Peer Reviews in Real Life – Motivators and Demotivators

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Abstract

Peer reviews are an efficient quality assurance method in software development. Several reviewing methods exist to match the needs of different organizations and situations. Still, peer reviews are not practiced as commonly as one would suppose. This study aims at finding out what types of reviewing methods are in use in software companies, surveying the most important benefits of peer reviews and investigating reasons for not utilizing reviews. The study is carried out in companies locating in the Oulu region, but the results can be generalized to all small software companies. The results show that companies that use reviews have adjusted the process for their own needs. The main motivator for arranging reviews is the decreased amount of defects in products while the other aspects of reviews, such as process improvement or knowledge sharing are not considered as important. The main demotivator for reviews is lack of time and people resources.

1. Introduction

Most of us agree that healthy ways of life, such as physical exercise, low-fat food, low-cal drinks and even avoiding sunshine are good for us. Problem is that people don't follow these disciplined alternatives in their everyday life. Software review and inspection is in many aspects similar to these health promotion activities, software practitioners understand that they could improve the quality of software artifacts by means of software inspection, but many of them see inspection too rigid to be adopted in their development process. This unwillingness is weird, because e.g. software reviews and inspections are recognized among the 55 facts of software engineering [12] and in the top ten list of software defect reduction [2].

In this paper the assumed benefits and obstacles of software reviews and inspection in Finnish software companies are studied. According to [14], the motivations for arranging inspections have remained the same for years. Similarly, peer review methods have been claimed to possess a number of shortcomings that have rarely been empirically justified. Articles concerning peer reviews often state that the review method is not used in industry as widely as it should be. This is another claim that has hardly ever been validated with empirical data. Thus, the aim of this study is to find out, to which extent peer reviews are used in software companies and what forms of reviews are in use. Furthermore, the study aims to validate the motivators and demotivators of reviews that have been mentioned in literature.

Several types of peer reviews exist. The methods can be categorized according to their rigorousness and formality. For example, Wiegers identifies seven subtypes of reviews: Inspection, team review, walkthrough, pair review, passaroud and ad hoc review. In the literature, the methods are referenced with slightly varying terminology, but the essence of the methods remains the same. Inspection is the most rigid form of reviewing a document, involving statistical measurement of the process and strict rules for reading the document and logging the issues. Other reviewing methods have more dynamic structure and procedures. Ad hoc reviews are completely unplanned. [24] Figure 1 lists different reviewing methods according to their formality.

![Figure 1. Types of peer reviews [24].](image-url)
The rest of this paper is structured as follows. Chapter two summarizes the benefits and shortcomings of peer reviews recognized in literature. Chapter three introduces the research setting and methods used in this study. Chapter four summarizes the findings of the study and chapter five discusses the meaning of the results.

2. Benefits and Shortcomings of Peer Reviews

According to [20], software inspections provide the highest return of investment factor amongst the most common methods. The literature includes several experience reports that confirm the cost-effectiveness of peer reviews. Grady & van Slack [13] report total savings of 33% in specification, design, code and test planning phases in Hewlett-Packard after introducing inspections.

Because defects are found earlier, testing becomes easier and less expensive than without reviews. [10] Inspections and reviews can also reveal faults that would be difficult to find in testing. [22]

Peer reviews introduce also some indirect advantages. First, reviews are one of the few quality assurance techniques available for artifacts other than code. Any human-readable artifact produced during the software development lifecycle, including specifications and designs, can be reviewed. Finding defects in the early phases of development is, of course, less expensive than in later phases. [8]

The statistical data gathered in reviews is useful in causal analysis, defect tracking and when predicting costs and efforts needed to produce software. If the data is analyzed further, it can be used to initiate and guide process improvement activities to reveal the weakest areas of development. [1]

Software inspections and other types of reviews help the developers to keep themselves updated of each other's work. Inspection meetings can greatly enrich communication and engineering knowledge within the organization. [9, 24]

Table 1 summarizes some of the benefits that have been recognized to be obtained with peer reviews. The list of benefits in the table is by no means complete. Instead, the most often referenced advantages that have been mentioned in research and experience reports are listed in the table and some examples of the literature references are given. Benefits are grouped in table 1 into quite general categories, such as knowledge sharing and education, which means improved communication between the group members, enabling knowledge transfer from experts to novices.

