

Gender Diversity in Technology Sector: Barriers and Perceptions Success of Women in Porto Digital

Lizandra Lgia Soares Bezerra Silva¹, Suzana Sampaio^{1,*} and Marcelo Luiz Monteiro Marinho¹

¹Universidade Federal Rural de Pernambuco, Recife, Brasil

Abstract

Over the years, it is remarkable that women have increasingly conquered their space in society, acquiring rights and acting in the labor market. However, gender inequality and the absence of women in certain roles is still a problem that persists, especially when it comes to women working in the technology field. In this context, the objective of this work is to analyze the reason for the low number of women working in software development, and if the identified barriers can be overcome from the perception of success. Based on a literature review, an online questionnaire was prepared, which was applied to women from the Porto Digital ecosystem in Recife, obtaining a total of 83 responses. To support the analysis of the results, in addition to the literature review, the SPSS tool was used to perform statistical calculations. It was possible to identify which personal and organizational barriers were found, such as self-demand, leadership problems and harassment. A positive work environment was indicated as an aspect of success in projects, and it can also be a solution to overcome problems.

Keywords

women in computer science, women in software development, barriers, success criteria, Porto digital

1. Introduction

Diversity in its various aspects (e.g., race, gender, culture, etc.) has been discussed in several areas with the aim of identifying whether it is possible to obtain better results in the industry [1]. In the area of software development, it has been no different [2]. Thinking specifically about gender diversity, there is a great lack of women joining the technology area [3], even though this is a sector that grows every day [4].

In Brazil, the 2019 IBGE census [3] showed that in the area of Computing, Information and Communication Technologies, only 13.3% are female students, while in courses in the area of Welfare the percentage of women reaches 88.3%. Still looking at data from the 2019 census, regarding the salary issue of the country in general, women receive about 77% of men's income, and when thinking about leadership positions, this difference becomes even greater, in which they receive only about 61% of men's earnings. Finally, another statistic from this census states that women dedicate themselves to caring for people or household chores almost twice as much time as men, with about 21 hours per week versus 11 hours per week, that is, it becomes more

XIV Congress of Latin American Women in Computing 2022, October 17–21, 2022, Quindio, Colombia

EMAIL: suzana.sampaio@ufrpe.br (S. Sampaio);

© 2022 Copyright for this paper by its authors.

Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).



CEUR Workshop Proceedings (CEUR-WS.org)

difficult for them to dedicate themselves entirely to their careers when they still must deal with the double workday and family.

Studies on team diversity have shown that this is an important factor in providing solutions with greater creativity and consequently achieving better results, thus bringing benefits to the business system [5]. However, it is necessary to make workspaces attractive so that these women feel the will to stay there. Thus, further studies on these aspects imply attracting more women to the area, as well as improving software development processes, given that diversity proves to be a differential in problem solving [5, 6].

Women represent only 10% of the total number of developers and the main causes of this under-representation may be associated with working conditions, which reflect male gender bias [7]. Furthermore, it is important to deepen the study on the aspects that can influence the participation of women in software development projects, as well as to propose ways of approaching the problems identified in the software communities [7]. Therefore, the objective of this work is to identify the barriers faced by women to work in the technology market, and to understand how these barriers can be mitigated or overcome.

Based on this, this work has as a guiding question: *"Why are there few women working in the technology sector?"*, and as supporting questions we have *"what are the barriers faced by women in the IT market?"* and *"what is the perception and success criteria of these women in relation to their performance within the team and the work environment?"*. For this, a study was carried out with women who work in technology companies in Porto Digital, located in the city of Recife - Pernambuco. An online questionnaire was used to collect the data, which identified obstacles in the work environment as a way to retrace the rise of women in this environment, while a friendly and positive work environment was indicated as a criterion for success in projects.

