

Perceptions on Diversity in Brazilian Agile Software Development Teams: A Survey*

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ABSTRACT

A lot has been said about the importance of talking about diversity in Computer Science and Software Engineering. There is a clear lack of representativeness when we observe gender distribution in Information Technology jobs and students in universities, for example. Diversity is good beyond ethnic reasons, it's recognized as valuable and, lot of studies have been done about it. Large technology companies have been creating annual reports of their efforts to have a more diverse workforce, increasing minority numbers through recruiting, working to minimize unconscious bias and also investing in programs to increase representativeness. In this paper, we present a work in progress study that links a definition of diversity to the results of a survey applied to explore the perceptions of diversity in agile software development teams in Brazil and an initial analysis focusing mainly on the role of women in those teams.

CCS CONCEPTS

• **Software and its engineering** → **Collaboration in software development**; • **Social and professional topics** → **Computing occupations**;

KEYWORDS

Software Engineering, Diversity, Gender, Women

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1 INTRODUCTION

More than ever, software development is a collaborative task, particularly when teams run under agile methodologies. From the beginning, in the Agile Manifesto [14], agile prioritizes "individuals

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and interactions over process and tools" and more recently, if we think in the Modern Agile [13], to "make people awesome" and create "psychological safety" in work environments. Agile is built upon collaboration and people interaction.

Software development teams are formed by different people and it's widely discussed that we have some underrepresented profiles. To have diversity in software development is a challenge being embraced by several companies. [3][5][2][1].

Frequently, when we talk about to increase diversity and representativeness in Software Engineering, there is a lack of a clear understanding of the definition of diversity. In this work, we are using two definitions of diversity: Identity diversity and Cognitive diversity [16]. Affiliation determines Identity diversity with a social group such as gender, culture, ethnicity, religion, sexual orientation, etc. Identity Diversity leads to Cognitive diversity, which differentiates individuals based on intellectual tools they possess. We consider four formal frameworks for modeling diversity, a set of intellectual tools that defines how to improve the collective ability to solve problems and make accurate predictions: diverse perspectives (ways of representing situations and problems), diverse interpretations (ways of categorizing or partitioning perspectives), diverse heuristics (ways of generating solutions to problems) and diverse predictive models (ways of inferring cause and effect) [16]. "Education, life experiences, and identity - for example, race, gender, age, physical capabilities and sexual orientation - can all contribute relevant cognitive diversity. How much each of these matters depends on the task." [16]

Supposing that we are observing a team running an agile framework like Scrum. Scrum expects the diligent participation of the individuals of the team, working together to define how a product/feature should be delivered. So, it looks clear that people with different identities and intellectual tools will get together to discuss the discovery, planning, and deliverables.

At this point, we bring the following point to the discussion: ability versus diversity. Are we giving up ability and specialization for the sake of having more diverse teams? Some individuals defend that specialization is what matters, but to consider different perspectives for problem-solving is equally important as specialization. Each individual brings their very own experiences, learning, perspectives, and when we put identity and cognitive diversity in the conversation, "When Identity Diversity produces bonus, inclusion involves no sacrifices. We do not confront a trade-off between excellence and diversity. Excellence demands diversity." [17]. A lack of diverse perspectives will inhibit innovation, productivity, and competitiveness [10].

We sent a survey to different regions in Brazil with the objective to understand how people in different software engineering-related

roles perceive the impact of diversity in their daily activities with the intention to better understand and discuss the perceptions of ability and diversity. We used the following questions to help us with that:

- Do you see diversity influencing the collaboration within a team? How?
- Do you recognize the difference between members of your team? Which ones are more prominent?

With the diversity definition we mentioned above in mind, through the text we intend to quickly recap some data about the decreasing number of women in Software Engineering and the factors that made it happened and to discuss the results of the survey. This work will also be input to a study that aims to quantitatively measure the impacts of diversity on results of agile development teams.

2 WOMEN IN SOFTWARE ENGINEERING

2.1 From the Second War to 2000's: what happened?

In the UK, women were the largest trained technical workforce of the computing industry during the second world war and through to the mid-sixties[12]. It was viewed as unskilled, highly feminized work. By the 1970s, there was a change in mindset and women were no longer welcome in the workplace: the government and industry had grown wise to just how powerful computers were and wanted to integrate their use at a management level. Women were systematically phased out and replaced by men who were paid more and had better job titles [9].

