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**Towards Improving the LGBTQIAPN+
Developer Experience (DevX) in the Software
Engineering Industry**

Campo Grande, MS, Brasil

October, 2025

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Towards Improving the LGBTQIAPN+ Developer Experience (DevX) in the Software Engineering Industry

Master thesis submitted to the Graduate Program in Computer Science, Faculty of Computing, Federal University of Mato Grosso do Sul, the Master's defense, as part of the requirements for obtaining the degree of Master in Computer Science (Concentration Area: Software Engineering)).

Federal University of Mato Grosso do Sul – UFMS

Faculty of Computing – FACOM

Postgraduate Program in Computer Science

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Campo Grande, MS, Brasil

October, 2025

Acknowledgements

First, I would like to thank my advisor, Prof. Dr. Awdren Fontão, for his trust, patience, and guidance throughout this research journey.

Special thanks to Luiz Biella; I express my deepest gratitude. His unconditional support, constant encouragement, and understanding regarding my absences were essential for me to dedicate the necessary time and energy to the completion of this master's dissertation.

I also thank my friends, who respected the immersion period required by the writing process, and my fellow master's students, whose exchange of knowledge and mutual support throughout the course were essential for my academic development.

I am especially grateful to the professors who comprised my examining board, Prof. Dr. Kiev Gama and Prof. Dr. Débora Paiva, for their thorough evaluation and valuable comments.

I would also like to thank the professors who, during academic events, contributed with suggestions and ideas that helped me improve this work. And finally, I thank my family who, understanding my particularities, respected my absence.

Abstract

Recent research highlights the growing study of hidden populations in software engineering and the dynamics that affect the productivity and experience (Developer Experience) of these groups. Therefore, identifying factors that affect the DX of LGBTQIAPN+ professionals becomes essential to charting paths that aim to mitigate challenges and provide solutions that integrate, facilitate, and direct sustainable software engineering environments for this developer population. This research sought to understand the state of the art regarding the experience of LGBTQIAPN+ developers, capturing elements of classical and formal literature and gray literature. Furthermore, two primary studies were conducted: a survey targeted at LGBTQIAPN+ professionals and a subsequent combination of survey and video interviews. This methodological design allows for the collection of evidence that supports the construction of a DX model for LGBTQIAPN+ professionals based on the practical experience of these professionals, in order to guide the agile technology industry in the reception, integration, and retention of these engaged professionals. Thus, the findings of this research include the following: Less structured environments, with immature teams and few processes, in small companies in general, are prone to episodes of prejudice and integration difficulties. On the other hand, environments with structured processes and more developed teams, such as those in large companies, provide a differentiated experience, but not exempt from episodes of bias or gender prejudice. Among the guidelines presented in the model proposed in this research are: listening to professionals, welcoming them in the face of episodes of prejudice, and respecting gender identities and pronouns. Furthermore, agile ceremonies can respect the processes and challenges these professionals face, fostering the development of an environment of collaboration and engagement.

Keywords: *Developer Experience, Agile, LGBT, LGBTQIAPN+, Software Engineering agile team, DEI, Tech industry.*

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1 Introduction

During the critical period of the Covid-19 pandemic, there was a boom in remote work, and researchers from various fields began to investigate the effects of this work model on workers' well-being (WELLS et al., 2023; FORD et al., 2021; SANTOS; MAGALHAES; RALPH, 2023). The economic crisis scenario, combined with the pandemic and exacerbated by social inequalities, further intensified unemployment and the precarious living conditions of LGBTQIAPN+ individuals (AZEVEDO; SILVA, 2021).

In a broader perspective, a recent scoping review on OECD countries found that, despite growing literature on employment disparities among marginalized groups, LGBTQIAPN+ populations are often overlooked. The review revealed that precariously employed LGBTQIAPN+ workers not only face unstable labor conditions but also have limited power to address hostility and discrimination in the workplace, underscoring the insufficiency of current social policies to tackle these inequities (KINITZ et al., 2025).

Bringing these patterns to light, evidence from the COVID-19 period shows that the shift to remote work can materially shape the daily well-being of LGBTQIA+ workers. They felt less stressed and less fatigued when performing paid work at home than when working in the workplace; Furthermore, in-person work appeared more detrimental to the well-being of LGBTQIAPN+ adults than to their cisgender heterosexual colleagues. This finding supports the idea that remote environments can mitigate minority stressors commonly encountered in the workplace (AMERIKANER et al., 2023).

In this sense, within the field of technology and software development, researchers (SANTOS; MAGALHAES; RALPH, 2023) examined the benefits and limitations of remote work for the LGBTQIAPN+ population. Their findings revealed that remote work benefits LGBTQIAPN+ individuals and that, despite social isolation, the advantages such as safety and visibility outweigh the disadvantages such as isolation and invisibility. These drawbacks, however, can be mitigated by support measures developed by software companies.

Diversity in the software industry is currently threatened by political and commercial decisions that shape the culture of the field (HYRYNSALMI et al., 2025). This trend runs counter to the numerous studies showing that diversity in teams is advantageous for companies. Although differences may lead to conflicts and challenges, the benefits gained from diversity outweigh the potential drawbacks (PELLED; LEDFORD JR; MOHRMAN, 1999; HOFFMANN et al., 2022; PRIKLADNICKI; AUDY, 2005; MIRANDA; PRIKLADNICKI, 2020; SANTOS; MAGALHAES; RALPH, 2023; WASSOUF-JR; FUKUDA; FONTÃO, 2025).

Furthermore, empirical data help identify opportunities for improvement in team management and retention strategies, since developers' work satisfaction directly contributes to daily productivity gains (PELLED; LEDFORD JR; MOHRMAN, 1999; HOFFMANN et al., 2022; PRIKLADNICKI; AUDY, 2005; MIRANDA; PRIKLADNICKI, 2020; SANTOS; MAGALHAES; RALPH, 2023; WASSOUF-JR; FUKUDA; FONTÃO, 2025).

By presenting this scenario, this master's thesis begins in the pandemic period (2022) and extends into the post-pandemic period (2025), a moment when the impacts of changes imposed by big tech companies directly affect diversity and inclusion sectors. These sectors are responsible for implementing affirmative action policies and fostering more plural work environments in an industry historically characterized by a predominantly male, white, and heterosexual profile (WASSOUF-JR; FUKUDA; FONTÃO, 2025; WASSOUF et al., 2025).

Within this context, this study seeks to provide both academia and industry with insights into how professionals perceive their experiences across different scenarios. It analyzes how inclusion policies or their absence, together with organizational culture and industry practices, shape the insertion, retention, and engagement of LGBTQIAPN+ individuals in the face of the challenges posed by the transformations of the agile technology industry.

1.1 Problematization

1.1.1 Software Engineering and Diversity

In the field of software engineering, 75% of the workforce is composed of heterosexual cisgender men. However, the number of LGBTQIAPN+ professionals in the software industry remains low (MURPHY et al., 2019; SANTOS; STUART-VERNER; MAGALHÃES, 2023). Today, the software industry faces a diversity crisis, as companies strive to remain competitive while maintaining a workforce whose diversity remains largely unassimilated (MURPHY et al., 2019; ALBUSAYS et al., 2021; JR, 1990). According to (SOUZA; GAMA, 2020), global investments in diversity stem from the recognition of the need to include underrepresented groups and the use of diversity as a business tool to improve corporate image and potentially enhance performance and profitability.

Support for diversity and inclusion (D&I) also aims to ensure that all team members, particularly those from minority groups, are equally engaged and satisfied. In this context, providing support in daily work interactions through processes designed to promote DI is considered beneficial (FILIPPOVA; TRAINER; HERBSLEB, 2017; FAGERHOLM; MÜNCH, 2012; PONCELL; GAMA, 2022; SANTOS; GAMA, 2024).

An inclusive and diverse environment facilitates collaboration, shared vision, and

a common understanding of tasks. By removing barriers to personal growth, a software development team that receives support for inclusion fosters a sense of safety among its members. Consequently, team members are encouraged to express their opinions and concerns in decision-making processes relevant to software development (ALEEM; AHMED, 2023; WAGNER; RUHE, 2018; PRIKLADNICKI; AUDY, 2005; SANTOS; MAGALHAES; RALPH, 2023).

1.1.2 Diversity and Agile

In the context of software engineering, agile methodologies dominate software development practices. According to (AGILEREPORT, 2022), 85% of American respondents reported using agile methodologies in their projects, while 50% of European respondents adopted agile approaches. Another study by (JR et al., 2020) found that 87.1% of participants reported working on projects utilizing agile methodologies.

Agile teams bring together individuals with diverse identities and intellectual backgrounds to discuss findings, plan activities, and deliver results (KOHL; PRIKLADNICKI, 2018). The Agile Manifesto outlines several guiding principles, two of which are particularly relevant: (1) satisfying the customer through early and continuous delivery of valuable software, and (2) prioritizing individuals and interactions over processes and tools (BECK et al., 2011).

Promoting diversity within agile teams allows organizations to achieve benefits that outweigh the challenges (SANTOS; MAGALHAES; RALPH, 2023; PONCELL; GAMA, 2022; SANTOS; STUART-VERNER; MAGALHÃES, 2023). Additionally, professionals from underrepresented groups often perceive themselves as less competent than their peers (SILVEIRA et al., 2019; WASSOUF et al., 2025) and may be concerned about scenarios in which inclusion is only performative or marketing-driven (WASSOUF-JR; FUKUDA; FONTÃO, 2025).