In the course of this work, the terms: barriers, obstacles, challenges, and problems are always used with the same intention of addressing the barriers faced by women. In addition to this introduction, this work presents in Sections 2 and 3 the context of the problem and the method applied. Section 4 presents the results and their implications. At last, 5 section presents the discussion, conclusions, limitations, and future work.

2. Background

2.1. Women in computing

In the emergence of the first computers, in the middle of the Second World War, women were involved from the financing of projects to the conception and programming of the machines, with the majority of programmers being women, as pointed out by [8]. This was because programming was seen as something that requires a lot of patience, persistence and attention to detail, and these characteristics were considered more prevalent in women.

Although computing spaces are predominantly male, many women were part of computing history and made contributions that are still remembered today. As is the case with Augusta Ada Byron King Lovelace, who was an English mathematician and writer who collaborated with Charles Babbage in writing algorithms for Charles Babbage's analytical engine. In this work, she developed algorithms that would allow the machine to compute the values of mathematical

functions, in addition to creating the concepts of “loop” and “subroutine”, because of this, she is now considered the first programmer in history [8, 9].

Another famous woman was Grace Murray Hopper, who was an admiral and systems analyst in the United States Navy and was one of the first programmers of the Harvard Mark I computer. She is primarily known for being the creator of the high-level Flow-Matic programming language, which in the future served as the basis for the creation of the COBOL language [8, 10].

2.2. Barriers faced by women in computer science

Some fields of Science, Technology, Engineering and Mathematics (STEM - Science, Technology, Engineering, and Mathematics) are more gender balanced than others, as can be seen in computer science where there is a large dropout by women, while this does not occur in biology degrees. This is because it is more difficult for women to fit into areas of predominantly male culture and a change in these predominantly male beliefs and values could make these fields more attractive not only to women but also to other men. The lack of teaching of some STEM fields in the early years of education is also a barrier that reinforces gender stereotypes and keeps open this gap in gender self-efficacy [11, 12, 13].

In 1991, the US Department of Labor defined the Glass Ceiling as, the fact that a qualified person is debarred at a lower level due to discrimination most often based on sexism or racism [14]. This commission also identified three categories of barriers that prevent women from entering predominantly male areas: social barriers (gender stereotypes and the concept that men and women have different roles in society), governmental barriers (lack of consistent monitoring and law enforcement to support for equality policies within the market), structural barriers (attitudes and conditions of business as a whole) [15, 16, 17, 18].

Stereotypes and prejudices end up becoming the biggest barriers faced in their careers, we can mention gender schemes, which are mental models that determine the expectations of individuals' gender roles based on biological sex. For example, some traditional gender roles suggest that a woman's role is to marry and raise children while a man's role is to work and financially support the family. As the IT industry is overwhelmingly male, it is male values that set the standard, and women entering this area can be seen as deviant and demeaned. Therefore, stereotypes and prejudices end up becoming the biggest barriers faced in their careers [19, 20, 13].

2.3. Diversity in work environments

Diversity can be characterized as recognizing and accepting differences between people in terms of age, gender, race, class, ethnicity, sexual orientation, religion, etc. [21]. Within an organization, diversity encompasses every difference of an individual that somehow affects a task or relationship; thus, diversity has an impact on existing products and services [22]. This impact proves to be positive to provide solutions with greater creativity and consequently achieve better results [5, 22].

According to [5], characteristics such as race, gender, ethnicity, age, as well as specialization, workplace, hierarchical level in the company and user skills are criteria considered important, according to team leaders, to obtain a diverse team and able to solve problems. On the other hand,

diverse teams can also cause more conflicts between members due to different perspectives, thus compromising the creativity and progress of the project. Therefore, it is important that social connections are encouraged among the members, emphasizing the value of diversity in the team [5, 23, 24].

Valuing diversity, in addition to making companies more profitable, can bring some competitive advantages, such as: increasing productivity, since in a work environment where members feel included and respected, negative attitudes are less common; increase marketing skills, as a diverse group of employees can bring different views about various customers; business retention, as some organizations take the initiative to say no to partners who do not demonstrate a commitment to diversity; among other advantages [25].

