

# Gender Diversity and Community Smells: Insights from the Trenches

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Effective communication and organization within a software development team might influence the quality of both the software development process and the software created [11]. It is estimated that the consequences of poor communication in terms of cost reached \$37 billion for companies<sup>1</sup>. This motivated the research to understanding so-called “social debt” [12], meant as the presence of non-cohesive development communities whose members have communication or coordination issues, and to identify *community smells* [3,15], namely socio-technical characteristics and patterns, which may lead to the emergence of social and technical debt [5].

While community smells have been widely studied, little was known about how team composition and, in particular, gender diversity influence their presence. In previous studies not strictly related to software engineering, women were reported as a fundamental element to increasing team efficiency and mediating

organizational quality [6]. It is important to note, that all these elements cited above are related to communication aspects, and in software engineering *communication is a crucial factor in project success* [7].

For these reasons, in our previous study [1] we conjectured that gender diversity and, in particular, the presence of women within a team improves communication and collaboration, thus reducing the number of community smells. To verify this conjecture, we analyzed 25 open-source projects and built a statistical model, showing the existence of this correlation; however, the perception of project managers or developers about this phenomenon is actually unknown - that perception, might be not necessarily aligned with the results of our previous work.

In this study, we triangulate the results previously obtained surveying 60 software practitioners to understand dimensions and presumed importance of gender diversity, but also whether there are additional factors to consider to reduce community smells.

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<sup>1</sup> <https://tinyurl.com/ydfjf4p6>

As a result, we found that practitioners seem not to perceive the phenomenon of gender diversity as an important factor to mitigate the presence of community smells. Nevertheless, practitioners who consider this as an important factor tried to strongly motivate their considerations. Finally, as main takeaway message from the survey, we found that most of the participants suggest taking into account communication skills 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. The perspective is of software practitioners who want to understand and take practical advice on which are the factors to consider when allocating resources or manage complex organizational structures.

We decided to focus on the same community smells studied in our previous work [1].

1. **Organizational Silo.** Siloed groups in the community that do not communicate with each other, except through one or two of their respective members;
2. **Black Cloud.** There is excessive information overload due to the

lack of structured communication. This might lead to a huge increase of *asynch* and *synch* data exchanges across a community;

3. **Lone Wolf.** Unsanctioned or defiant contributors who work in an irrespective manner or regardless of their team;
4. **Radio Silence.** One team member interposes themselves into every formal communication across two or more sub-communities with little or no flexibility to introduce other parallel channels.

## SURVEYING SOFTWARE

### PRACTITIONERS

We define a questionnaire composed of five main sections. Moreover, we followed the guidelines of Flanagan et al. [3], keeping the survey anonymous, short and preventing our influence in the answers. The detailed structure of the survey, along with the expected response type, is reported in our appendix [14]; however, in the following, we explain each question.

In the first four sections, we describe a scenario associated with the description of a community smell. Since we analyzed four community smells, we had one different scenario for each section. It is important to note that we did not explicitly report in the survey that we were studying community smells since we did not want to influence the participants.

Afterwards, for each scenario we asked participants to rate the importance of three aspects, i.e., (i) gender diversity, (ii) experience of developers and (iii) team size to mitigate the presence of the problem, using a Likert scale from “Not at all important” to “Very Important”. Finally, we asked to motivate their rating, eventually suggesting additional factors that could mitigate the problem. It is important to note that we asked about the experience and team size for triangulation purposes, as we defined them as control variables within our statistical model in our previous study [1]. In the last section, we collected demographic information of the participants, including gender, job programming/management experience as well as some information about the size of the company and her/his team in order to characterize the sample of practitioners taking part in the study.

We created the survey using a Google survey module sharing it through our personal contacts, but also involving project managers’ associations (e.g., Project Management Institute - Southern Italy Chapter, GUFPI-ISMA).