1.1.3 Diverse Agile Environment and Non-technical Aspects

Among the principles of the Agile Manifesto is the emphasis on motivation, advocating the development of projects around motivated individuals (BECK et al., 2011; PRIKLADNICKI; AUDY, 2005). In software development, communication and shared context form the foundation of effective work (PRIKLADNICKI; AUDY, 2005). A lack of trust can have severe consequences, including reluctance to share information and negative impacts on product quality (SILVEIRA; PRIKLADNICKI, 2019; SANTOS; MAGALHAES; RALPH, 2023).

Consequently, professionals require adequate support to trust in their ability to perform their work correctly (BECK et al., 2011; PRIKLADNICKI; AUDY, 2005). Main-

taining developer satisfaction is essential, as unsatisfied developers tend to perceive their productivity as lower than their potential and may be dissatisfied with the quality of their deliverables (WAZLAWICK, 2019).

Moreover, demotivated or dissatisfied team members in software development can make work-related decisions that negatively affect software quality and value delivery to the customer (GRAZIOTIN; WANG; ABRAHAMSSON, 2014; GRAZIOTIN et al., 2017a; FAGERHOLM; MÜNCH, 2012; WAZLAWICK, 2019).

1.1.4 Developer Experience and LGBTQIAPN+ Software Developers

Recent research provides insights into the experiences of LGBTQIAPN+ developers in agile software teams, highlighting both benefits (e.g., work models, visibility, engagement dynamics) and challenges (e.g., prejudice, invisibility, psychological insecurity) (SANTOS; MAGALHAES; RALPH, 2023; SANTOS; GAMA, 2024; PONCELL; GAMA, 2022; WASSOUF et al., 2025; WASSOUF-JR; FUKUDA; FONTÃO, 2025).

A 2022 report indicated that 23% of LGBTQIAPN+ respondents experienced impacts at work due to their sexual orientation, and 43

The study by (SANTOS; GAMA, 2024) highlights the low engagement of underrepresented groups, such as the LGBTQIAPN+ community, in software development research. The authors attribute this low participation to “sensitive issues” for these populations, including misgendering, toxic environments, engagement dynamics within teams, implicit discrimination, and the need to advocate for their rights.

Developer experience (DX) encompasses non-technical aspects, as noted by (PRIKLADNICKI; AUDY, 2005; FAGERHOLM; MÜNCH, 2012). (FAGERHOLM; MÜNCH, 2012) defines DX as a comprehensive concept reflecting how developers perceive and feel about their satisfaction with the software development process, their deliverables, and their personal well-being.

DX is influenced by various factors, including team culture, relationships with colleagues, work environment, and personal satisfaction (FAGERHOLM; MÜNCH, 2012). Psychological safety is particularly relevant, affecting engagement and the overall developer experience (GREILER; STOREY; NODA, 2022; FONTÃO; DIAS-NETO; VIANA, 2017). Under this scope, populations such as LGBTQIAPN+ developers are impacted by prejudice and discrimination, which hinder their integration and participation in software development (SANTOS; MAGALHAES; RALPH, 2023; WASSOUF et al., 2025).

Considering the diversity challenges in the technology industry affecting LGBTQIAPN+ populations, the literature offers recommendations to improve DX (SANTOS; GAMA, 2024; SANTOS; MAGALHAES; RALPH, 2023; WASSOUF et al., 2025). While (MIRANDA; PRIKLADNICKI, 2020) proposes a general model for diversity and inclusion

in software development teams, it does not address the specific needs of LGBTQIAPN+ professionals. In contrast, studies by (SANTOS; MAGALHAES; RALPH, 2023; SANTOS; GAMA, 2024; SANTOS; ADISAPUTRI; RALPH, 2023; SANTOS; STUART-VERNER; MAGALHÃES, 2023; WASSOUF et al., 2025; WASSOUF-JR; FUKUDA; FONTÃO, 2025) provide recommendations tailored to this population.

Key recommendations include increasing visibility, investing in workplace diversity, offering remote work options, implementing codes of conduct, managing identity disclosure, and promoting inclusion, diversity, and professional development programs.

1.2 Hypothesis

The lack of models aimed at improving the experience of LGBTQIAPN+ developers in agile software teams, constructed based on developers' experiences and data from both traditional literature and gray literature, which provide pathways to enhance developer experience (DX), leads to the following hypothesis:

The application of a model composed of recommendations, grounded in strategies from both gray and formal literature and aligned with the perspectives of the LGBTQIAPN+ population, will contribute to improving the overall developer experience (DX) for these professionals in agile software teams.

Based on this hypothesis, the research questions presented in the following section were formulated.

1.3 Research Questions

Most studies on diversity in software development focus on gender-related issues, particularly on the experiences and participation of women in software teams. In contrast, research on diversity in information technology and software development that addresses underrepresented groups such as LGBTQIAPN+ remains peripheral (FORD; MILEWICZ; SEREBRENIK, 2019; SOUZA; GAMA, 2020; BRUNO et al., 2023; SANTOS; STUART-VERNER; MAGALHAES, 2023; JORANHEZON; FLEURY, 2020).

This study aims to investigate indications and perceptions regarding the experiences of LGBTQIAPN+ professionals within the context of software engineering and agile software development. In doing so, it seeks to contribute to the literature by proposing a model based on recommendations to improve developer experience (DX).

Therefore, this research aims to answer the following question:

[RQ] What elements determine whether the application of a recommendation-based model is appropriate and effective in improving the experience of LGBTQIAPN+

software developers in agile software teams?

To address the main research question, the following auxiliary questions were defined:

[**RQ1**] What do the scientific literature and the gray literature report about the experience of LGBTQIAPN+ software developers in agile software teams?

[**RQ2**] What are the perceptions of LGBTQIAPN+ software developers regarding their experience as software professionals in agile software development teams?

[**RQ3**] Which elements constitute the structure of a model aimed at improving the developer experience (DX) of LGBTQIAPN+ software developers in agile software teams?

Research question **RQ1**, related to the Multivocal Literature Mapping, is addressed in Chapter 3 of this master's thesis. Research question **RQ2** is answered in Chapter 4, and research question **RQ3** is addressed in Chapter 5. The conclusions of this study are presented in Chapter 6.

1.4 Goals

After defining the main research question, the objective is to answer it by initiating the construction of a recommendation-based model aimed at improving the Developer Experience (DX) of LGBTQIAPN+ professionals. This will be pursued through strategies applicable to aspects related to the dynamics of LGBTQIAPN+ professionals' engagement with the team, as well as their relationship with the company. The model, comprised of recommendations at different levels, aims to align with the concepts of Diversity and Inclusion, considering the challenges faced by LGBTQIAPN+ professionals in teams, in software engineering processes, and how these variables impact such dynamics. The purpose is to provide strategies for enhancing DX from the perspective of these professionals' satisfaction. This endeavor will be aligned with recommendations identified in both formal and grey literature and further supported through validation of the captured and proposed strategies with LGBTQIAPN+ professionals.

1.5 DSC - Design Science Research

The methodological design comprises the phases executed in this research (Fig. 1).

1.6 Organization of the Text

This master's thesis is organized into six chapters.