The authors [26] and [27] address the aspect of diversity in agile teams, whether that diversity is in relation to visible characteristics, such as race and age, as well as invisible characteristics, such as experience and educational level. While [26] evaluates diversity in conjunction with collective intelligence, [27] discusses diversity and the psychological safety of teams.

Some factors that are linked to the diversity of people are communication, collaboration, and a reliable team environment, according to [28]. These characteristics are important parts of the agile way of working, and as the level of agility in the industry has been growing in recent times, these factors have been pointed out as success criteria for more diverse teams.

2.4. Success criteria in software development

A list of characteristics is relevant in teamwork to improve the quality of performance, namely: communication, coordination, balancing the contribution of members, mutual support (willingness to help each other), effort and cohesion (motivation and focus on team goals and not just individual goals) [29].

The study by [28] indicates that team environment, team spirit and team capability are important success factors within teams. In this way, examining teams against these success criteria can make it easier to solve problems, for example, when using other communication tools to improve team communication.

Women have a management style focused on communication and building positive relationships, these being essential characteristics of a Scrum Master, for example. In this way, enhancing the concept that women work effectively in agile teams and in leadership positions, as well as men [30]. Good leaders can inspire the team, connect people with purpose, and in turn help team members find meaning in their work. Some solutions to help women enter these positions are educating women and men about gender bias and creating safe workspaces to make transitions to higher positions [31, 7]. In this work, we use the success criteria to analyze how the women of Porto Digital see the business environment in which they live.

3. Methodology

An exploratory review was carried out [32], considering articles that addressed the theme of diversity within workspaces in the technology field, and specifically the existence of women in these environments. Works that cited at least one topic of interest in the research were also considered, namely: (I) barriers faced by women to advance in their careers, (II) performance of

software development teams with greater diversity, (III) women who work in leadership roles in software projects.

The data collection questionnaire was prepared online through the Google Forms platform, and was divided into four sections, with questions: (1) Socio-demographic characterization; (2) Questions related to current employment; (3) Regarding the barriers faced by women within the labor market; and (4) Regarding the success criteria found within the development teams. For each item (Sections 3 and 4) the respondents were asked to indicate the level of agreement on a Likert scale [33] from 1 (strongly disagree) to 5 (strongly agree), given that this scale is the most used in research of opinion, and allow respondents to respond considering their point of view.

The statements in Section 3 were taken from the study by [34], which aimed to gain a better understanding of barriers to career advancement for women in technology sectors. As for the statements in Section 4, they were taken from the study of [28] and [29], who sought to understand how some agile methodology practices positively influenced teamwork. The questionnaire also had two optional open-ended questions, which allowed respondents to express themselves freely about other barriers and/or success criteria not mentioned.

Its distribution was through email groups and the social network LinkedIn, for women who work in technology companies within the city of Recife - PE. The city is known for providing the Porto Digital [35] technology park, which has more than 330 companies and institutions on board in its territory, most of them in the Information and Communication Technology (ICT) area. The collection began in mid-March 2021 and lasted until May 2021, obtaining 83 valid responses.

Finally, the collected data were validated and analyzed to obtain the answers to the research questions of this study. The PSPP [36] tool was used for data analysis.

4. Results

4.1. Participants and Companies Profile

More than half of the respondents (51.8%) are between 25 and 34 years old, and a percentage of 39.8% are between 18 and 24 years old, thus, we can say that research's biggest part of participants are still a young population.

As for monthly family income, 45.8% reported having 3 to 6 minimum wages (from R\$3,045.00 to R\$6,270.00). And regarding to schooling, 38.6% reported having incomplete higher education, which may mean that they are still attending a degree in technology area. Still looking at schooling statistics, around 30% have higher education, 20.5% have postgraduate degrees and 9.6% have a master's degree.