Before the advent of the home computer in the early 1980s, substantially more women undertook computer science degrees. In the 1984-1985 academic year, women accounted for nearly 37% of all computer science undergraduate students in USA [6]. This number dropped as the widespread use of home computers became more common. As of 2010-2011, women made up just 17.6% of computer science students. Furthermore, the percentage of women working in computer science-related professions has steadily declined since the 1990s, dropping from 35% to 25% in the last 15 years [8].

2.2 An overview from Brazil

Brazil has currently a population nearly 208 million people. Around 20% percent of a 580 thousand sample, are women in Information Technology companies [7] and only 15% of undergrad students in Computer Science related courses are women [15]. Some numbers say that says that 79% of women give up undergraduate courses in the very first year [11].

3 SURVEY

The main purpose of the survey was to understand the perceptions of diversity in software development teams and how it impacts their daily activities, focusing mainly on gender diversity. We spot the main roles played by women and how the genders understand and perceive diversity as positive or negative in their daily work routines.

Table 1: Gender Distribution

Gender	%
Female	43.9%
Male	53.8%
I prefer not to say	1.73%
Transgender	0.58%

3.1 Demographics

We distributed the survey in different channels and communities of software engineering, companies, and universities. We had a total of 173 respondents from 14 of the 27 Brazilian states. From this sample, 43.9% identified themselves as women, and 53.8% identified themselves as men. Three respondents preferred not to say (1.73%) (Table 1). On age, 47.2% of the respondents are in the range of 26-35 years old, 18.96% women and 27.59% men. 19% between 21-25 years old, 17.2% between were 36-40, and 16.6% of the respondents are distributed among the other ranges, including over 60 years old.

3.1.1 The female roles in software engineering. We can see interesting numbers when we observe the roles distribution in Table 2. In the sample, we see men distributed across the whole range of roles, except by in computer network. We see women utterly unrepresented as Database Administrators, Games Developers DevOps, Games developers and Information Security. Women have a slight majority as desktop/full stack developers, designers, and quality/test engineers. However, as students, the women are six times the number of men and as professors (in computer science) we have twice as many women. In contrast, the most prominent differences are Technical leadership positions where we have six times more men and twice men as Scrum masters/Agile Coaches.

3.1.2 Perception of the importance of diversity. The percentage of respondents that Agree or Strongly Agree with diversity as important is 78.8%, 14.4% are neutral, and 6.9% Disagree or Strongly disagree. Women tend to Agree more than man about the importance of diversity. Only one woman Strongly opposes that diversity is important.

3.1.3 How do you evaluate the experience working with a diverse team? The percentage of respondents that assess the experience working with a diverse team as positive or sometimes positive is 77.6%. Only 1.7% negative or sometimes negative and 15.5% neither positive nor negative. asking "What is diversity?". Here, we see that the number of respondents that are neutral to the experience of working in diverse teams (15.5%) is near to the percentage of the ones that are neutral regarding their perceptions about diversity as important (14.4%). But men, tend to be more neutral on their perceptions. Only men reported the experience of working with a diverse team as negative. Nine respondents used the field "Others", mostly saying that they didn't have the experience or didn't have an opinion. The most strong opinion about the experiences on working in a diverse team was: "Irrelevant. To the client what matters is to have the job done."

Table 2: Roles Distribution by Gender

Role	Female(F)	Male(M)	(F/M)%
Business/System Analyst	9	12	-25%
Data Scientist	1	4	-75%
Database Administrator	-	2	-100%
Desktop/Full Stack Developer	5	4	+25%
Games Developer	-	1	-100%
Mobile Developer	1	3	-66%
Web Developer	13	20	-35%
Designer/UX	5	3	+66%
DevOps/Infrastructure	-	2	-100%
Quality/Test Engineer	8	7	+14%
Student	12	2	+500%
Managers (People/Technical)	-	9	-100%
Technical Leader	1	6	-83%
Product Owner/Manager	3	5	-40%
Professor	4	2	+100%
Computer Network	1	-	+100%
Scrum Master/Agile Coach	5	10	-50%
Information Security	-	1	-100%

3.2 Findings

In this section, we will be analyzing some of the answers collected in the open questions of the survey. The idea was to link the demographic answers to a detailed explanation of the perceptions.