Table 1. Benefits of reviews recognized in literature.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge sharing and education</td>
<td>x</td>
</tr>
<tr>
<td>Increased project awareness and tracking</td>
<td>x, x, x, x, x, x</td>
</tr>
<tr>
<td>Process improvement</td>
<td>x</td>
</tr>
<tr>
<td>Finding more defects</td>
<td>x</td>
</tr>
<tr>
<td>Finding defects earlier and faster</td>
<td>x, x, x, x</td>
</tr>
<tr>
<td>Reduced development costs</td>
<td>x, x, x, x, x, x</td>
</tr>
</tbody>
</table>

According to many literature sources, peer reviews are not as popular as one would suppose. [15, 16], for example, state that only 20% of software companies use inspections. However, there is little empirical research and evidence of reasons for low usage.

Arranging reviews in distributed environment may be complicated and extra tools are needed to enable convenient reviewing process. [16, 23] Furthermore, if parts of the development have been outsourced, traditional reviews may be inflexible. [5]

There can also be problems with the types and domains of the documents that are reviewed. For example, object-oriented code and designs require different reading techniques than their procedural counterparts. [7]

Reviews are human-centric, and some people issues may arise. Finding right people for reviews, especially in small companies that have limited number of developers available, may be challenging. [24] Conflicting personalities may also cause problems in meetings. [10]

Jalote and Haragopal have noticed that even though many companies recognize the benefits of peer reviews, the method is often considered unsuitable for the company's specific situation. This resistance is called NAH (not applicable here) syndrome. [15]

Establishment of the peer reviewing method may be difficult. Starting reviews requires investment in the beginning. Developers may also fear that reviews
would be used to benchmark individuals and project teams.

The list of disadvantages in Table 2 summarizes these and other most typical problems that have been identified in research articles. There are numerous other experience reports that indicate similar problems. References in the table provide an overview of the recognized problems. Lack of time is the most typical obstacle according to the literature sources. Investments that are needed in the introduction of review method are also considered a significant disadvantage.

Table 2. Obstacles to arranging reviews recognized in literature.

<table>
<thead>
<tr>
<th>Obstacle</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of time</td>
<td>Chimenti &amp; Leen [5]</td>
</tr>
<tr>
<td></td>
<td>Galkowski et al. [6]</td>
</tr>
<tr>
<td></td>
<td>Glass [11]</td>
</tr>
<tr>
<td></td>
<td>Johnson [16]</td>
</tr>
<tr>
<td></td>
<td>Laitenberger et al. [17]</td>
</tr>
<tr>
<td></td>
<td>O’Neill [18]</td>
</tr>
<tr>
<td></td>
<td>Shepherd &amp; Kelly [21]</td>
</tr>
<tr>
<td>Lack of human resources</td>
<td>x</td>
</tr>
<tr>
<td>Cost</td>
<td>x</td>
</tr>
<tr>
<td>Laboriousness</td>
<td>x</td>
</tr>
<tr>
<td>Complexity or inadequate training</td>
<td>x</td>
</tr>
<tr>
<td>Resistance to change</td>
<td>x</td>
</tr>
<tr>
<td>Inefficiency</td>
<td>x</td>
</tr>
</tbody>
</table>

3. Interviews

The data was gathered in semi-structured interviews in 13 software development divisions in 11 software companies at the Oulu region. The development organizations were smallish, eight of them having 18-75 employees. Smallest company had only five employees and the largest one several thousands, organized into independent divisions. Some companies operated in several locations, also in other countries.

The participant companies represented a variety of domains, including embedded systems, mobile services, data management systems and automation.

Interviewees were working at the quality assurance, project management or senior software development functions. They had a good view of the official development methodologies and processes and more importantly, they knew how the methods were applied in practice.

The interview was based on a form including 21 questions. Some of them were multiple choice questions and some were open questions. The questions attempted to find out what types of reviews were in use in the company. For that, the review types and the overall steps of the review process were explained to interviewees.

The first eight questions deal with the background information, such as size of the company and presence of a quality assurance system. The purpose of these questions was to get an overview of the status and orderliness of the quality function of the organization.

The next section of questions focused on finding out how comprehensive the review process in the company is. The questions concerned documents that were typically reviewed, selection and number of participants, tool support and reading techniques in use, data that is gathered in reviews and phases that the review process consists of.

The most important motives for arranging reviews were inquired. The interviewees were asked what of the listed motivators were considered the most important in the company. Finally, the interviewees were asked which obstacles to arrange reviews that were found in literature applied to their companies. They were asked to choose the main reasons for not arranging reviews.

Each interview lasted from 40 to 90 minutes. The questionnaire form was handed to all interviewees and the questions were discussed to the full and openly to gain common understanding and to create relaxed atmosphere. Review-specific vocabulary was also written in the questionnaire and clarified to the interviewees.