Moving on to the section on questions regarding current employment, 33.7% of respondents have worked in the technology market around 3 to 5 years, while 30.1% have worked between 1 and 2 years, and 19.3% work for less than 1 year. The remaining percentage is divided into 8.4% both for those who work between 5 and 10 years and for those who work for more than 10 years in this field. Therefore, the total number of respondents who have up to 5 (five) years of experience corresponds to 83.1% (69 participants), meeting the expectation of analyzing mainly the group of women who are at the beginning of their careers, but not restricted to just them.

From 83 responses obtained in this questionnaire, data were collected from women from 31 different companies. From the companies mentioned by the participants, almost 64% have 500 or more employees, thus being considered large companies according to the definition of SEBRAE [37]. Regarding the role that the participants play within the teams, almost 63% perform the role of Developer and 18.1% perform the role of Testers, the other almost 20% of the roles are distributed among several areas, from Support, Design, Data, Leadership, etc.

It was also possible to observe that, in the results referring to the size of the teams and the number of women that make up these teams, only 7.2% have many women (between 8 and 12) within the teams, which means only 6 answers.

4.2. Barrier Analysis

When asked if they have faced or face obstacles to advancing in their careers, a majority of 63.9% answered 'yes', while 36.1% answered 'no'. Analyzing only women who work in the IT market with up to five years of experience and women who work for more than five years. We obtain that, for the first group, about 56% respond that 'yes', have already faced or face problems to advance in their career, while for those who are over five years old, the result of 'yes' is about 71%. Then, they were asked to conceptualize the proposed statements (referring to the barriers presented in Table 1) according to the reality seen by each one.

In addition to this average, a calculation of the percentage of respondents who agreed with each statement (NC) was also performed, to bring greater clarity to the data analysis later. For this, the results corresponding to "I totally agree" (NCT) and "I partially agree" (NCP) were grouped, so that: $NC = ((NCT + NCP) * 100) / 83$.

For the statement "Working up to 2x more than men to be recognized", for example, NCT was equal to 24 and NCP was equal to 26. Applying the formula, it is possible to obtain the value of 60.24%.

Table 1. Problems encountered by women

ID ¹	Problems	Average	NC
P	Working up to 2x more than men to be recognized	3,48	60,24%
O	Salaries not compatible with the market	3,46	61,44%
O	Leadership issues	3,33	55,42%
I	Lack of female role models to be inspired	3,28	55,42%
E	Balancing work with family	3,08	43,37%
O	Important information is hidden by other team members in certain situations	3,05	43,37%
P	Little incentive to remain in the career	2,95	45,78%
I	Inadequate selective process	2,94	39,75%
P	Gender discrimination	2,92	44,57%
S	I don't find barriers	2,22	25,30%

¹ P - personal, O - organizational, I - industry, E - work-life balance, and S - no gender issues

The results are visible in Table 1, together with the respective averages of each item on the scale, in descending order, as well as the percentage calculations for NC. In addition to the

average and percentage, the problems listed in Table 1 were classified into categories following the proposed research by [34]. After conceptualizing the statements, the participants were able to report other problems or obstacles encountered through the discursive and optional question. These answers bring the unique perception of women about other problems, which for them are impediments to advancing in their careers. These reports were also categorized following the proposal by [34], to identify the 3 (three) categories that had the highest average in the Table 1.

The personal category reports relate to the fact that women in technology sectors are especially likely to perceive individual-level barriers to career advancement and company growth, also caused by gender schemas [19]. Examples of reports from this research were: "Self-demand, [...] having to be available to work overtime without planning, Mental exhaustion" (P2); "Having their achievements questioned because of gender" (P21); "Women charge themselves much more to prove themselves and prove to people that they deserve the place they occupy. [...]" (P22); and "I would say more personal obstacles such as insecurity, imposter syndrome..." (P24). The Table 2 presents the reports of the Organizational category, which refers to cultural aspects of companies, whether informal rules of behavior, incentives, and even organizational priorities. The industry category refers to the fact that organizations are not gender neutral. Under this topic, P10 replied that "The way some selection processes are conducted for minorities. Sometimes it gives the impression that it's just a facade, it only makes companies have the opportunity to raise the flag (but not always act in fact)". P11 pointed out that "[...] the environment in most technology courses is very masculine and even a little hostile. Movements to retain women in the course are growing, but it is still very preliminary; And who is making a career change. Usually, these people learn to program with online courses, alone or in a program. The problem is the market reception for these people."