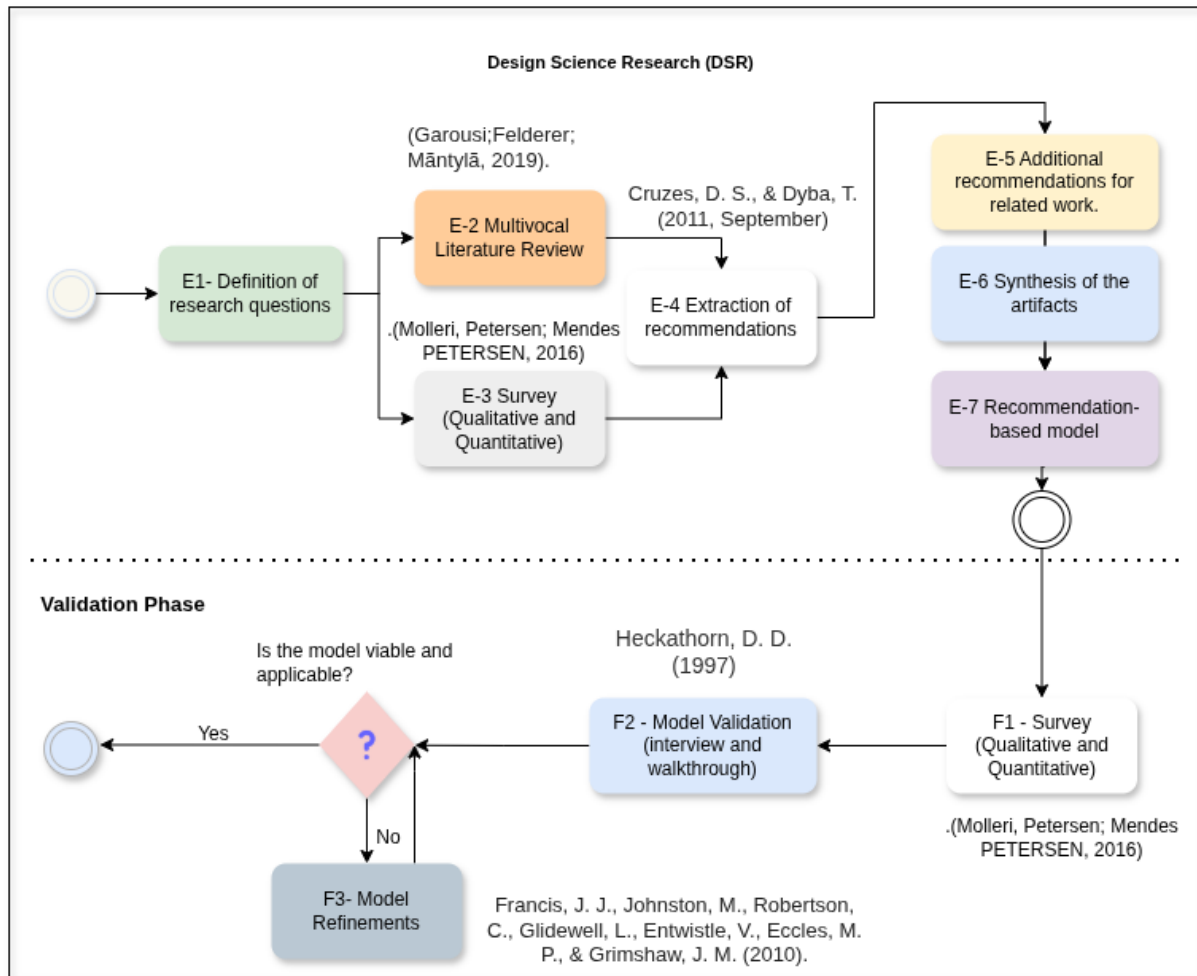


Figure 1 – Enter Caption

Chapter 1 – Introduction. This chapter presents the research context, problem description, hypothesis, research questions, objectives, and the methodology adopted.

Chapter 2 – Background. This chapter describes the theoretical framework used in the research. It discusses: (2.1) Software Engineering and the Agile Manifesto, (2.2) Developer Experience (DX), (2.3) non-technical aspects in software development, (2.4) sexual and gender diversity, and (2.5) related work.

Chapter 3 – The Developer Experience of LGBTQIAPN+ People in Agile Teams: a Multivocal Literature Review. This chapter is presented in article format and was published in the *International Conference on Cooperative and Human Aspects of Software Engineering (CHASE)*. It introduces the multivocal literature review, its objectives, and research questions, as well as the steps performed in the systematic mapping of both academic and gray literature. Finally, the results and discussion are presented.

Chapter 4 – Investigating the Developer eXperience of LGBTQIAPN+ People in Agile Teams. This chapter is also presented in article format and was pub-

lished in the *International Conference on Software Engineering (ICSE)*. It describes the introduction, objectives, research questions, methodology, results, and the design of the data collection instrument. The chapter details the construction of the survey form, followed by sections on quantitative and qualitative questions. In addition, it includes data analysis, threats to validity, and respondents' feedback.

Chapter 5 – Towards an applicable and flexible DX model for LGBTQI-APN+ software professionals. This chapter is structured in article format and will later be submitted for publication in an international software engineering journal. It includes the problem introduction, objectives, and methodology. The proposed model, and its validation through semi-structured interviews, as well as a synthesis of the results obtained.

Chapter 6 – Conclusion and Future Work.

The final Chapter discusses the contributions of this study, threats to validity and possibilities for future studies.

2 Theoretical Background

2.1 Software Engineering and the Agile Manifesto

According to (DRAGIČEVIĆ; BOŠNJAK, 2019), there has been an almost unimaginable expansion in the use of technology in everyday life, along with a continuous increase in the speed of software delivery. Thus, organizations seek to remain competitive and become faster and more efficient in software delivery (KLOTINS; GORSCHKE; WILSON, 2023).

Software Engineering (SE) is a human, complex, and challenging activity. In this sense, SE emerges as a subject of study for a better understanding of the challenges faced by teams. Teams routinely encounter challenges related to organizational techniques, cultural differences, sexual and gender diversity, as well as diverse geographical locations (DAMIAN; MOITRA, 2006; ŠMITE et al., 2010; PRIKLADNICKI; AUDY, 2005; RE-NAUD, 2023; HOFFMANN et al., 2022; SANTOS; MAGALHAES; RALPH, 2023; SANTOS; ADISAPUTRI; RALPH, 2023).

From this perspective, it is undeniable that the Agile Manifesto has transformed the software industry by serving as a fundamental foundation in modern software development. Within the agile context, the focus is on customer satisfaction, flexibility, speed, and reducing overhead. Among the manifesto's principles are: (1) satisfying the customer through early and continuous delivery of valuable software, and (2) prioritizing individuals and interactions over processes and tools (BECK et al., 2011)(HOU; JANSEN, 2023)(ANJUM; WOLFF, 2021).

Thus, projects are encouraged to be built around motivated individuals, ensuring they have the necessary support to believe they will perform their work correctly. Developer satisfaction proves crucial, as dissatisfied developers feel their productivity is lower than their potential. Moreover, dissatisfied professionals often regret the lack of quality in the product generated by their work (WAZLAWICK, 2019; BECK et al., 2011; HOFFMANN et al., 2022; FAGERHOLM; MÜNCH, 2012; MIKKONEN, 2016; RIYANTO; ENDRI; HERLISHA, 2021).

From this perspective, organizations must pay attention to professional satisfaction and invest in improvements to the *Developer Experience* (DX). In this regard, factors such as psychological safety, satisfaction, and motivation are fundamental for commitment to delivery and overcoming challenges in agile teams (FLEURY, 2000; FAGERHOLM; MÜNCH, 2012; VENKATESH et al., 2020; KURIAN; THOMAS, 2023; RIYANTO; ENDRI; HERLISHA, 2021).

2.2 Developer Experience (DX)

According to (FAGERHOLM; MÜNCH, 2012), Developer Experience (DX) is a concept that captures how developers think and feel about their activities in their work environments. Improvements in developer experience have a positive impact on software development project outcomes (FAGERHOLM; MÜNCH, 2012).

In today's software industry, there is demand for continuous delivery, customer satisfaction, and maintaining competitiveness. Organizations that invest in improving developer experience gain increases in developer productivity, satisfaction, and retention. Consequently, organizational performance improves. From this perspective, enhancing professionals' DX is essential to delivering value (KLOTINS; GORSCHKE; WILSON, 2023; GREILER; STOREY; NODA, 2022; KROPP et al., 2020).

Research has reported the influence of non-technical (human and social) factors that affect productivity and value delivery in agile software development. Among these factors are *communication*, *collaboration*, *knowledge*, and *motivation* (DUTRA; DIIRR; SANTOS, 2021; MACHUCA-VILLEGAS et al., 2022).

2.3 Dx Factors

Previous research on developer experience (DX) has focused on identifying various factors that contribute to it, referred to as DX factors (GREILER; STOREY; NODA, 2022). Through the use of open-ended interviews, researchers gathered these factors directly from participants, which allowed for the elimination of biases from existing literature. This approach ensured that the findings genuinely reflected the participants' perceptions. The identified factors were then categorized into thematic groups that represent the core dimensions of developer experience.

Another study (FONTÃO; DIAS-NETO; VIANA, 2017) examined DX factors in Mobile Software Ecosystems (MSECOs), using forward snowballing and thematic analysis across 11 papers to surface 20 factors grouped into three sources: development infrastructure, feelings about the work, and perceived value of one's contribution. Clarifying how platform design and human factors jointly drive developer attraction, engagement, and retention.

According to Hicks et al. (HICKS; LEE; RAMSEY, 2024), developer thriving is shaped by four key socio-cognitive factors: agency, which refers to the ability to have a voice within the team, participate in decision-making, and critically evaluate success metrics; motivation and self-efficacy, which capture the sense of being driven, recognizing progress, working on tasks that align with personal interests, and sustaining confidence when challenges arise; a strong learning culture, which fosters continuous skill development

and knowledge sharing among peers; and support and belonging, which emphasize the importance of receiving encouragement to grow, experiment, and occasionally fail, while also feeling genuinely accepted and integrated within the team. Therefore, several factors influence Dx, including non-technical factors.

2.4 Non-technical Aspects in Software Development

The study conducted by (RABELO et al., 2022) analyzed non-technical aspects in job candidates in the software industry. Results showed that individuals seeking relocation in software development emphasized their non-technical skills as a differentiator. In this context, (RABELO et al., 2022) concluded that hiring in the software industry prioritizes non-technical skills because they support organizational dynamics with both teams and clients.

Research by (PRIKLADNICKI; AUDY, 2005) and (PILATTI; PRIKLADNICKI; AUDY, 2007) provides a broad literature review on non-technical aspects that impact software development. Trust within the team is emphasized as crucial, since communication and context are the basis for work, while a lack of trust can generate reluctance to share information and cause irreversible impacts on projects.

The main non-technical aspects listed by (PRIKLADNICKI; AUDY, 2005; NIVA; MARKKULA; ANNANPERÄ, 2023; OBIE et al., 2023; SANTOS; SOUZA; FALCÃO, 2024) are: **trust, collaboration, communication, language, culture, cooperation, knowledge, and context**. These elements influence both professional development within the team and collaboration for task estimation and alignment with the goal of delivering value to the client (HOFFMANN et al., 2022; PRIKLADNICKI; AUDY, 2005).