The part of the questionnaire that concentrates on review types, motivators and demotivators is listed in Table 3. Questions A, B, F, G, I and K are answered in a scale of 1 (not at all) to 5 (largely) or N/A. The other questions are open questions.

Table 3. Questionnaire about reviews.

<table>
<thead>
<tr>
<th>Interview questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. What review types are you familiar with?</td>
</tr>
<tr>
<td>• Management review</td>
</tr>
<tr>
<td>o I know the procedure</td>
</tr>
<tr>
<td>o It is used in organization</td>
</tr>
<tr>
<td>o I participate in it</td>
</tr>
<tr>
<td>o I recognize the need for it</td>
</tr>
<tr>
<td>• Inspection (The same sub-entries as above)</td>
</tr>
<tr>
<td>• Team review (The same sub-entries as above)</td>
</tr>
<tr>
<td>• Pair review (The same sub-entries as above)</td>
</tr>
<tr>
<td>• Walkthrough (The same sub-entries as above)</td>
</tr>
<tr>
<td>B. What documents are reviewed and how comprehensively?</td>
</tr>
<tr>
<td>• Requirements</td>
</tr>
<tr>
<td>• Designs</td>
</tr>
<tr>
<td>• Code</td>
</tr>
<tr>
<td>• Test plans</td>
</tr>
<tr>
<td>• Test specifications</td>
</tr>
<tr>
<td>• User manuals</td>
</tr>
</tbody>
</table>
• User interface designs
• Project documentation
• Contracts
• Others

C. Who is responsible for planning and managing of reviews?

D. Who participate in reviews?

E. How many people typically participate?

F. Which supporting tools are used in reviews?
• Checklists
• Summary report
• Issue log
• Typo list
• Computer tools

G. What phases does the review process have in your company?
• Planning
• Overview
• Preparation
• Review meeting
• Rework
• Follow-up

H. What data is gathered in reviews?

I. What of the following motivators do you concern to be important in your company when arranging reviews?
• Knowledge sharing
• Information sharing
• Education
• Project tracking and management
• Process improvement
• Finding more defects
• Finding defects before subsequent development phases
• Finding defects earlier

J. Do you think that reviews have been arranged extensively enough in your company?

K. If not, why?
• Lack of time
• Lack of resources
• Management does not require
• Only author understands the artefact
• Costs
• Inadequate knowledge on reviews
• Laboriousness
• Geographically distributed teams
• Reviews are not applicable in the organization
• No need to review

The full questionnaire used in interviews can be found in the i3 research group homepage (http://www.tol.oulu.fi/i3).

The research questions that were especially interesting were: 1) What types of peer reviews are utilized in real life companies in the Oulu region? 2) What factors inspire the companies to review their software documents? 3) What factors inhibit or restrain the review process?

Semi-structured interview was chosen for the data collection method, as we wanted to ensure that the interviewees had adequate knowledge of reviewing methods. Furthermore, we felt that such an interview allowed gaining more in-depth information about the companies’ situation than a form-based survey.

4. Results

Twelve development units from ten companies were chosen for the final data analysis. To ensure the regularity of the data, interview from one company was left out from the analysis, because the organization was considerably larger than the others. Review processes of that company will be analyzed in different context.

Because the size of the sample is rather limited, statistical methods have not been used to analyze the data. Regardless of the sample size, the data can be investigated in reflection to the research questions and indications of the review practices can be outlined from the data.

Almost all companies had addressed quality issues somehow. Seven companies had established a quality assurance group and six companies had a quality handbook in use. Seven companies had an established testing group.

The software inspection was the least known peer review method. Interviewees were more familiar with management reviews, team reviews, pair reviews and walkthroughs. The semi-structured interview proved itself in question A, as even though some interviewees claimed to know inspections, further discussion of the details of the method revealed that they did not actually know it very well.

The twelve companies were divided into three categories according to the rigidity and coverage of their review processes. Companies that had quality handbooks and actively managed the quality assurance functions were put in class I. If the quality operations were considered less mature, the company was put in class II or class III. The quantity of documentation that were reviewed and the frequency of arranging reviews were other classification foundations.

Five companies were finally categorized to belong to the first class, four in the second class and three in the third class. This classification helps to see, if the maturity of the development process has effect on the frequency and coverage of reviews. Table 4 summarizes the types of reviews that are used in these three classes of companies. The leftmost column of the table shows the category of the company and bullets in each cell represent the frequency of arranging each type of reviews.

| Table 4. Reviews in use in different types of organizations. |
As can be observed from the table, all companies exercise management reviews, i.e. they use reviews for evaluating the project progress. Only the most matured companies use inspections to validate documentation, whereas team reviews are used in all companies to some extent. Pair review is rather popular type of review, as even class III companies use it sometimes and more matured companies use it regularly. Walkthrough is clearly an occasional alternative; companies use it sometimes despite the class that they belong to.