Table 2. Organizational category reports

ID	Response
P4	"Lack of credibility, lack of recognition, not having your ideas and opinions taken into account"
P5	"Sexism by co-workers and fear of being harassed for being in an environment surrounded by men"
P7	"Male colleagues on the same team being recognized for things I did, whereas I received no credit"
P8	"Organizational climate that does not provide security and openness to contribute to the team"
P23	"There are some dialogue barriers between women and superiors (team leaders, managers, etc.). Most of the time, desires that are expressed to seek professional growth are not prioritized in most companies, generally forcing women to settle in a comfort zone, which does not allow them to face new challenges who are necessary and fundamental for their growth."

Thinking about solutions to these problems, it is possible to find some approaches in the literature. For the organizational category, a solution would be the "habit breaking" approach, where participants become aware of the prejudiced habits they have and learn the consequences of continuing to reproduce this prejudice. Despite proving to be effective, this approach requires a great commitment of time and trained educators [38].

To alleviate problems related to work-life balance, one option is to allow flexible working hours, which can have beneficial effects especially for mothers [38]. As for the industry category, one solution is the implementation of multicultural and organizational training for managers, for their development and better team management [39].

Still observing the barriers faced by women, the PSPP software was used to calculate the reliability of the data. The value **0.84** was obtained, which indicates good reliability. Then, the Pearson Correlation Coefficient [40] was calculated with the values of all statements in this section of barriers, and the only result that showed a significant value was a moderate correlation of **0.538** between the statements ‘Leadership issues’ and ‘Salaries not compatible with the market’.

4.3. Analysis of success criteria

As for the performance within the team and perceptions about the work environment, the Likert scale from 1 (one) to 5 (five) was also used, where 1 (one) represented "I totally disagree" and 5 "I totally agree". The results are visible in Table 3, together with the respective averages of each item on the scale, ordered in descending order. As in the previous section, after conceptualizing the statements, the participants were able to answer an optional discursive question to cite other success factors.

In these reports, it is possible to find some characteristics that are linked to the agile development methodology, as stated by P5 "Performing application tests and working in pairs makes productivity and quality delivery speed increasingly frequent." or by P7 "Type/Flexibility of Scope, Customer Communication".

Regarding the success criteria, a reliability of 0.84 was also obtained in the PSPP software, which indicates a good reliability. As in the barriers section, the Pearson Correlation Coefficient was also calculated. A moderate correlation of 0.717 was found between the statements ‘Team members help and support each other as best they can’ and ‘Suggestions and contributions from team members are respected’; a moderate correlation of 0.619 between ‘Team members help and support each other as best they can’ and ‘There is frequent communication within the team’; and an also moderate correlation of 0.614 between ‘Team members help and support each other as best they can’ and ‘Friendly and positive environment’.

Table 3. Success and performance criteria x Average

ID ¹	Success/Performance criteria	Average	NC
P	I show myself willing to improve and I always get chances to do so.	4,70	97,59%
O	Team members help and support each other as best they can	4,64	97,59%
P	I am able to meet project goals on time	4,63	92,77%
T	The result of teamwork is of high quality	4,57	93,97%
P	There is frequent communication within the team	4,54	93,97%
O	Friendly and positive environment	4,51	92,77%
P	Suggestions and contributions from team members are respected	4,47	95,18%
T	Team members contribute to the achievement of team goals according to their specific potential	4,47	91,56%
T	The team follows agile software development practices	4,20	78,31%
T	Technical training and mentoring for the team happen frequently	3,59	60,24%

