Gender diversity and community smells

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Gender Diversity and Community Smells: Insights From the Trenches

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// Given growing attention to gender diversity in software development teams, we asked practitioners if it was a useful tool to mitigate undesirable communication patterns. While many participants didn't consider gender diversity useful in this context, those who did were motivated by their own professional experience. //

EFFECTIVE COMMUNICATION AND organization within a software development team might influence the quality of both the software development process and the software created.¹ Costs of poor communication are estimated at US\$37 billion.² This motivated the research on social debt,³ i.e., the presence of noncohesive development communities whose members have communication or coordination issues, and to identify what are called *community smells*, sociotechnical characteristics and patterns that may lead to the emergence of social and technical debt.⁴

While community smells are increasingly being studied, little is known about how team composition, including gender diversity in particular, influences their presence. In previous studies outside of the realm of software engineering, women were reported as a fundamental component to increasing team efficiency and mediating organizational quality.⁵ Both team efficiency and organizational quality are related to communication, and in software engineering, communication is a crucial factor in project success.⁶

For this reason, in our previous study,⁷ we conjectured that gender diversity (and in particular, the presence of women within a team) improves communication, thus reducing the number of community smells. It is important to note that each community smell investigated is strictly connected to a communication issue (as shown in the “Design” section). To verify our conjecture, we analyzed 25 open source projects and built a statistical model showing the existence of the relationship between the presence of women and four community smells; however, the perception of this relation by project managers or

developers is unknown. Understanding their perception would be helpful to better understand our previous results as well as perform a more realistic analysis by listening to the opinion of experts.

In this study, we triangulate the results previously obtained by surveying 60 software practitioners. We aim at understanding the presumed importance of gender diversity as well as other factors over the presence and prominence of community smells. We found that practitioners seem not to consider gender diversity as an important factor to mitigate the presence of community smells. Nevertheless, practitioners who consider this as an important factor motivate their considerations with their own professional experience. Finally, as the main takeaway message from the survey, we found that most of the participants suggest taking communication skills into account when hiring and managing teams.

Study Design

To address the challenge of understanding the impact of gender composition of software development teams, we conducted a survey of software developers and project managers. We sought the perspective of software practitioners who want to understand and take practical advice on which factors to consider when allocating resources or managing complex organizational structures.

We decided to focus on the same community smells studied previously:⁷

- *Organizational silo*: siloed groups in the community that do not communicate with each other, except through one or two of their respective members
- *Black cloud*: an excessive information overload due to the lack of structured communication,

which might lead to a huge increase of data exchanges across a community

- *Lone wolf*: unsanctioned or defiant contributors who work in an irrespective manner or regardless of their team
- *Radio silence*: one team member interposing himself or herself into every formal communication across two or more sub-communities with little or no flexibility to introduce other parallel channels.

Surveying Software Practitioners

We created a questionnaire composed of five main sections. Moreover, we

community smells since we did not want to influence the participants.

Afterward, for each scenario, we asked participants to rate the importance of three aspects of team composition to mitigate the presence of the problem: gender diversity, experience of developers, and team size. We consider the experience and team size for triangulation purposes as these variables have been used as control variables in our earlier statistical model.⁷ We asked participants to score the importance on a Likert scale from “Not at all important” to “Very important” and to motivate the rating, eventually suggesting additional factors that could mitigate the problem. In the last section, we

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followed the guidelines of Flanagan et al.,⁸ keeping the survey short and anonymous, thus preventing us from influencing or biasing the answers. The detailed structure of the survey, along with the expected response type, is reported in our appendix;⁹ in the following paragraphs, we give an overview of the questions.

In the first four sections of the survey, we describe a problem scenario associated with the description of a community smell. Since we analyzed four community smells, we had a different scenario per section. We did not explicitly state that we were studying

collected the demographic information of the participants, including their gender and job programming/management experience, as well as the size of the company and their team to characterize the sample of practitioners taking part in the study.

We created the survey using a Google survey module and sharing it through our personal contacts (i.e., 20 people) but also involving project managers' associations, such as the Project Management Institute—Southern Italy Chapter. While we do not have the exact number of individuals who were asked to fill out

FIGURE 1. The graphics of the background of our participants. CTO: chief technology officer.

the survey, we are confident that our sample is representative just the same since both personal contacts and those that belong to the project managers' associations have considerable experience in managing human resources in the context of software development, operation, and evolution. As a result, we have collected 60 fully compiled questionnaires.

Results

Background of Participants

Figure 1 shows the background of the participants. Among the 60 respondents, 43.3% (26 participants) are women. Also, 64.9% and 80.8% of

the participants evaluate themselves as (highly) experienced in team management and software development, respectively. In terms of the respondents' jobs, the sample is composed of a variety of roles: 16.7% of the participants are project managers and 28.3% are developers. In addition, 38.3% of the respondents work in a large company composed of more than 2,000 employees/contributors, and 45% work within teams of five to 10 developers. Based on these statistics, we claim that the respondents' opinions are likely to represent the population of software developers and managers as a whole. Detailed results of the survey are available in the appendix.⁹

Distribution Analysis

Figure 2 summarizes the relevant factors for mitigating the presence of community smells. We observed that the majority of the participants agree on the importance of experience of team members as a mediator of the presence of community smells (the median for all the smells is four), as well as of the size of the team (the median is between three and four, depending on the community smell). For gender diversity, we find different levels of agreement; this is visible looking at the boxplots themselves but also when examining the presence of several outlier values.

