

# Gender Diversity and Community Smells: Insights from the Trenches

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## ABSTRACT

While attention to gender diversity in software development teams is growing, it is not yet known whether practitioners see gender diversity as useful to mitigate undesirable communication patterns. In our previous study, we found, through the application of statistical models, a strictly connection between gender diversity and communication patterns, for this reason, we asked practitioners their opinion through the administration of a survey. We observed that while practitioners do not seem to consider gender diversity as being useful in this context, those practitioners who tend to motivate their considerations with their own professional experience. Moreover, participants highlighted that beside technical expertise, good communication skills are fundamental for developers within a software team and need to be carefully checked during the hiring process.

**Keywords:** Gender Diversity, Survey, Community Smell

## INTRODUCTION

Effective communication and organization within a software development team might influence the quality of both the software development process and the software created [11]. Costs of poor communication are estimated as \$37 billion [16]. This motivated the research on “social debt” [12], i.e., the presence of non-cohesive development communities whose members have communication or coordination issues, and to identify *community smells* [3], socio-technical characteristics and patterns, which may lead to the emergence of social and technical debt [5].

While community smells are increasingly being studied, little is known about how team composition and, in particular, gender diversity 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 [6]. Both team efficiency and organisational quality are related to communication, and in software

engineering *communication is a crucial factor in project success* [7].

For this reason, in our previous study [1] 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 communication issue (as shown in 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 in order to better understand our previous results as well as performing a more realistic analysis 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 are able to motivate their considerations with their own professional experience. 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 previously [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 an excessive information overload due to the lack of structured communication. This might lead to a huge increase of 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 us from influencing or biasing the answers. The detailed structure of the survey, along with the expected response type, is reported in our appendix [15]; below 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 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 of team composition to mitigate the presence of the problem, i.e., (i)

gender diversity, (ii) experience of developers and (iii) 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 [1]. We asked 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 collected demographic information of the participants, including their gender, job programming/management experience as well as the size of the company and their 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 (i.e., 20 people), but also involving project managers' associations (e.g., Project Management Institute - Southern Italy Chapter, GUFPI-ISMA). While we do not have the exact number of individuals we asked to fill the survey, we are confident that our sample is representative just the same since both personal contacts and people that belong to project managers' company have a 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

### A. Background of Participants

Figure 1 shows the background of the participants. Among the 60 respondents, 43.3% (26 participants) are women. 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 5-10 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 [15].

### B. Distribution Analysis

Figure 2 summarizes the relevant factors for mitigating the presence of community smells. We observe 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 4), as well as of the *size of the team* (the median is between 3 and 4, depending on the community smell). For gender diversity

we find different levels of agreement; this is visible looking at the boxplots themselves but also at the presence of several outlier values.

### C. Open answer Analysis

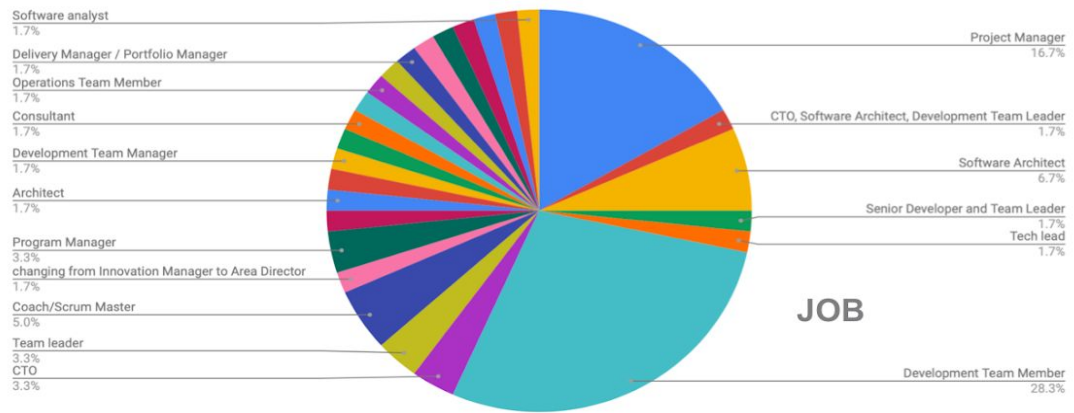
As for the open question where we asked the participants to motivate their evaluation, we noticed that practitioners that gave a higher rating to the importance of gender diversity tried to better motivate the importance of this aspect; analyzing some open answers for the Organizational Silo, participant **#46** argues that "*in a team, people of different genders allow a different comparison within the team*" as well as the number **#55**, who reported that "*diversity is a strength of the team and fosters appropriate behaviours 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