¹ P - personal, O - organizational, T - technical

5. Discussion and conclusion

According to Orser, Riding, and Stanley [34], career challenges were categorized into 7 (seven) different categories, where the 3 (three) most mentioned by the 115 participating women were: *personal*, *organizational*, and *industry*. Analyzing the problems encountered by the women (See Table 1), it was also possible to notice that among 5 (five) categories imposed in the questionnaire, 3 (three) with the highest average and distinct were also: *personal*, *organizational*, and *industry*. Personal category concerns that women in technology sectors are especially likely to perceive individual-level barriers to career advancement and company growth, also caused by the [19] gender schemas, as stated in reports P2, P21, P22, and P24. Organizational category refers to the company's cultural aspects, whether informal rules of behavior, incentives, and even organizational priorities, as mentioned by P4, P5, P7, P8, and P23 in Table 2. Finally, the Industry category refers to organizations being not gender-neutral, as reported by P10 and P11. Thus, it is possible to see that the most cited categories that indicate the most significant problems women face in the study by Orser, Riding, and Stanley [34] are also the problems most pointed out by women in the Porto Digital ecosystem.

Table 1 shows the problem with the highest average in the ranking was “working up to 2x more than men to be recognized”, which falls into the personal category. No solutions were found in the literature for this problem type since it is a highly personal factor and is rooted in how women learned to work in the market so that they are more likely to be recognized, as mentioned by P22. It is possible to verify that the obstacles to advancing in the IT career are a fundamental factor, however less noticeable (56%) among women with less experience in the market, perhaps because they are at the beginning of their careers. While for women with more experience, this value increased (from 63% to 71%), indicating that over the years, there is a probability that women increase their perception of career barriers.

Analyzing the answers to the open question about the problems encountered, a worrying point cited by some participants is the issue of harassment at work. This problem is mentioned in P5, P18, and P20 (Table 1). Canedo et al. [7] bring up the importance of having anti-harassment policies in work environments to solve this type of problem.

The statement “Lack of female examples to be inspired by” in the Industry category (See Table 1) had an agreement rate of 55.42%. It could indicate that for most women in this study, the industry has not highlighted other women who can serve as inspiration, such as in leadership positions. A more appropriate approach, proposed by Orser, Riding, and Stanley [34], to be used by companies to make work environments more welcoming is to use mentorships more frequently for this audience.

Regarding the results obtained in the present study, the statement “Technical training and mentoring for the team happen frequently” (see Table 3) did not obtain an average as high as the other 9 (nine). So, this indicates that possibly this is not a constant practice (for around 40% of respondents) of companies in Porto Digital. However, for Alahyari et al. [28], technical training use is a project's success criteria.

Pearson's Correlation Coefficient calculation indicated that 3 (three) different statements obtained a moderate correlation with the same statement “Team members help and support each other in the best way they can”. Given that this correlation between these success criteria was positive, we can say that by seeking to increase this indicator and encouraging teamwork. The other statements can also improve performance. Thus, according to the three distinct characteristics, the suggestions and contributions of team members will be more respected, there will be an improvement in team communication, and the environment will become more friendly and upbeat.

Therefore, it is recommended that companies encourage enthusiasm and good relationships among their employees. Thamhain [39] points out that factors that satisfy personal and professional needs positively impact the performance of projects. The leader's role is to guide everyone throughout the project to build strong bonds between team members. Furthermore, in a complementary way, [41] also states that team performance also depends on the organizational context provided by management.

In summary, through our research question: "Why are there few women working in the technology sector?", we found that this is due to obstacles encountered to advance in the career, whether personal or organizational. A positive work environment is indicated as an aspect of project success, thus contributing more for women to overcome the obstacles encountered.