FIGURE 2. The results related to the relevant aspects for mitigating the presence of community smells. (a) Organization silo evaluation. (b) Black cloud evaluation. (c) Lone wolf evaluation. (d) Radio silence evaluation.

Open Answer Analysis

As for the open question where we asked the participants to motivate their evaluation, we noticed that practitioners who gave a higher rating to the importance of gender diversity tried to better motivate the importance of this aspect. Analyzing some open answers for the organizational silo, participant #46 argued that “in a team, people of different genders allow a different comparison within the team,” while participant #55 reported that “diversity is a strength of the team and fosters appropriate behaviors and communications.” Participant #58 also stated that “the presence of different genders can be an important element of the team’s cohesion, as well as interteam interaction, trying to prevent the formation of information silos.” It is important to note that these participants hold a management position; this expertise increases the reliability of the opinions provided on the relevance of gender diversity.

In contrast, practitioners who do not perceive that gender diversity is important answered very vaguely to the open question (participant #1 said that “Gender should not matter” for the organizational silo). A possible explanation behind this fact might be attributable because they had less experience within heterogeneous teams, which directly impacts their ability to understand how gender diversity influences community smells. Indeed, Wang et al.¹⁰ showed that people tend to minimize the importance of factors about which they are less knowledgeable.

Focusing on the experience factor, participant #6 stated that “more experienced developers would tend to communicate better” (organizational silo). However, looking at the open answers for the lone wolf effect

it seems that experienced developers tend to isolate themselves, and our respondents tried to justify this behavior by referring to higher productivity. Indeed, participant #17 argued that “the most experienced members tend to decide individually, without concern about managerial decisions” and participant #13 commented that “people of experience tend to do it more, so experience is an important, but not necessarily positive, factor.” This might happen when it is assumed that a more experienced developer can be a good communicator, and only their technical skills are examined. However, communication and productivity go hand in hand with technical aspects.¹¹

While our previous results found a high correlation between gender diversity and the presence of the black cloud effect, we noticed that the perception of our participants is the opposite; for instance, participant #41 declared that “typically gender and, in general, cultural differences can affect communication in a team.” In general, what the participants recommended for this smell was to define a rigorous protocol of communication together with the correction of the team mind-set, independently from other factors.

As for the radio silence effect, once again, it seems that the higher the experience of a developer, the higher the possibility that a team member interposes himself or herself in every formal communication. For instance, on one side, participant #40 argued that “dominant programmers try to push their ideas. The experience affects this situation. On the other side, Participant #26 argued that “genders are always important in contradictions, but we can never predict the role it’ll play within a particular group of people,” while participant #57 argued

for the creation of “teams with good mixture of gender and experience to provide a feel-safe culture.” Finally, when asked what additional factors should be considered to mitigate the presence of community smells, the majority of participants suggested that an adequate communication protocol and a proper assessment of communication skills during the hiring process could mitigate the introduction of all community smells.

As shown by Heering,¹² gender diversity brings multiple benefits to companies, such as an increase in business performance, number of customers, revenues, and profits. Moreover, the presence of women within teams improves communication and collaboration.⁵ Based on these validated theories, our previous study⁷ investigated the relationship between gender diversity and presence of community smells. In this article, we triangulated our findings through a survey with practitioners. Based on the achieved results, the following takeaway messages can be drawn.

Gender diversity is perceived as being less important than experience or team size to mitigate community smells. However, in the open answers, participants who considered gender diversity important tried to strongly motivate the reason behind its importance. We conclude that practitioners might benefit from more empirical evidence of the importance of gender diversity to deal with community smells. At the same time, we strongly encourage the research community to further replicate our study and investigate the strength of this relationship. Furthermore, our previous results,⁷ together with some positive opinions given

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by survey participants, highlight the need for companies to take into account and face more seriously the problem of gender diversity within their team. As a matter of fact, it is estimated that there is only one woman for every seven men in IT.¹³

As an important output of our survey, participants highlighted that besides technical expertise, good communication skills are fundamental for developers within a software team. This means that communication skills should be better assessed during the

hiring process. Indeed, it is commonly believed that the higher the expertise of a developer, the better his or her communication skills, and the higher the productivity.^{11,14} So a tradeoff should be found. Hence, we plan to further investigate the role of communication

within software teams through interviews with project managers.

Several studies reported that a developer's experience should be considered as an important factor in development¹⁵ and management¹⁶ processes. It seems that developer experience is connected to two particular community smells (i.e., lone wolf and black cloud effects). Indeed, participants highlighted how experienced developers tend to make the decision alone without communicating with team members. We conclude that the positive and negative impacts of a developer's experience, gender balance, and related organizational and social dimensions of software in community and technical aspects of source code deserve further research as well as attention from practitioners at large. The study recapped here, including the research stream behind it, serves as an insight-gathering exercise for practitioners to garner attention to these topics. 🌐

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