Some works address non-technical factors that may affect motivation and engagement among professionals from underrepresented groups in the software industry. Studies by (SANTOS; MAGALHAES; RALPH, 2023; SANTOS; ADISAPUTRI; RALPH, 2023; SANTOS; STUART-VERNER; MAGALHÃES, 2023; SANTOS; GAMA, 2024; FORD; MILEWICZ; SEREBRENİK, 2019; ROCHA; FLEURY et al., 2023) indicate that prejudice and discrimination can affect the experience of LGBTQIAPN+ developers and, consequently, their engagement with teams and projects.

From this perspective, research focused on *sexual and gender diversity* reinforces the beneficial role of diversity in agile team performance (SANTOS; MAGALHAES; RALPH, 2023; PONCELL; GAMA, 2022; SANTOS; STUART-VERNER; MAGALHÃES, 2023).

2.5 Sexual and Gender Diversity

The theme of sexual and gender diversity is present in studies of underrepresented populations (SOUZA; GAMA, 2020; SANTOS; STUART-VERNER; MAGALHAES, 2023; PONCELL; GAMA, 2022; PRADO et al., 2020; SANTOS; MAGALHAES; RALPH, 2023; SANTOS; GAMA, 2024). Below, some concepts relevant to this theme are provided.

The concept of **gender** can be understood as a set of socially constructed values that define different characteristics (emotional, affective, intellectual, or physical) and behaviors assigned by each society. Gender is socially constructed (TOURINHO, 2021). **Sexual orientation** defines the attraction one feels toward other individuals, involving emotional and not only sexual aspects (TOURINHO, 2021).

Gender identity is a category of social identity and refers to an individual's identification as male, female, or with a category different from male or female (CAMARGO; NETO, 2017). The concept of **inclusion** involves the ability of a person to contribute fully and effectively to an organization (ROBERSON, 2006). **Diversity** can be defined as a "mix" of people with different identities interacting within the same social system (FLEURY, 2000).

The acronym **LGBTQIAPN+** represents Lesbians, Gays, Bisexuals, Travestis, Transgender, Transsexuals, Queer/Questioning, Intersex, Asexual, Aromantic, Agender, Pansexual, Polysexual, and non-cisgender individuals who do not identify as trans or with any other definition included in the acronym (TOURINHO, 2021; MOREIRA, 2022).

Recent studies by (SANTOS; MAGALHAES; RALPH, 2023; PRADO et al., 2020; SANTOS; STUART-VERNER; MAGALHÃES, 2023; SANTOS; ADISAPUTRI; RALPH, 2023; SANTOS; GAMA, 2024; PONCELL; GAMA, 2022) provide insights into the experiences of LGBTQIAPN+ professionals in agile software development teams. These authors respect the construction of these identities by clarifying concepts of gender and sexuality, reaffirming the visibility of this diversity acronym. Furthermore, they highlight the benefits of investing in diversity and the need for further investigation into the experiences of LGBTQIAPN+ individuals in the agile software industry.

2.6 Related Work

(PRIKLADNICKI; AUDY, 2005) discuss the scenario of distributed software development (**DSD**), highlighting globalization and teams in different countries and locations with different cultures. They also review the existing literature in this area and define several non-technical aspects: **trust**, **collaboration**, **language**, **culture**, **coordination**, **cooperation**, **communication**, **context**, and **knowledge**, present in software develop-

ment environments, proposing an interdisciplinary approach to address these aspects in relation to **DSD**.

The authors also point to the challenges that may arise from non-technical aspects and emphasize the idea of **preventive work regarding non-technical difficulties** throughout a project. The study recommends investing in solution-building aligned with organizational goals and the importance assigned to non-technical aspects. In conclusion, the authors highlight that interdisciplinarity is necessary for future studies in this field and for creating solutions to address these issues.

The work of (HOFFMANN et al., 2022) provides an overview of research connecting the human side of software engineering to factors such as developer happiness, project success, and productivity. This study investigates contemporary human challenges in teams and their causes in software engineering, particularly the effects of team virtualization. It employed an interview-based exploratory approach, asking participants to evaluate critical scenarios and challenges within teams, between teams and clients, and whether mitigation strategies were in place.

Results identified two groups of challenges: intrapersonal and interpersonal. No strong correlation was found between team challenges and participant nationality. However, teams with developers from more than two or three nationalities faced greater human challenges, which the authors suggest as an area for further study. The study concludes by presenting a set of human challenges that can serve as a starting point for further research on virtualization and the increase of human challenges in team-based software development.

(MIRANDA; PRIKLADNICKI, 2020) report that software development organizations have increased their understanding of the importance of diversity and inclusion in agile teams, leading companies to create diversity management models. However, no single model covers all diversity aspects.

Accordingly, (MIRANDA; PRIKLADNICKI, 2020) developed a generalized model for this task based on three stages: inclusion, development, and representation. Furthermore, the authors highlight that management participation is essential through diversity and inclusion initiatives to increase organizational diversity.

The study by (SANTOS; GAMA, 2024) discusses the difficulties encountered when researching underrepresented/hidden populations in software engineering contexts. Challenges include population identification, sampling issues, limited engagement of participants and researchers, and substantial criticism in peer reviews overlooking the limitations of empirical methods for studying hidden populations.

The authors emphasize the importance of discussions within the research community to promote a more inclusive investigation environment. They also report that

understanding the unique challenges faced by these populations is essential for gaining *insights* into their experiences and distinct difficulties in the software industry.

In a study conducted by Prado et al. (PRADO et al., 2020), the authors investigated the perceived challenges and needs faced by the trans community when participating in *hackathons*. Findings showed that, by participating, trans individuals reported acquiring more technical skills, opportunities to socialize, and deeper involvement in short-term project building. Thus, participating in more inclusive environments can be beneficial.

However, the study also reported that some participants experienced gender prejudice and other forms of discrimination, including from hackathon organizers. Additionally, participants expressed dissatisfaction with the lack of a code of conduct to protect them.

In conclusion, the study made five recommendations to make *hackathons* safer and more inclusive: a more gender-inclusive organizing team, promotion of inclusive communication, conduct that ensures safety, provision of good working conditions for participants, and leveraging the visibility of *hackathons* to give visibility to trans individuals.

2.6.1 Gaps in recommendation models

In the Software Engineering literature, DI management models/recommendations are proposed to explain how individual differences affect trust, performance, and cohesion, guiding actions that increase benefits and mitigate conflicts within teams. In this context, Miranda & Prikladnicki (MIRANDA; PRIKLADNICKI, 2020) conducted action research in a Brazilian multinational and presented a three-stage model: inclusion, development, and representation, with suggested actions, challenges, and opportunities for managing diversity in the software industry.

However, although the introduction explicitly mentions LGBTQIAPN+ as a target group, the empirical design and study participants were exclusively ethnic-racial, and the authors themselves acknowledge that generalizing the model to other groups without discussing their specificities poses a threat to its validity. In this sense, there is an opportunity for studies on minority issues in times related to the LGBTQIAPN+ population.

Greiler et al (GREILER; STOREY; NODA, 2022) present the DX Framework, a practical, interview-based model for understanding and improving the developer experience. Based on semi-structured interviews with 21 industry developers and iterative coding, the study identifies practical factors that shape the developer experience, contextual characteristics that modulate its importance, cross-cutting barriers, and coping strategies and mechanisms at both the team and individual levels. Psychological safety consistently emerges as a central facilitator, and the authors describe an Ask-Plan-Act cycle to put the framework into practice.

While the work aims for participant diversity, the description of the reported sam-

ple highlights the gender skew, with only one woman, and does not provide or analyze data on sexual orientation or gender identity. The framework and results are presented at a general level, not for specific diversity groups. This creates a clear gap for adapting and validating the DX Framework for LGBTQIAPN+ contexts, operationalizing recommendations based on the DX Factors for this population in order to assess their effects on psychological safety, retention, and progression in relation to the framework's general factors.

3 The Developer Experience of LGBTQI-APN+ People in Agile Teams: a Multivocal Literature Review

Research on underrepresented populations is essential for fostering greater diversity within the software industry. Team diversity is important for reasons that go beyond ethics. Diversity contributes to greater innovation and productivity, helping decrease turnover rates and reduce team conflicts. Within this context, LGBTQIAPN+ software engineering professionals face unique challenges, e.g., self-isolation and invisibility feeling. Developer Experience (DX) encompasses cognitive, emotional, and motivational considerations, supporting the idea that improving how DX can enhance team performance, strengthen collaboration, and lead to more successful software projects. This study aimed to examine traditional and grey literature data through a Multivocal Literature Review focused on the DX of LGBTQIAPN+ professionals in agile teams. Our findings reveal that issues such as invisibility, prejudice, and discrimination adversely affect their experiences, compounded by the predominance of heterosexual males in the field. Conversely, professionals who feel welcomed by their teams and organizations, especially in processes tailored to their needs, report more positive team dynamics and engagement.

Keywords: *LGBT, LGBTQIAPN+, diversity, developer experience, agile.*

3.1 Introduction

Developer Experience (DX) refers to how developers perceive and feel about their activities, tools, and environments within software development. It emphasizes cognitive, emotional, and motivational factors, highlighting that improving DX positively impacts team performance, collaboration, and software project outcome (FAGERHOLM; MÜNCH, 2012). The emotional factors of DX concern how developers feel about their work, encompassing aspects such as respect, belonging, attachment, and social and team dynamics, which are deeply connected to psychological safety (FAGERHOLM; MÜNCH, 2012; RAZZAQ et al., 2024; GREILER; STOREY; NODA, 2022). For underrepresented groups, including LGBTQIAPN+ professionals, these factors are particularly critical, as they often face challenges in fostering a sense of belonging and inclusion in environments traditionally dominated by male and heterosexual norms (SANTOS; MAGALHAES; RALPH, 2023; SANTOS; STUART-VERNER; MAGALHÃES, 2023; SANTOS; GAMA, 2024).