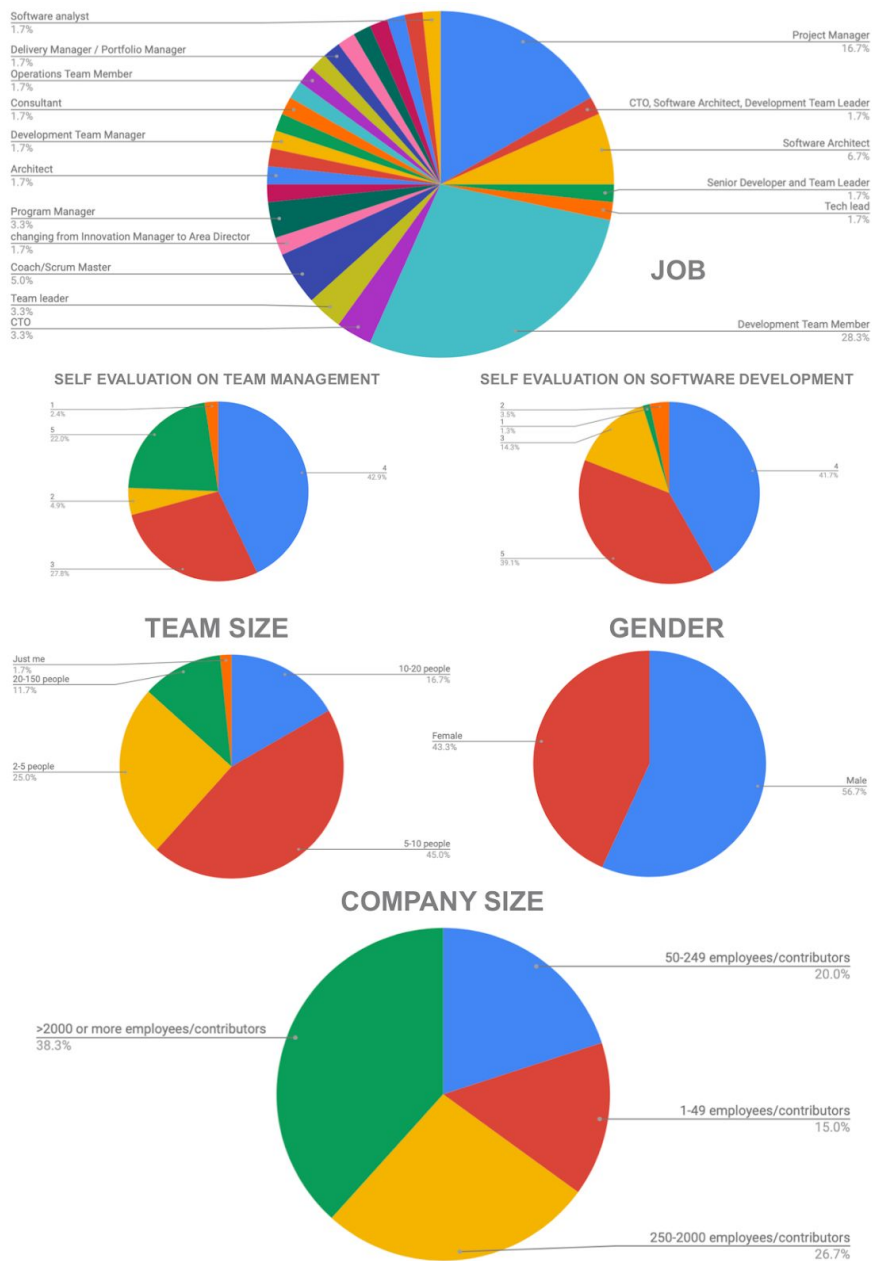
As a result, we have collected 60 fully compiled questionnaires.

## RESULTS

Figure 1 shows the background of the participants. Among the 60 respondents,

43.3% (26 participants) are women. Moreover, 64.9% and 80.8% of the participants evaluate themselves as highly experienced in team management and software development, respectively (range from 4 and 5). Looking also at their job we noticed that the sample is composed of a variety of roles, in particular, 16.7% of the participants are Project Managers while 28.3% are Developers. In addition, 38.3% of them work in a large company composed of more than 2,000 employees/contributors and 45% work within teams of 5-10 developers. From these descriptive statistics, we can claim that their opinions are likely to provide us with valid and reliable insights. Detailed results of the survey are available on the appendix [14].

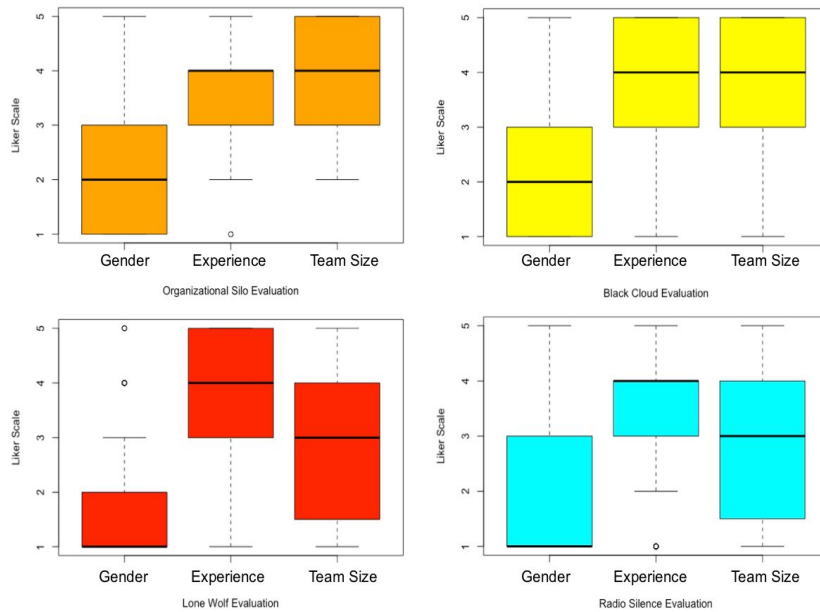
Regarding the relevant factors for mitigating the presence of community smells, looking at the boxplots in Figure 2 we notice that, while the majority of the participants agree on the importance of *experience of team members* as a mediator of the presence of community smells (the median for all the smells is 4), as well as for the *size of the team* (the median is between 3 and 4, depending on the community smell), we find different levels of agreement when they