Project documentation and software designs are the most common documents that are reviewed. Requirements specifications and code are also quite frequently reviewed in several organizations, while test plans and especially contracts are reviewed less frequently in the companies.

In most companies the author is responsible for initiating the review. Only a couple of interviewees said that the quality assurance group either invited reviews or provided support for reviews. The main responsibility of arranging reviews seems to belong to the project manager in these small companies.

The number of participants follows quite well recommendations. The interview data clearly shows that a bigger number of people participate in management reviews, walkthroughs and team reviews than in inspections. One reason for this could be the rigidity of the method – finding skilled inspectors in a small company may be difficult.

E-mail is the most popular supporting tool in arranging reviews. E-mail is used mainly for distributing the material and sending invitations to the participants. Review report was produced always or almost always in ten companies. Surprisingly, checklists were used only sometimes in most companies and typo lists for reporting minor defects were not used in any of the companies. Four companies had implemented a dedicated database application for data gathered in reviews. Traditional review reporting documents were often adjusted to the needs of the company. For example, issue log and summary report could be combined, or the information was stored directly in database without paper versions of the forms.

Next, phases that were included in the review process of a company were inquired. The rework phase is only phase that is included in every company's process. Individually done review – preparation – is present in almost all companies, but the other stages are implemented less frequently. About half of the interviewees reported that reviews are planned and followed up always in their companies. The overview phase was only sometimes. Only a couple of the companies always held review or inspection meetings. In half of the companies meetings were arranged almost always. Figure 2 summarizes the phases that the review processes of the companies consist of.

![Figure 2. Review phases.](image)

Question H concerned the data that is collected during reviews. The number of defects, severity of a defect and status of the document (approved/rejected) were mentioned by more than five interviewees. Other metrics were more sporadic. For example, defects per page, defects per hour and preparation time were mentioned by a couple of interviewees.

Questions I, J and K were the most interesting in this questionnaire. First, reasons for arranging reviews
in the company were asked from the interviewee. Results are represented in Table 5. Numbers in the table represent the number of interviewees that chose the answer option. E.g. one person stated that knowledge sharing is seen as a very important motivator for reviews in his or her organization and seven people considered it important.

As can be seen in the table, finding more defects and finding them earlier in the development cycle are the main motivators for arranging reviews in most organizations. Ten or more respondents considered these factors as very important or important motivators within their organizations.

**Table 5. Review motivators recognized in interviews.**

<table>
<thead>
<tr>
<th>Motivator</th>
<th>Very important</th>
<th>Important</th>
<th>Rather important</th>
<th>Some importance</th>
<th>Not important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge sharing</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Information sharing</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Education</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Project tracking and management</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Process improvement</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Finding more defects</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Finding defects before subsequent development phases</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Finding defects earlier</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

An interesting observation can be made when these motivating factors are contrasted to the state of practicing reviews (inquired in questions A and B). It seems that even though the management reviews are the most frequently arranged type of reviews and project documentation the most common type of target of reviews, motivation for using reviews as a tool for managing and tracking project performance is considered only moderately important.

Process improvement and information sharing are other areas that are considered less important than the other motivators. One reason for this could be the size of these organizations. When development teams are small and team members communicate with each other in everyday work, the role of review meetings as an additional communication channel is less significant.

Finally, the reasons for not practicing reviews were investigated. Answers that the interviewees gave to this question are summarized in Table 6. Numbers represent the number of respondents that chose a specific option.

**Table 6. Review obstacles recognized in interviews.**

<table>
<thead>
<tr>
<th>Obstacle</th>
<th>Very important</th>
<th>Important</th>
<th>Rather important</th>
<th>Some importance</th>
<th>Not important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of time</td>
<td>8</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lack of resources</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Management does not require</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Only author understands the artifact</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Costs</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Inadequate knowledge on reviews</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Laboriousness</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Geographically distributed teams</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Reviews are not applicable in the organization</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>No need to review</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>

Results indicate clearly that shortage of time and resources are the most important obstacles to arranging reviews in these companies. In fact, none of the other problems was considered very important by the interviewees except for geographic distribution, which was a very important problem in one organization. Especially unanimous the company representatives were about the appropriateness and necessity of reviews. All said that reviews would be applicable in their organization and almost all recognized the need to review software documentation in order to improve quality.