In the context of agile software, the composition of teams and the dynamics of engagement among professionals are key to determining the success of delivering value to customers (MATSUBARA et al., 2023; TIWARI et al., 2024; ZÄHL et al., 2023; SANTOS et al., 2024). Thus, it is essential to keep these professionals engaged and to prevent team disintegration, which can lead to a loss of retention (SANTOS; ADISAPUTRI; RALPH, 2023). Retained developers are motivated to engage in transactions continuously and are willing to continue their relationship with their teams (FONTÃO et al., 2023). While fostering LGBTQIAPN+ inclusion contributes to innovation and productivity, it is primarily a fundamental ethical commitment to ensuring dignity, equality, and belonging for all individuals, regardless of their identity. This research underscores the intrinsic value of inclusion as a cornerstone for both equitable workplaces and broader societal progress.

Gender studies focusing on women and the presence of gender bias in the workplace are gaining traction (TRINKENREICH et al., 2022b; PETRESCU; MOTOGNA; BERCIU, 2023), with researchers increasingly examining the benefits and difficulties associated with team composition that includes diverse cultures, ethnicities, and nationalities (MASON; KUTTAL, 2024). However, there is still a lack of data regarding the DX of professionals from underrepresented groups, particularly those in the LGBTQIAPN+ community, within the agile industry (SANTOS; MAGALHAES; RALPH, 2023; SANTOS; GAMA, 2024). Furthermore, social dimensions, satisfaction, respect, psychological safety, and trust in team dynamics and agile ceremonies are essential to assess the DX (ALAMI; ZAHEDI; KRANCHER, 2023; FAGERHOLM; MÜNCH, 2012; AHMAD, 2023).

Researchers have investigated how various work models affect different LGBTQIAPN+ populations (FORD; MILEWICZ; SEREBRENİK, 2019; SANTOS; MAGALHAES; RALPH, 2023). Gender bias impacts not only women but also LGBTQIAPN+ professionals, including transgender women, non-binary and queer people (PRADO et al., 2020; NICHOLSON et al., 2022). It is essential to understand the particular challenges faced by those professionals in the agile industry and to identify recommendations that can enhance their experiences. By examining the diversity within work environments, we can better understand how it shapes DX, including the benefits of fostering inclusion, its impact on engagement, and the practical application of diversity policies in the industry (WELSCH et al., 2024; SANTOS; MAGALHAES; RALPH, 2023). However, factors such as sexual prejudice, discrimination, and various forms of violence can detrimentally affect DX, as they undermine performance, motivation, and the sense of belonging for LGBTQIAPN+ developers (SANTOS; ADISAPUTRI; RALPH, 2023; SANTOS; MAGALHAES; RALPH, 2023; SANTOS; STUART-VERNER; MAGALHÃES, 2023).

As Software Engineering (SE) is a practitioner-oriented field, the role of “grey” (i.e., non-academic) literature should be formally recognized and included in research (GAROUSI; FELDERER; MÄNTYLÄ, 2019). In this sense, alongside peer-reviewed studies, ma-

terials produced directly by industry professionals can be highly valuable (GAROUSI; FELDERER; MÄNTYLÄ, 2019; GAROUSI et al., 2020). Such resources reflect the daily experiences and insights of professionals within their communities. We performed a multivocal literature review to gather insights from academic and industry sources about the challenges faced by LGBTQIAPN+ professionals from a DX perspective. The aim is to synthesize recommendations to improve the DX of this underrepresented group. Key findings show that measures should prioritize the well-being of LGBTQIAPN+ professionals by tackling invisibility and discrimination in teams. Results highlight the need for effective inclusion policies for this underrepresented group.

3.2 Background and Related Work

3.2.1 Diversity in Software Engineering

In traditional literature, gender diversity in Software Engineering (SE) is frequently studied under a binary male-female perspective that leaves behind problems faced by individuals of various gender identities from the LGBTQIAPN+ groups. In a systematic mapping study about diversity in SE conducted by Silveira et al. (SILVEIRA; PRIKLADNICKI, 2019), the authors found 129 papers on gender identity concerning women and only two about LGBTQI. In the most recent literature review on diversity in SE (RODRÍGUEZ-PÉREZ; NADRI; NAGAPPAN, 2021), while there were 80 studies about gender diversity identified, there were only two focusing on transgender software engineers (FORD; MILEWICZ; SEREBRENIK, 2019; PRADO et al., 2020) and no mentions of other LGBTQIAPN+ studies. Within a variety of sexual and gender identities in the LGBTQIAPN+ community, transgender professionals often face underrepresentation and invisibility (FRLUCKAJ et al., 2024; SANTOS; GAMA, 2024). A pioneering study examining the role of remote work in enabling the inclusion of transgender professionals was conducted by Ford et al. (FORD; MILEWICZ; SEREBRENIK, 2019). The authors argue the importance of controlling identity disclosure and promoting safe disengagement from harmful interactions. In addition, they suggest further research to improve support for marginalized groups in technology through remote practices. Prado et al. (PRADO et al., 2020) analyzed the inclusion of transgender professionals in hackathons, identifying challenges such as discrimination and identity invalidation.

Overall, the effects of workplace discrimination and prejudice on the productivity and well-being of LGBTQIAPN+ developers, which are aspects that can negatively impact the developer experience, remain underexplored in the literature. Recent research on workplace discrimination in SE conducted by Zhao et al. (ZHAO; YOUNG, 2023) aimed to understand this issue through the lens of male and female genders, however, there is a gap in the experience of professionals who identify beyond these genders that can be

addressed in studies with this focus. Studies addressing this aspect are limited, such as the study conducted by e Souza and Gama (SOUZA; GAMA, 2020), where the respondent comment the minimization of episodes of lgbtphobia against LGBTQIAPN+ developers. de Souza Santos et al. (SANTOS; MAGALHAES; RALPH, 2023) discussed how remote work improves psychological safety for LGBTQIAPN+ professionals, reducing exposure to discrimination and allowing identity control. Still, it runs the risk of isolation without inclusive practices.

3.2.2 Developer Experience (DX)

Fagerholm and Munch (FAGERHOLM; MÜNCH, 2012) when defining Developer Experience (DX), reiterate that experience does not refer to expertise, but rather to the involvement of developers in software development activities. In a conceptual framework defined by them, three axes delimit DX: Cognition (techniques, platform, process, skill, procedures), Conation (Plans, goals, alignment, commitment, motivation, intention), and Affect (respect, team, social, attachment, belonging). In this sense, DX becomes a lens for analyzing and improving the experience, observing the main factors that influence productivity, engagement, and job satisfaction (FAGERHOLM; MÜNCH, 2012), (GREILER; STOREY; NODA, 2022).

The tech industry uses strategies such as surveys to verify satisfaction and productivity to improve the DX of professionals. Many of these processes are shared in the field as in the research conducted at Google by D'Angelo et al. (D'ANGELO et al., 2024). DX is often analyzed from a very technical perspective around tools and technologies, but it is a highly personalized experience, varying significantly between individuals. DX is shaped by a combination of individual, organizational, and technical challenges. Concerning the *affect* dimension, the concept of psychological safety is a key driver of team and business performance and is critical in DX as noted by Greiler et al. (GREILER; STOREY; NODA, 2022).

The concept of psychological safety is a shared belief among team members that they can take interpersonal risks, such as expressing ideas, admitting mistakes, or seeking help, without fear of criticism or blame (ALAMI; ZAHEDI; KRANCHER, 2023). Furthermore, the concepts of psychological distress and psychological safety were captured as factors influencing DX in the Systematic Literature Review performed by Razzaq et al. (RAZZAQ et al., 2024). The authors identified 33 factors influencing DX and distilled them into 10 core themes. When reviewing the synthesis of knowledge obtained through the review, a gap is noted in the literature on DX for underrepresented groups in the software industry - this includes LGBTQIAPN+ professionals who face unique challenges in the face of prejudice and discrimination in software development.

In software teams, it is crucial to foster open communication, collaboration, and

innovation, enabling teams to effectively address challenges and improve performance (GREILER; STOREY; NODA, 2022; SANTOS; MAGALHAES; RALPH, 2023). In addition, although traditional literature was thoroughly reviewed, data from industry professionals in grey literature sources (e.g., forums and online posts) were not incorporated. This grey literature data is essential (GAROUSI et al., 2020) for understanding the lived experiences of these professionals and enhancing their workplace experience.

Our research focused on following recommendations from diversity researchers in the technology sector to explore the experiences of LGBTQIAPN+ professionals in the software industry (SANTOS; MAGALHAES; RALPH, 2023; SOUZA; GAMA, 2020; FORD; MILEWICZ; SEREBRENIK, 2019; SANTOS; GAMA, 2024). We gathered evidence by examining peer-reviewed literature and analyzing materials shared by LGBTQIAPN+ professionals in the industry. Our goal is to synthesize recommendations to improve the experience of this underrepresented group.