**Figure 1:** Graphics of the background of our participants

considered the problem of gender diversity; this is visible looking at the shape of each boxplot but also at the presence of some outlier values. In general, it seems that gender diversity is not perceived as an important factor both by men and women, independently from the community smell. Indeed, we deeper

analyzed if the distribution of the Likert scale varied when considering the ratings given by women and men but, as a result, we noticed that there is no difference and, in some cases, the



**Figure 2:** Results related to the relevant aspects for mitigating the presence of community smells

average of the ratings given by women results lower than that given by men. This additional analysis is available on the appendix [14].

As for the open question where we asked the participants to motivate their evaluation, we noticed that practitioners that gave a high rating to the importance of gender diversity tried to better motivate the importance behind this factor; analyzing some open answers for the Organizational Silo, participant **#46** argues that *“in a team, people of different genders allow a different comparison”* as well as the number **#55**, who 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 inter-team*

*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.

Contrary, practitioners that do not perceive gender diversity important answered very vaguely to the open question (Participant **#1** said that *“Gender should not matter”* - Organizational Silo); a possible explanation behind this fact might be attributable to their lower experience within heterogeneous teams, which directly impacts their ability to understand how gender diversity influences community smells. Indeed, how shown in the study of Wang et al. [4] people tend to minimize the importance of one or more factors when they have less knowledge.

Focusing on the experience factor, on the one side participant **#6** states, for the Organization Silo, that *“more experienced developers would tend to communicate better”*. However, looking at the open answers for the Lone Wolf it seems that experienced developers tend to isolate themselves, working alone and not communicating with the members of the team, and it seems that our participants try to justify them for the simple fact that they have high productivity. Indeed, participant **#17** argued that *“the most experienced members tend to decide individually, without concern about managerial decisions.”* and the **#13** comments how *“people of experience tend to do it more, so experience is an important, but not necessarily positive factor”*. This might happen when it is believed that a more experienced developer can be a good communicator, only looking at her/his technical skills. However, communication and productivity go hand in hand with technical aspects [8].

While our previous results found a high correlation between gender diversity and presence of Black Clouds, we noticed that the perception of our participants is 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 mindset, independently from other factors.

As for the Radio Silence, once again it seems that the higher is the experience of a developer, the higher is the possibility that a team member interposes her/himself 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 the creation of *“teams with good mixture of gender and experience to provide a feel-safe culture”*.

Finally, when we inquired the participants about additional factors to consider for mitigating the presence of community smells, the majority of them suggested that an adequate communication protocol and a proper assessment of communication skills during the hiring process of new team member could mitigate the introduction of all community smells.

## **DISCUSSION AND IMPLICATIONS**

Based on the results described above, we can argue the following findings and takeaway messages:

1. Based on the results discovered when analyzing the distribution of the Likert Scale values for each community smell, we found that gender diversity seems not important to mitigate sub-optimal situations. However, in the open answers, participants that considered gender diversity important tried to strongly motivate the reason behind its importance. Thus, we conclude that *the benefits and perceptions around gender balancing are still far from being clear*. Furthermore, our previous results [1], together with some positive opinions given by survey participants, should tempt 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 every seven men in the IT sector.<sup>2</sup>
2. As an important output of our survey, *participants highlighted that good communication skills are fundamental for developers within a software team, besides technical expertise*. This means that communication skills should be deeper assessed during the hiring

process. Indeed, It is a common way thinking that the higher is the expertise of a developer, the better is their communication skills but also the higher is the productivity [13]. However, Pritchard [8] explained that productivity goes hand in hand with communication skills. So, a good compromise should be found. For this reason, we plan to further investigate the role of communication within software teams, interviewing project managers.

3. Despite several studies in the literature reported that developer's experience should be considered as an important factor both in development [9] and management [10] processes, it seems that this latter is strictly correlated with two particular community smells (i.e., Lone Wolf and Radio Silence). Indeed, participants highlighted how experienced developers tend to make the decision alone without communicating with team members. *We conclude that a deeper understanding of the positive and negative impacts of developer's experience, gender balance, and related organisational and social dimensions of software in community and technical aspects of source code deserves*

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<sup>2</sup><https://tinyurl.com/yx9o7xan>

further research as well as attention from practitioners at large.

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