---

TECHNICAL (for example, design, analysis, coding, configuration management, or quality assurance)

:	:	:	:	:
---	---	---	---	---

MANAGERIAL (including people with some technical duties)

:	:	:	:	:
---	---	---	---	---

OTHER *Please Describe Briefly*

--

- 6 Approximately how many identifiable projects or similar product development or maintenance groups did your division have underway as of March 31, 1992?
(Please Specify 0:123456789)

:	:	:
---	---	---

7 Does your division have direct control over the establishment of its standard operating procedures? *(Mark One Box)*

- ☐ NO
- ☐ YES -- SUBJECT TO APPROVAL BY THE ORGANIZATION
- ☐ YES -- WITHOUT REQUIRED REVIEW BY THE ORGANIZATION
- ☐ OTHER *Please Describe Briefly*

8 Does your division have direct control over funding for its software improvement efforts? *(Mark One Box)*

- ☐ NO
- ☐ YES -- SUBJECT TO APPROVAL BY THE ORGANIZATION
- ☐ YES -- WITHOUT REQUIRED REVIEW BY THE ORGANIZATION
- ☐ OTHER *Please Describe Briefly*

Part III Here are some questions about this and future SEPG Workshops.

1 How do you rate the current SEPG Workshop? *(Mark One Box For Each Category)*

	INADEQUATE OK EXCELLENT ← →				
The Workshop in General	☐	☐	☐	☐	☐
The CMM Workshop					
Disposition Reviews	☐	☐	☐	☐	☐
The Keynote Speakers	☐	☐	☐	☐	☐
The Panels	☐	☐	☐	☐	☐
The Working Sessions	☐	☐	☐	☐	☐
The Workshop Notebook	☐	☐	☐	☐	☐
The Birds of a Feather Sessions	☐	☐	☐	☐	☐

+

2 What did you like the most about the workshop? *(Please Describe Briefly)*

3 What did you like the least about the workshop? *(Please Describe Briefly)*

4 Should future SEPG Workshops continue to be designed around Working Sessions?
(Mark One Box)

- ☐ YES
- ☐ NO
- ☐ I DON'T KNOW

+

5 Would you attend another SEPG workshop in the future? (Mark One Box)

- ☐ YES _____
- ☐ NO
- ☐ DON'T KNOW

5.1 When should it be held? (Please Specify

0	1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---	---

)

MONTH YEAR

•	•
•	•

/

•	•
•	•

52 Should it be held in conjunction with another CMM Workshop?
(Mark One Box)

- ☐ YES
- ☐ NO
- ☐ DON'T KNOW

6 What would you change for future Workshops? (*Please Specify*)

--

7 What was your primary reason for attending the SEPG Workshop? (Please Specify)

--

+

Part IV Finally, we need to know how to contact you to give you your summary report comparing SEPGs.

This information is for administrative use only:
so we can send you your personalized report.
Your identity will be kept in strict confidence.

To keep your responses confidential, we will
detach this sheet prior to analyzing the data.

Respondent Identification: (Please Specify

0	1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---	---

)

YOUR NAME:

ADDRESS:

TELEPHONE:

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EMAIL:

Thank you very much for your time and effort!!!

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**SEPG Workshop:
Questionnaire & Event Evaluation**

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Dennis R. Goldenson, PhD
Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213-3890
dg@sei.cmu.edu

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