3.3 Method

3.3.1 Goal and Research Questions

We used the GQM (BASILI, 1994) to define our goal and RQs. Our goal is to **analyze** scientific evidence and material produced by SE practitioners outside academic forums **aiming to** understanding challenges and expectations, **concerning** developer experience **from the viewpoint of** researchers and LGBTQIAPN+ developers **in the context of** agile teams. The main research question (RQ) for this multivocal systematic literature review is: **What do the scientific literature and grey literature say about the DX of LGBTQIAPN+ developers in agile teams?** To help answer this the following sub-questions were used:

A.1: Rationale: it explores how team integration happens in a field dominated by heterosexual male norms.

A.2: Rationale: it aims to uncover how their experiences align or diverge from their expectations.

A.3: Rationale: it seeks to synthesize evidence-based recommendations to create environments where LGBTQIAPN+ developers can thrive.

3.3.2 Multivocal Systematic Literature Review

To address the research question, we used the multivocal systematic literature review method that has been widely used in SE research because it provides methodologies to categorize published studies and in areas where primary studies are scarce or not very relevant (GAROUSI et al., 2020; GAROUSI; FELDERER; MÄNTYLÄ, 2016). Following

systematic review guidelines from Garousi et al. (GAROUSI; FELDERER; MÄNTYLÄ, 2019), which advocate for the inclusion of grey literature to broaden perspectives and insights, we employed these strategies to formulate research questions and execute a multivocal systematic literature review. The planning and execution of our multivocal literature review were organized into five distinct stages:

- *Stage 1*) We began by defining our research questions and composing a search string. This string was refined multiple times and control studies were identified. We reviewed the scope and continued to refine the string until we achieved saturation, which we tested using the IEEEExplore platform.
- *Stage 2*) Next, we defined our inclusion and exclusion criteria. We executed the search¹ on various databases, including IEEEExplore, ACM Digital Library, and Scopus Elsevier.
- *Stage 3*) We classified the studies and updated the systematic review employing backward and forward snowballing. Then, we conducted a thematic synthesis of all included studies.
- *Stage 4*) We examined the use of grey literature. The use of grey literature can be an interesting mechanism to fill the gap in the connection with the practice of SE (Software Engineering) and by people who research and work with SE in academic contexts (GAROUSI et al., 2020). Inclusion and exclusion criteria were established, and we constructed two different search strings. The first string was used to index documents directly from the Dev² platform, while the second string utilized the *Google Search Engine* to index documents from the same platform. Both strings were refined before the searches were executed.
- *Stage 5*) Finally, we classified the returned documents and performed a thematic synthesis of the documents and posts.

3.4 Systematic Literature Review

We performed our systematic review³ (SLR) according to the guidelines proposed by Kitchenham et al. (KITCHENHAM; BUDGEN; BRERETON, 2015). Our SLR was conducted from March to May 2024, covering publications up to 2023 across various databases. Our protocol outlines the planned procedures for conducting the systematic review, covering the search strategy, study selection, data extraction, and data analysis. Additionally, it clarifies the primary responsibilities of each co-author. The first author prepared the initial draft of the protocol, which was then reviewed by all authors.

¹ <https://bit.ly/amcSearch> <https://bit.ly/ieeeSearch> Our access to the Scopus platform generated a link via the institution's interface.

² <https://dev.to/>

³ keyword extraction, systematic review, snowballing <https://figshare.com/s/04c5471717429e121110>

3.4.1 SLR Method

QASI (Quasi-Gold Standard): Control studies (QASI) were used to verify the relevance of database search results after composing the search string (ZHANG et al., 2011). The selected control studies provide key terms related to gender (KOHL; PRIKLADNICKI, 2018) and sexual diversity (SANTOS; MAGALHAES; RALPH, 2023) within the context of software development, as well as minority groups related to sexual diversity. Table 1 presents these selected works.

Table 1 – QASI: Quasi-Gold Standard

ID	Authors	Title
C1	Kohl, Karina; Prikladnicki, Rafael;	Benefits and difficulties of gender diversity on software development teams: A qualitative study.
C2	de Souza Santes, Ronnie; de Magalhães, Cleyton; Ralph, Paul	Benefits and limitations of remote work to LGBTQIA software professionals.
C3	de Souza Santos, Ronnie; Stuart-Vermer, Brody; de Magalhães, Cleyton;	What do transgender software professionals say about a career in the the software industry?
C4	de Souza Santos, Ronnie; Stuart-Vermer, Brody; de Magalhães, Cleyton;	Diversity in software engineering: A survey about scientists from underrepresented groups.
C5	de Souza Santos, Ronnie; Stuart-Vermer, Brody; de Magalhães, Cleyton;	LGBTQIA (In) Visibility in Computer Science and Software Engineering Education.
C6	Blincoe, Kelly; Springer, Olga; Wrobel, Michal;	Perceptions of gender diversity's impact on mood in software development teams.

Search String: We used the PICO strategy (PETERSEN; VAKKALANKA; KUZNIARZ, 2015) to frame relevant theoretical references to build the search string. The Population considers terms to the LGBTQIAPN+ population. In the intervention, terms from the domain of methodologies and agile teams were added, in addition to terms related to software development. A final string (Table ??) was obtained that returned the control works and the searches became saturated, no longer returning works related to the target theme.

Table 2 – Search String Used in the Systematic Literature Review

((“lgbt*” OR “LGBTQIAPN+” OR “gender diversity” OR “underrepresented groups” OR “sexual diversity” OR “trans” OR “queer” OR “non binary”)
AND (“software development” OR “agile development” OR “software professionals” OR “mobile team” OR “devops” OR “remote team”
OR “software engineering” OR “agile remote team” OR “agile software development teams” OR “squad” OR “tribe” OR “scrum” OR “xp”))

Studies Selection: Figure 2 illustrates the search performed in three databases. It yielded 815 studies distributed across the ACM Digital Library, IEEE, and Scopus. We extracted the authors’ data, title, journal/conference information, and the DOI for each paper. After constructing the spreadsheet, the paper filtering criteria were defined, following the model used in (FONTÃO et al., 2023). We applied the following inclusion/exclusion criteria: (A)

Peer-reviewed studies; (B) Studies written in English; (c) Studies that answer at least one auxiliary question; (D) Study available on the Web or by contacting the authors; (E) Non-duplicated studies. Studies that met all the criteria were included. Otherwise, the study was excluded.

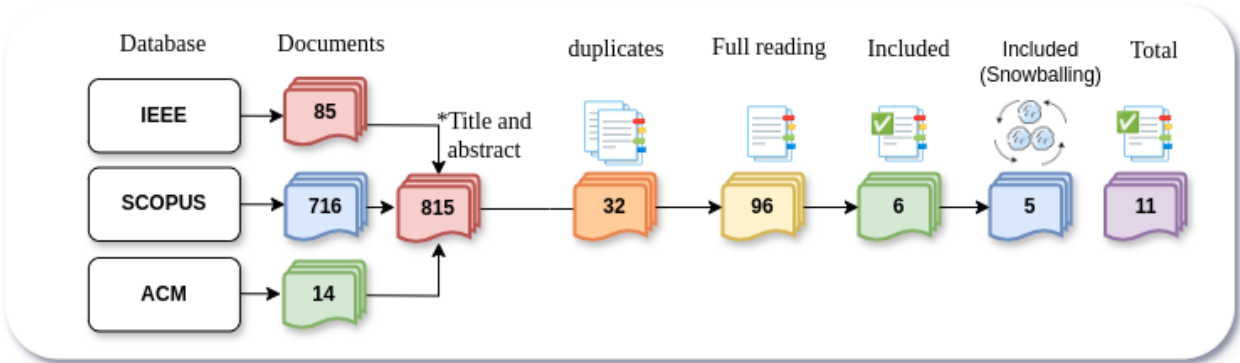


Figure 2 – Process of filtering, classifying and analyzing articles from review and snowballing.

Snowballing: We chose to enrich the systematic mapping of traditional literature with the *Snowballing (Backward and Forward)* technique, guided by the review updates provided by (GARNER et al., 2016),(FELIZARDO et al., 2016). In this way, new works can be obtained by applying *Snowballing* to the studies included in the mapping. The papers were classified into codes by iterating the *Forward Snowballing* technique on the six included papers. The suffix 'F' was added to each included paper followed by an identifying code (numbered in order of discovery), which allowed the papers to be tracked. The same process was adopted when applying the *Backward Snowballing* technique, adding the suffix 'B' to the code of the included study. Four papers resulting from the application of *Forward Snowballing* went through the criteria evaluation process and were included. Considering the four papers included, all of these resulted from the iteration on paper **S3**. Through the application of *Backward Snowballing*, one study was included from study **S1**. There were no more papers included after applying the *Snowballing* technique (Fig. 3). Then, the five articles included in the systematic mapping of traditional literature and the application of *Snowballing* in the included works were listed with a unique tracking code. Table 3 lists all the works included in the mapping of traditional literature (six studies) enriched with *Snowballing* (five studies), the **ID "S"** was added, according to the order of discovery.

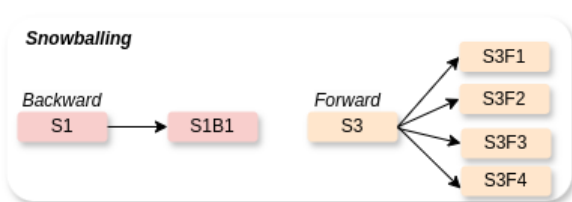


Figure 3 – Snowballing performed to enrich the literature review

Quality Assessment: We applied the quality criteria (QAC) following recommendations from Yang et al. (YANG et al., 2021). The questions that supported the quality assessment are: Is the study relevant to Software Engineering? Is the purpose of the study clear? Does the study present the methodology used? Are the study’s contributions clear? Was the research published in a reputable venue?