Some limitations were observed in this study. First, the questionnaire was aimed at women only, obtaining a list of barriers related to advancement in technology careers with a focus on the female gender. However, this study does not assume that some or all the problems documented are unique to women. Therefore, future work would compare the career challenges between both genders.

In addition, another limitation of the study was the sample size. We consider ourselves women who work in the technology sector at Porto Digital in Recife. However, due to the low number of participants, the research was limited in terms of statistical analysis. Thus, the need to expand the number of the sample remains so that the result of the present study can better reflect the scenario of Porto Digital.

References

- [1] M. P. Lima, As mulheres na ciência da computação, *Revista Estudos Feministas* (2013).
- [2] J. G. Rashina Hoda, Norsaremah Sallehm, The rise and evolution of agile software development, *IEEE Software* (Volume: 35, Issue: 5) (2018).
- [3] IBGE, Estatísticas de gênero: ocupação das mulheres é menor em lares com crianças de até três anos, 2019. Último acesso em 25/04/2021.
- [4] CNN, Setor de tecnologia deve crescer 12% ao ano — e os salários devem aumentar, 2021. Último acesso em 04/11/2021.
- [5] T. M. Egan, Creativity in the context of team diversity: Team leader perspectives, *Advances in Developing Human Resources* (2005).
- [6] T. M. Mariama Baldé, Aristides I. Ferreira, Seci driven creativity: the role of team trust and intrinsic motivation, *Journal of Knowledge Management* (2018).
- [7] E. D. Canedo, H. A. Tives, M. B. Marioti, F. Fagundes, J. A. S. de Cerqueira, Barriers faced by women in software development projects, *Information* (2019).
- [8] D. Gürer, Pioneering women in computer science, *ACM SIGCSE Bulletin* (2002).

- [9] A. R. Christopher Hollings, Ursula Martin, *The early mathematical education of ada lovelace*, Taylor and Francis Group (2017).
- [10] C. S. George Strawn, *Grace hopper: Compilers and cobol*, IT Professional Vol 17 (2015).
- [11] S. Cheryan, S. A. Ziegler, A. K. Montoya, L. Jiang, *Why are some stem fields more gender balanced than others?*, *Psychological bulletin* 143 (2017) 1.
- [12] L. J. Sax, K. J. Lehman, J. A. Jacobs, M. A. Kanny, G. Lim, L. Monje-Paulson, H. B. Zimmerman, *Anatomy of an enduring gender gap: The evolution of women's participation in computer science*, *The Journal of Higher Education* 88 (2017) 258–293.
- [13] A. N. M. Allison Master, *Cultural stereotypes and sense of belonging contribute to gender gaps in stem*, *International Journal of Gender, Science and Technology* (2021).
- [14] U. S. D. of Labor, *A report on the glass ceiling initiative*, U.S. Dept. of Labor (1991).
- [15] M. L. Johns, *Breaking the glass ceiling: Structural, cultural, and organizational barriers preventing women from achieving senior and executive positions*, *Perspect Health Inf Manag* (2013).
- [16] N. S. LESLIE CLEVENGER, *Exploring barriers that lead to the glass ceiling effect for women in the u.s. hospitality industry*, *Journal of Human Resources in Hospitality and Tourism* (2013).
- [17] L. M. W. Beatriz Benedito de Oliveira, *O fenômeno glass ceiling e o acesso À informação: Estudo sobre barreiras invisíveis impostas Às mulheres no trabalho*, *Complexitas - Revista de Filosofia Temática* (2018).
- [18] I. H. Audrey Babic, *The glass ceiling for women managers: Antecedents and consequences for work-family interface and well-being at work*, *Front. Psychol* (2021).
- [19] M. P. Mary A. Lemons, *Gender schemas: A cognitive explanation of discrimination of women in technology*, Springer Science+Business (2007).
- [20] H. Chaudhry, A. E. Wall, J. L. Wall, *Exploring the gender gap in tech companies: Why aren't there more women?*, in: *Competition Forum*, volume 17, American Society for Competitiveness, 2019, pp. 275–280.
- [21] L. O. Silvana Mara de Moraes dos Santos, *Igualdade nas relações de gênero na sociedade do capital: limites, contradições e avanços*, *Espaço Temático: Desigualdade e Gênero*, *Rev. katálysis* 13 (2010).
- [22] A. R. Gila, J. Jaafa, M. Omar, M. Z. Tunio, *Impact of personality and gender diversity on software development teams' performance*, in: *2014 International Conference on Computer, Communications, and Control Technology (I4CT)*, IEEE, 2014, pp. 261–265.
- [23] D. v. K. Inga J. Hoever, Jing Zhou, *Different strokes for different teams: The contingent effects of positive and negative feedback on the creativity of informationally homogeneous and diverse teams*, *Academy of Management Journal* Vol. 61, No. 6 (2018).
- [24] K. M. Nalongded Luanglath, Muhammad Ali, *Top management team gender diversity and productivity: the role of board gender diversity*, *Equality, Diversity and Inclusion Journal*, Volume 38 Issue 1 (2019).
- [25] E. M. Sutanto, *Turning diversity into competitive advantage: A case study of managing diversity in the united states of america*, *Journal Manajemen Dan Kewirausahaan* (2009).
- [26] P. Hennel, *Measuring the effect of team diversity and collective intelligence in agile teams on software development efficiency*, *Americas Conference on Information Systems* (2017).
- [27] P. H. Christoph Rosenkranz, *Team diversity and performance – how agile practices and*