Reviews are considered somewhat laborious by about half of the interviewees. The third obstacle in the list (reviews are not required by the management) is seen as at least rather important problem by four respondents. There are slight expertise problems, also, as some interviewees state that reviews are not practiced because there is a lack of knowledge either on the product or the review process.
5. Discussion

This paper aims at comparing the benefits and shortcomings of peer reviews found in literature and real life. The first contribution of the study is that it provides a snapshot from smallish Finnish software companies, describing the state of practice report on peer reviewing methods.

It is often stated in research articles dealing with reviews and inspections that reviews are not used in industry as widely as they should. However, the literature rarely provides empirical evidence for the statement. This paper aims at providing information from real-life companies to outline how widely the method is really used. Similarly, obstacles and shortcomings of inspections and reviews are not often rationalized with real-life data. Extensions and modifications to review methods are typically justified by assumptions or experiences that date back quite a long time. Thus, this study outlines the current situation in real-life companies, providing status report on what types of reviews are used and how they are arranged.

The second contribution of this paper is that it gives information about the reasons why reviews are not practiced in some companies. Furthermore, the main reasons for arranging reviews are investigated. This data can be used to target further research on the review methods and other quality assurance techniques.

The results suggest that a typical review consists of a limited set of stages and concentrates on the individual preparation and rework. The typical process in small companies is also restricted in terms of responsibilities and bureaucracy. Author and project manager are the key persons and liable for reviews. Thus, it seems that the peer review methods of real life are lightweight versions of the models presented in literature.

The most typical targets for reviews are project documentation and software designs. Correspondingly, management reviews are the most popular types of reviews that are arranged in the companies. However, an interesting contradiction emerges when the motivators for reviews are examined. Even though project documentation is regularly reviewed in management reviews in analyzed companies, data from reviews is not used to track and manage projects. Similarly, using review data to initiate process improvement is not considered important in these companies. The reason for this may be the size of the investigated companies. Because the development process is rather dynamic and organization chart very flat, process improvement and measurement may seem too distant objectives.

In most cases, the actual review method in use differs from the models represented in review textbooks. Furthermore, a very limited set of metrics is collected during reviews. It is possible that the companies have not noticed how easily the review data could be used to measure the process and reveal possible inadequacies in development.

Companies seem to understand the primary motivations for reviews very well. That is, finding more defects in the early phases of development. However, by extending the range of documentation that is reviewed and including reviews in each phase of the development, even more benefits could be gained. Only those companies that had established quality assurance function considered knowledge and information sharing as a significant motivator.

It also seems that the most favorable way to advertise the review method in companies that have not yet utilized the process is to emphasize the early defection of defects. In this respect, the unanimity of the interviewees about the power of reviews should encourage other small companies to adopt the method. If the company has an established quality assurance function, other motivations, such as information and knowledge sharing become more important.

Unsurprisingly, lack of time and human resources were ranked the most influential factors for not arranging reviews. In less mature companies, also lack of personnel and laboriousness of the process were considered significant demotivators. Thus, ensuring senior management support for the method and providing adequate training are crucial. Reviews should be a company policy and included in project plans, and raining is needed to ensure that reviewing tasks are carried out efficiently.

These interpretations have to be generalized very cautiously. The biggest limitation of this work is the relatively small number of companies involved in the study. Only twelve companies were analyzed. The results can be used to outline the current situations of peer reviews in similar companies. This is useful, when planning and targeting further research in the area.

Semi-structured interview as a data gathering method seemed to suit very well for this sort of study. It became clear during the interviews that some of the company representatives had incorrect impressions of the review-related concepts, and these would have caused considerable anomalies in the data. In interviews it was easy to ensure that the interviewer and the interviewee spoke the same language.
6. Conclusion

Small software companies consider peer reviews as an important quality technique. However, they have adjusted the method to match the limited resources. Even though these adjustments, peer reviews provide an efficient defect detection technique.

More metrics data should be collected in reviews in order to facilitate process measurement and improvement. Furthermore, reviews could be applied to a wider range of documentation. Management support is needed to overcome resource and scheduling problems.

Results of this study can be summarized as follows:
1) Companies use modified versions of peer reviewing methods that have been presented in literature. 2) The principal motivator is improved product quality. "Side effects" are not considered that important. 3) The main obstacle to using reviews is lack of time and human resources.

These issues need to be taken into consideration when introducing peer reviews in organizations, teaching the method or doing review-related research in organizations. It is delightful to notice that companies agree on the power of peer reviews, but there are still lots of work to do get the most of the method.

References