Data Analysis - Thematic Synthesis: To search for themes on the findings of the selected studies, we applied the recommendations from Cruzes and Dyba (CRUZES; DYBA, 2011) to perform the thematic⁴ synthesis of the research. Our findings were synthesized by organizing codes into broad categories based on their labels, with each code assigned to a single category. Quotations linked to each code were analyzed in their original context, and observations were used to draft concise code descriptions. The categories were then refined iteratively, involving the reassignment of some codes and adjustments to category definitions, until a final structure was established. Any additional inconsistencies or errors in the extraction were identified and promptly addressed through direct communication with the original extractors. In total, we obtained 24 themes⁵ after processing the thematic synthesis.

Table 3 – Studies included

ID	Authors	Research Databases	Title & Year
S1	Poncell, Igor; Gama, Kiev	ACM	Diversity and Inclusion Initiatives in Brazilian Software Development Companies: Comparing the Perspectives of Managers and Developers. (2022)
S2	de Souza Santos, Ronnie; de Magalhães, Cleyton	ACM	Benefits and limitations of remote work to LGBTQIAPN+ software professionals. (2023)
S3	Ford, Denae; Milewicz, Reed; Serebrenik, Alexander	ACM	How remote work can foster a more inclusive environment for transgender developers. (2019)
S4	de Souza Santos, Ronnie; Stuart-Verner, Brody; Magalhães, Cleyton	IEEE	What do transgender software professionals say about a career in the software industry. (2023)
S5	Wang, Yi; Xinyue Zhang; Wei Wang	IEEE	Fundamentalists, Integrationists, Transformationists: An Empirical Theory of Men Software Engineers’ Orientations in Gender Inequalities. (2023)
S6	Kohl, Karina; Musse, Raupp; Manssur, Isabel; Vieira, Renata; Prikladinick, Rafael	SCOPUS	Reinforcing diversity company policies: Insights from Stackoverflow developers survey. (2019)
S7 (S1B1)	de Souza, Natália; Gama, Kiev	IEEE	Diversity and inclusion: Culture and perception in information technology companies. (2020)
S8 (S3F1)	Prado, Rafa; Mendes, Wendy; Gama, Kiev; Pinto, Gustavo	IEEE	How trans-inclusive are hackathons? (2020)
S9 (S3F2)	Gunawardena, Sanuri; Devine, Peter; Beaumont, Isabelle; Garden, Lola; Murphy-Hill, Emerson; Blincoe, Kelly	ACM	Destructive criticism in software code review impacts inclusion. (2022)
S10 (S3F3)	de Souza Santos, Ronnie; Adisaputri, Gianisa; Ralph, Paul	IEEE	Post-pandemic Resilience of Hybrid Software Teams. (2023)
S11 (S3F4)	Popoola, Gabriel; McKie, Morgan; Moten, Jade; Fletcher, Trina	IEEE	Remote Work and Satisfaction for Black Engineers and Computer Scientists. (2022)

⁴ <https://figshare.com/s/eb209548db4f49731832>

⁵ Codebook SLR: <https://figshare.com/s/6146d5c8595e26258b02>

3.4.2 SLR Results

A.1:

Studies show that diverse teams often achieve higher productivity and resilience, leveraging unique perspectives in problem-solving (S1, S10). In remote work (S2), LGBTQIAPN+ professionals benefit from a sense of safety and control, which aids team integration and performance, though challenges like isolation and invisibility persist. This dynamic supports agile environments by fostering psychological safety while highlighting areas for improved visibility and inclusive communication.

To support the understanding of the themes identified in the studies, based on the thematic synthesis, themes associated with developers' perceptions about agile teams dynamics are marked with the symbol **Q**.

In **S1**, the focus was on **Q low perceived DEI (Diversity and Inclusion)**. The authors interviewed managers and people from underrepresented groups, including LGBTQIAPN+ developers from three companies. From the perspective of some respondents, engagement in affirmative actions for inclusion was difficult to advertise because the communication tool (*Slack*) was crowded with work-related messages. Still, they recognized the importance of these actions. In one of the companies, the diverse teams' productivity was better than the non-diverse teams. The study **S1** highlights the **Q benefits of diversity** when reporting higher performance from a diverse team compared to a less diverse team, aligning with existing literature. It also notes how the perception of a welcoming and diverse environment affects the performance of LGBTQIAPN+ software developers and other underrepresented groups. Similarly, **S10** (a survey on hybrid work and resilience) had 23% of respondents identifying as LGBTQIAPN+. The authors emphasize that diverse teams bring varied perspectives and life experiences, enhancing problem-solving and overcoming challenges.

In **S2**, a dynamic of greater involvement between developers and the team is evidenced, in the **Q remote work environment**; the authors investigated a sample of 57 software professionals, with different genders, ethnicities, and orientations, belonging to the LGBTQIAPN+ community. When interpreting the experiences of professionals, using *Grounded theory methodology* (GTM) in **S2**, the authors report that remote work benefits LGBTQIAPN+ people, this is due to increased safety and visibility, which facilitates involvement with the team, since when integrated into a team, professionals who fear violence and discrimination feel safe, in addition, gains are made about control over their identity.

The authors in **S2** discuss the dynamics of team involvement, noting that individuals may choose to share their LGBTQIAPN+ identity later in remote work setups. However, challenges such as **Q invisibility and isolation** for LGBTQIAPN+ professionals are reported as frustrations. This issue of invisibility in **S2** relates to team integration and engagement, impacting developers' motivation in agile environments. Another finding

from **S2** is that LGBTQIAPN+ developers can adapt well to remote work because  **they can control their environment** through camera settings and chat. This control is beneficial, as it enhances psychological safety for this underrepresented group, which often faces discrimination and violence.

A.2:

LGBTQIAPN+ developers in agile teams expect a welcoming environment with representation and effective inclusion policies, viewing remote work positively due to increased safety and control over identity disclosure (S1, S2, S10). Challenges include dealing with discrimination, microaggressions, and balancing participation in D&I initiatives with work demands, often exacerbated in in-person settings (S4, S7, S11). Control over identity sharing and protective policies are essential for psychological and physical safety in these agile environments (S8, S10).

To support the understanding of the themes identified in the studies, based on the thematic synthesis, themes associated with developers' expectations are marked with the symbol , while themes related to challenges are marked with .

In **S1**, the respondent expresses their  **expectations regarding representation**. The respondent states that a leadership figure from underrepresented groups helped her consider the professional journey. In addition, participants also report the  **challenge of participating in diversity and inclusion events** proposed by their employer, as they need to reconcile participation in events with work demands and a work tool (*Slack*) with a large volume of information.

Study **S4** presents accounts from transgender participants working as software professionals.  **Expectations about team acceptance** are reported. In addition, there is  **frustration** about the presence of tokenism regarding invitations for trans people to participate in discussions about diversity in the company, which should be the responsibility of the company to promote a safe and inclusive environment.

Another point discussed in **S4** is the report of the transgender developer, about the importance of working remotely and the fact that she can control the camera on days when she is having dysphoria crises (a psychological process in which there is an aversion to one's own image). Still on transgender people, in study **S6**, it is reported that  **companies that have inclusion and diversity policies** are preferred by non-binary and transgender professionals participating in the research.

Study **S11** reports the experience of a *queer* person and software professional, about their suffering with returning to in-person work, since they report a routine of microaggressions in the workplace and the loss of autonomy. There is also an  **expectation** about hybrid work, as opposed to returning to the in-person work model. This is consistent with the findings of **S2**, which describes the challenge of LGBTQIAPN+ professionals when dealing with  **discrimination**, possible aggression and violence in the in-person

work model. In addition to possible ☹ **toxic environments** faced in the in-person work by the research participants. This data is consistent with the reports brought in **S7** about the experiences of LGBTQIAPN+ professionals who suffered discrimination and sexism.

In work **S8**, the participants reported problems related to *hackathons* organizations, events that are part of the agile scope. The research participants reported suffering ☹ **discrimination** by the *hackathons* organization and a transgender person also reported that she stopped participating in *hackathons* due to discrimination suffered. ☹ **Control over the disclosure of one's identity** was also a challenge presented by a trans person when participating in the *hackathon*. This data is also reported in studies **S2**, **S3**. This fact is important for LGBTQIAPN+ developers, to express what information other people can access and when to share it (FORD; MILEWICZ; SEREBRENIK, 2019; SANTOS; MAGALHAES; RALPH, 2023).

☹ **Control over identity sharing** is extremely important, since by exposing one's gender identification, pronouns, or sexuality, the LGBTQIAPN+ community can be victims of discrimination and violence (DAVID, 2017; FORD; MILEWICZ; SEREBRENIK, 2019; SANTOS; MAGALHAES; RALPH, 2023; PRADO et al., 2020). In **S2** this issue is also brought up and emphasized as essential for the safety and better experience of LGBTQIAPN+ people in agile software development environments.

S10 highlights ☑ **practical actions**: creating a safe, inclusive environment for LGBTQIAPN+ ☑ **individuals requires managing identity disclosure**. In the study **S9** contributes to this discussion, it only partially addresses the issue, as non-binary participants note that ☹ **frustration about destructive feedback** in *code reviews*. Despite its limited contribution, it's important to recognize the scarcity of studies on the experiences and challenges faced by non-binary individuals in agile software development.