3.2.1 Do you see diversity influencing the collaboration within a team? How? Respondents that agreed that diversity impacts collaboration used words/expressions such as more innovation, creativity, quality, respect, increase tolerance, empathy, take people out of their comfort zone and, creates a safe place for sharing. Some expressions were used from a positive perspective: different opinions, the different point of views, different abilities, different life experiences, different backgrounds, different perspectives, out of the box thinking, different visions, more ideas, different mental models for problem-solving. Some examples of answers were: *"More heterogeneous teams increase chances of better final results."*, *"More than a social point, diversity makes people more open to other points of view."*, *"For sure! If the diversity is not only gender-based but in different cultures and behavioral models."* and, *"Yes, bringing different perspectives and out of the box thinking"*

One respondent that agreed that diversity influences positively on teams brought attention to their perception of cultural diversity and said that this kind of diversity could be very prejudicial. *"Nobody wants different cultures in a company"*. The explanation was related to the collaboration culture versus the kind of culture where people want the best only for themselves, and there are no moral breaks to achieve that. He concluded with *"Cultural diversity is an illusion and a big mistake in my opinion"* but brought a solution: to work to have a culture of collaboration in the companies, and the diversity problem would be automatically solved.

Respondents that answered that diversity is not important, negative or neutral tend to justify the influencing in collaboration in mainly two ways: what matters is knowledge and competence and

to consider diversity is a kind of discrimination. We also have respondents that didn't agree that diversity influences or negatively believe that diversity influences. A widespread perception across the answers is that a person in a diverse group is benefited only for being "different" and more skilled people are put aside to give space to diversity. Respondents mention that people in diverse groups are technically weaker: *"Most of the teams I worked in, company policies forced diversity and were not natural. People from minority groups had a different treatment and were clearly technically weaker."* or *"People don't want to work with people that are different from themselves"*

3.2.2 Do you recognize the difference between members of your team? Which ones are more prominent? When we asked subtly if differences between team members are identified the answers were mostly regarding behavior words frequently used were: critical behavior, cultural differences, age, quieter, talker, experience, personality, political view, task-oriented, values, attitude, cordiality, etc.

3.3 Highlights about Gender

Some answers to the survey put the gender issue explicitly on the spot. Concerning women, sexism was mentioned twice when the question was about the differences perceived in the teams. One respondent mentioned that the presence of women could cause sexual tension. The absence of communication was reported by a woman that said she was the only woman in the team. Some feel impaired in development roles when their tasks are credited to the male workmates.

There were also subtle mentions of gender bias. One answer mentioned that diversity doesn't influence on teamwork, but professionals must be men or women. Following the same line of argument, in the other response, we read: *"What is diversity? The place I work in we have men and women working in peace."*

The LGBTQ community also highlighted gender issues: *"From my life experience, I believe that lack of diversity limits collaboration. I'm a lesbian, and I constantly feel like walking on thin ice to express my opinion or to ask for help in solving problems. I think if I felt more comfortable my tasks would flow better."* and *"I work with a team where I am the only woman and also the only one "non-heterosexual"*

4 CONCLUSIONS

Diversity and gender issues in Software Engineering are being studied and have gained relevance in the last few years. Large companies are putting significant effort to close the gender gap through hiring and supporting the development of students. In our sample, we found out some interesting points: the number of women students answering the survey was six times bigger than the number of men, similarly for the number of Computer Science professors as well. Of course, we can't generalize the results; we would need a much bigger sample. But, as food for thought, we can think that the movement to encourage women to engage in Computer Science / Software Engineering-related courses is increasing, and lots of communities of practice, mainly to support programming languages learning are also appearing. These communities of practice are safe places for women that want to learn and to encourage them. Also, there are initiatives such as "Meninas Digitais" (Digital girls) [4]

under Brazilian Computer Society coordination that aims to raise interest in Computer Science / Software Engineering-related careers in high school girls. It seems that the initiatives and discussions about the subject are reaping the benefits.