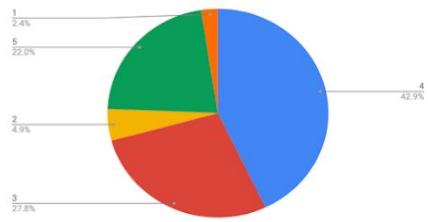
heterogeneous teams, which directly impacts their ability to understand how gender diversity influences community smells. Indeed, Wang et al. [4] showed that people tend to minimize the importance of factors they are less knowledgeable about.

Focusing on the experience factor, participant **#6** states that *“more experienced developers would tend to communicate better”* (Organization Silo).

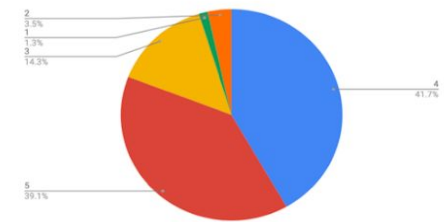
However, looking at the open answers for the Lone Wolf it seems that experienced developers tend to isolate themselves, and our respondents try to justify this behaviour by referring to higher productivity. Indeed, participant **#17** argued that *“the most experienced members tend to decide individually, without concern about managerial decisions.”* and the **#13** comments how *“people of experience*



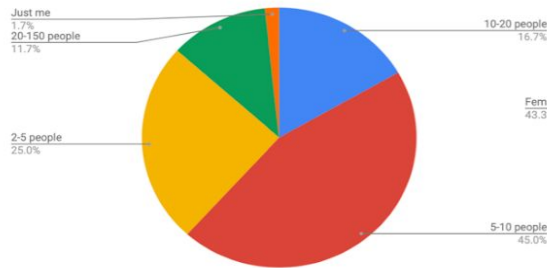
**SELF EVALUATION ON TEAM MANAGEMENT**



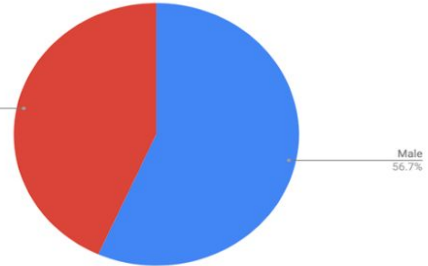
**SELF EVALUATION ON SOFTWARE DEVELOPMENT**



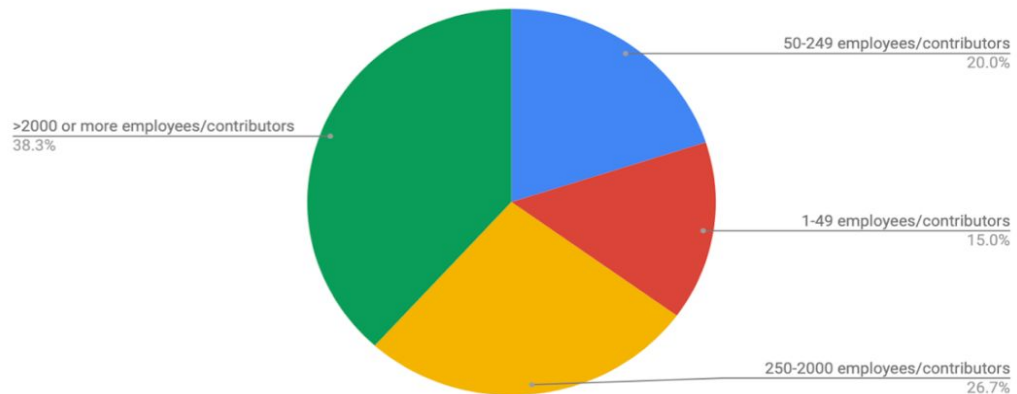
**TEAM SIZE**



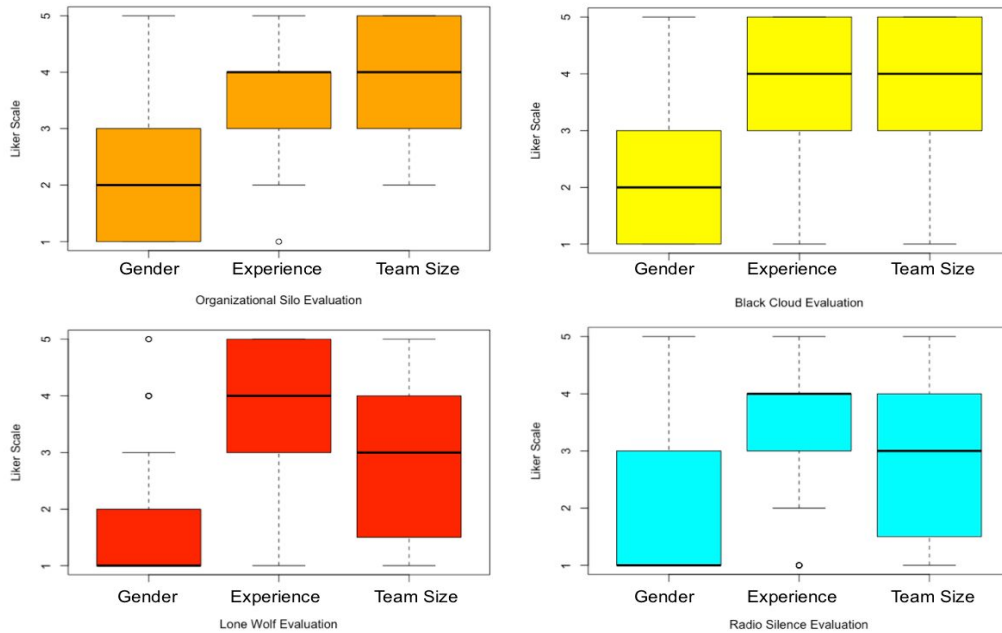
**GENDER**



**COMPANY SIZE**



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



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

*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 their 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 inquired about additional factors to consider for mitigating 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 of new team member could mitigate the introduction of all community smells.

## CONCLUSION AND IMPLICATIONS

As shown by Heering [14], 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 [6]. Based on these validated theories, our previous study [1] investigated the relationship between gender diversity and presence of community smells. In this work, we triangulated our findings through a survey with practitioners. Based on the achieved results, the following takeaway messages can be drawn:

1. Gender diversity is perceived as being less important than experience or team size to mitigate community smells. However, in the open answers, participants that 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 [1], together with some positive opinions given 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 every seven men in IT [17].

2. 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 is the expertise of a developer, the better are their communication skills, and the higher is the productivity [8,13]. So, a trade-off should be found.



Hence, we plan to further investigate the role of communication within software teams, interviewing project managers.

3. Several studies reported that developer's experience should be considered as an important factor in development [9] and management [10] processes. It seems that the developer experience is connected to two particular community smells (i.e., Lone Wolf and Black Cloud). 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 further research* as well as attention from practitioners at large. The study recapped here and the research stream behind serve as an insight-gathering exercise for practitioners to garner such attention.

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[16] <https://tinyurl.com/ydfjf4p6>

[17] <https://tinyurl.com/yx9o7xan>