- psychological safety interact, International Conference on Information Systems (2017).
- [28] H. Alahyari, J. Horkoff, O. Matsson, K. Egenvall, What do agile teams find important for their success?, 25th Asia-Pacific Software Engineering Conference (2018).
- [29] Y. Lindsjørn, D. I. Sjøberg, T. Dingsøy, G. R. Bergersen, T. Dybå, Teamwork quality and project success in software development: A survey of agile development teams, Journal of Systems and Software (2016).
- [30] P. B. Erica Weilemann, Less distress with a scrum mistress? on the impact of females in agile software development teams, 24th Australasian Software Engineering Conference (ASWEC 2015) (2015).
- [31] D. M. K. Herminia Ibarra, Robin J Ely, Women rising: The unseen barriers, Harvard Business Review (2013).
- [32] E. R. T. Armando Piovesan, Pesquisa exploratória: procedimento metodológico para o estudo de fatores humanos no campo da saúde pública, Rev. Saúde Pública 29 (1995).
- [33] D. A. B. Harry N. Boone, Analyzing likert data, Journal of Extension (2012).
- [34] B. Orser, A. Riding, J. Stanley, Perceived career challenges and response strategies of women in the advanced technology sector, Entrepreneurship and Regional Development: An International Journal (2012).
- [35] P. Digital, O que é o porto digital, 2021. Último acesso em 23/10/2021.
- [36] GNU, Gnu pspp, 2013. Último acesso em 25/11/2021.
- [37] SEBRAE, Anuário do trabalho na micro e pequena empresa 2013 (2013). Último acesso em 16/07/2021.
- [38] M. R. B. Tessa E.S. Charlesworth, Gender in science, technology, engineering, and mathematics: Issues, causes, solutions, The Journal of Neuroscience (2019).
- [39] H. J. Thamhain, Critical success factors for managing technology intensive teams in the global enterprise, Engineering Management Journal (2011).
- [40] J. A. d. S. J. Dalson Britto Figueiredo Filho, Desvendando os mistérios do coeficiente de correlação de Pearson (r)*, Revista Política Hoje, Vol. 18, n. 1 (2009).
- [41] T. D. Viktoria Gulliksen Stray, Nils Brede Moe, Challenges to teamwork: A multiple case study of two agile teams, Springer-Verlag Berlin Heidelberg (2011).