However, from the survey we applied in different regions from Brazil, we observed that gender bias and prejudice is still high in Computer Science / Software Engineering - related professions. Some people defend that diversity and gender issues are not important, but ability, specialization, respect and, equal treatment are. At the same time, some blame diversity for technical gaps. On the other side, people considered from diversity groups reported situations they live in their jobs, when they face sexism, gender bias, prejudice, different treatment and, others, mostly not related with their abilities, or minimizing them. So, there is an evident polarization of perceptions in the area. These results and different perspectives are the starting point for more prominent work on the field that aims to quantitatively measure the benefits of having diversity mainly in agile software development teams and contributing to minimize the gender bias in the area.

To talk about diversity and gender issues is clearly needed and it demands empathy and absence of judgment. As a respondent said: *"Diversity demands empathy and lots of people don't even know what it is"*

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REFERENCES

- [1] [n. d.]. Diversity and Inclusion at GitHub. ([n. d.]). Retrieved Feb 2, 2018 from <https://diversity.github.com/>
- [2] [n. d.]. Facebook Diversity Update: Building a More Diverse, Inclusive Workforce. ([n. d.]). Retrieved Feb 2, 2018 from <https://newsroom.fb.com/news/2017/08/facebook-diversity-update-building-a-more-diverse-inclusive-workforce/>
- [3] [n. d.]. Google Diversity. ([n. d.]). Retrieved Feb 2, 2018 from <http://www.google.com/diversity>
- [4] [n. d.]. Meninas Digitais (Digital Girls). ([n. d.]). Retrieved Feb 2, 2018 from <http://www.sbc.org.br/institucional-3/chancela-sbc/meninas-digitais>
- [5] [n. d.]. Microsoft Global Diversity and Inclusion. ([n. d.]). Retrieved Feb 2, 2018 from <https://www.microsoft.com/en-us/diversity/>
- [6] [n. d.]. National Center for Education Statistics. ([n. d.]). Retrieved Feb 2, 2018 from https://nces.ed.gov/programs/digest/d12/tables/dt12_349.asp
- [7] [n. d.]. PNAAD (National Sample Household Survey) - 2009. ([n. d.]). Retrieved Feb 2, 2018 from <https://biblioteca.ibge.gov.br/visualizacao/livros/liv45767.pdf>
- [8] [n. d.]. Women in Computer Science: Getting Involved in STEM. ([n. d.]). Retrieved Feb 2, 2018 from <https://www.computerscience.org/resources/women-in-computer-science/>
- [9] Kirstie Brewer. [n. d.]. How the tech industry wrote women out of history. ([n. d.]). Retrieved Feb 2, 2018 from <https://www.theguardian.com/careers/2017/aug/10/how-the-tech-industry-wrote-women-out-of-history>
- [10] Hakan Erdogmus. 2009. Diversity and Software Development. *Software, IEEE* 26 (May 2009), 2–4. <https://doi.org/10.1109/MS.2009.62>
- [11] Carine Roos Fernanda Coelho, Gabriela Prado. [n. d.]. Women Leaders in Technology - 2016. ([n. d.]). Retrieved Feb 2, 2018 from <http://upwit.org/E-book-Mulheres-Lideres-na-Tecnologia-1>
- [12] Marie Hicks. 2017. *Programmed Inequality: How Britain Discarded Women Technologists and Lost Its Edge in Computing*. MIT Press, Cambridge, Massachusetts.
- [13] Joshua Kerievsky. [n. d.]. Modern Agile. ([n. d.]). Retrieved Feb 2, 2018 from <http://modernagile.org/>
- [14] Alistair Cockburn Ward Cunningham Martin Fowler Jim Highsmith Andrew Hunt Ron Jeffries Jon Kern Brian Marick Robert C. Martin Ken Schwaber Jeff Sutherland Dave Thomas Mike Beedle, Arie van Bennekum. [n. d.]. Agile Manifesto. ([n. d.]). Retrieved Feb 2, 2018 from <http://agilemanifesto.org/>
- [15] Dalto Jose Nunes. [n. d.]. Computer Science Education Statistics 2016. ([n. d.]). Retrieved Feb 2, 2018 from <http://www.sbc.org.br/documentos-da-sbc/send/133-estatisticas/1167-educacao-superior-em-computacao-estatisticas-2016>
- [16] Scott E. Page. 2007. *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies*. Princeton University Press, xyz.
- [17] Scott E. Page. 2017. *The Diversity Bonus: How Great Teams Pay Off in the Knowledge Economy (Our Compelling Interests)*. Princeton University Press, xyz.