In a study conducted in **S7** involving two companies with inclusion and diversity programs and policies, two respondents from each company were interviewed. One interviewee described experiencing rude and ☹ **discriminatory treatment** when interacting with the product owner of another team. Conversely, another participant noted that their current company, which implements ☑ **D&I policies**, offers better opportunities compared to their previous employer. The feelings of ☹ **frustration and abandonment** identified by the authors stem from the ☹ **inadequacy of the inclusion and diversity initiatives**. A participant in **S7** states that her leader minimizes incidents of homophobia within the team. A self-identified lesbian describes experiencing hypersexualization from her superior. The four participants express dissatisfaction with the effectiveness of D&I policies, highlighting that such policies alone are insufficient for retaining LGBTQIAPN+ professionals.

In study **S5**, the research examines the mindset change of participants from fundamentalists regarding gender diversity to integrators and transformers in software develop-

ment,  **promoting greater acceptance of gender diversity**. One participant noted that this  **transition was challenging**, as it coincided with their acceptance of their sexuality—a process unique to LGBTQIAPN+ individuals that cisgender heterosexual people do not experience.

When analyzing the contributions of the works, positive expectations regarding diversity in teams for LGBTQIAPN+ professionals are noted in **S1, S4, S7, S6, S10**. In studies **S2, S3, S8, S10**, the importance of controlling identity sharing/disclosure is noted. Challenges related to fear of physical and psychological violence, and discrimination/LGBTphobia suffered by professionals are reported in **S2, S4, S7, S8, S11**. Positive expectations about remote work are present in **S2, S3, S10, S11**.

In **S1 S2, S7 S8, S10** they address reflections on the importance of effective inclusion and diversity policies for LGBTQIAPN+ professionals. In **S2, S3, S7, S8, S11** points such as psychological safety, physical safety, LGBTphobia, and microaggressions are pointed out as challenges experienced by LGBTQIAPN+ professionals within their teams. The expectations of professionals for remote work as opposed to in-person work are found in **S2, S3, S4, S10, S11**.

A.3:

The studies recommend offering remote or hybrid work options, promoting democratic structures that allow workspace choice, and fostering inclusive recruitment and onboarding (S2, S9, S10). Establishing LGBTQIAPN+ committees and supportive networks helps reduce isolation, while inclusive hackathon organization and visible anti-discrimination policies can enhance participation and safety (S8, S10). Recognizing diversity as a driver of innovation also builds a welcoming culture, supporting retention and broader interest in tech fields.

Aiming to support the connection between recommendations found in literature and DX dimensions (affect, conation, cognition). **We present below the identified recommendations for each DX dimension.**

Concerning **affect**, in **S2**, recommendations include promoting a culture of diversity and inclusion, creating committees for LGBTQIAPN+ developers to connect, celebrating diversity and inclusion, and recognizing diversity as a driver of technological development. In **S8**, recommendations for hackathon organization emphasize inclusive communication, increased participation of transgender individuals in organizing teams, and the establishment of codes of conduct against LGBTQ+phobia to ensure a welcoming and safe environment.

Regarding **conation**, in **S2**, the development of democratic remote work structures is recommended, allowing professionals to choose their workspace and helping LGBTQIAPN+ software developers address violence, toxicity, and challenges related to in-person work. **S10** advocates for fair recruitment practices, inclusive onboarding, and democratic

remote work structures, highlighting the specific needs of LGBTQIAPN+ professionals and emphasizing diversity as a driver of innovation and investment. In **S8**, transparency in selection processes is recommended to facilitate access for trans individuals to job opportunities in the software industry, addressing challenges highlighted in **S6**.

Finally when analyzing **cognition**, **S9** suggests remote or hybrid work as a factor for improving the developer experience. However, while the study intersects with LGBTQIAPN+ issues, its primary focus is on racial matters, providing only partial insights into the question. **S2** addresses the benefits and limitations of remote work, noting a trend in 2024 towards in-person models. Gaps remain in addressing the in-person model, but challenges can be mitigated by offering remote work options.

3.5 Grey Literature Review

We followed the recommendations for systematic grey literature reviews from Garousi et al. (GAROUSI; FELDERER; MÄNTYLÄ, 2019) (GAROUSI et al., 2020) and Kamei et al. (KAMEI et al., 2021). Many SE studies overlook community platforms like Dev.to⁶ and Medium as data sources (LIANG et al., 2024). We selected the Dev.to database for its reputation as a prominent hub where software professionals share insights and discuss industry topics (PAPOUTSOGLU; WACHS; KAPITSAKI, 2021). It was recently used as the single source of another GLR (CERQUEIRA et al., 2024) and in a mining study (PAPOUTSOGLU; WACHS; KAPITSAKI, 2021). We excluded Medium due to the prevalence of paywalled articles, whereas Dev provides free access to content.

3.5.1 GLR Method

Test for use of grey literature: Due to the small sample of works found in the traditional literature to collaborate with the research questions, we performed the test proposed by Garousi et al. (GAROUSI; FELDERER; MÄNTYLÄ, 2019) obtaining "Yes" in more than three questions. Thus, we were able to verify the use of literature in our research and design the search strategy.

Search Strategies: Two strategies were defined to search for material on the Dev.to. The first (Strategy A) consists of constructing a search string that is different from that used in SLR. In Strategy A, the search for content on dev.to was indexed by the Google Search Engine. The second (Strategy B) consists of searching directly on the Dev.to for terms related to the scope of this research. The GLR process is described in Fig. 4 and the strings used in Table 4.

⁶ <https://dev.to/>

To search for grey literature documents, the Chromium⁷ browser was used in anonymous mode. A stopping criteria (called Effort bounded (GAROUSI; FELDERER; MÄNTYLÄ, 2019)) was defined to capture up to 100 documents/*posts* for both search strategies based on the Google ranking algorithm. According to Google's search and indexing tools, to index results from a website, "site:address" must be added to the end of the search. Thus, to execute search strategy A, a search string was constructed using the PICO strategy (PETERSEN; VAKKALANKA; KUZNIARZ, 2015), with the addition of site:dev.to. The search strategy A led to 100 posts according to the previously defined stopping criteria. In search strategy B, 59 documents referring to user posts were returned.

Table 4 – Search strategies used in the grey literature review

Strategy A	Strategy B
("gay" OR "Bisexual" OR "Transgender" OR "Trans" OR "LGBT" OR "Queer" OR "non*binary") And ("tech" OR "developer") site:dev.to	LGBT tech
Filtered Documents: D1, D2, D3, D4, D5, D6, D7, D8, D9	Filtered Documents: E1, E2, E3, E4, E5, E6

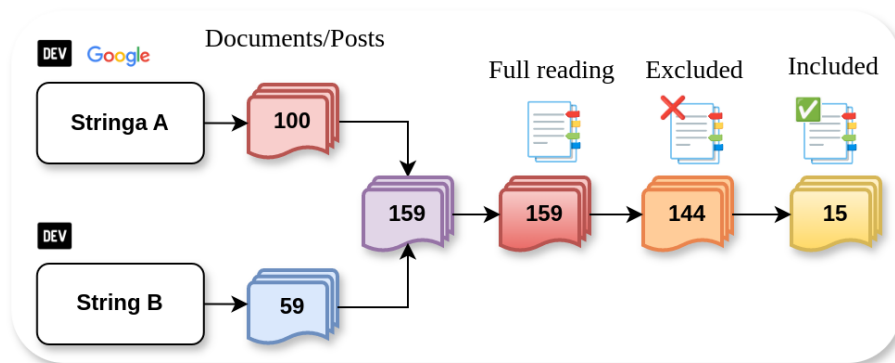


Figure 4 – Grey literature review process/method execution.

Inclusion and Exclusion Criteria: we defined the following criteria based on Garousi et al. (GAROUSI; FELDERER; MÄNTYLÄ, 2019): (A) Materials accessible on the Web or by contacting the authors - to allow being able to trace findings from the original study to each individual source; (B) Material available in text; (C) Material that answers at least one auxiliary question, partially or fully - to consider that material is linked to research question discussed, and; (D) Non-duplicated material. We also analyzed whether the author has expertise in the field by reviewing their LinkedIn profile. After filtering the documents using the criteria, they were read in full. In Strategy A, nine documents (posts) were included, in Strategy B, six documents were included. The documents included after

⁷ <https://www.chromium.org/>

classification were placed in a spreadsheet and assigned an ID. For documents in strategy A, the prefix "D" was added, followed by the order of discovery. For documents in strategy B, the prefix "E" was added, followed by the order of discovery (Table 4).

Thematic synthesis from grey literature: We applied the same process used in SLR (Section A). We obtained 23 themes⁸. The main themes are discussed in the next section.

3.5.2 GLR Results

A.1:

Professionals express frustration and dissatisfaction with their team dynamics. They face challenges such as difficulties in sharing identities, feelings of isolation, a lack of perceived diversity within the team, and the prevalence of male dominance. Despite these issues, they find satisfaction in participating in hackathons and collaborating with teams that prioritize diversity.

In **D1**, a transgender professional in a software team describes her experience at a start-up. She received **Q positive treatment when sharing gender identity** but was denied a promotion despite wanting a reassignment for six months. She emphasizes her dedication to resolving technical issues, including coding and training, and addresses key points relevant to the technology field. “Just because I don’t have an engineering degree doesn’t mean I don’t know anything about technology or that I can’t easily understand it (...)”

In **D2**, a transgender professional recounts aspects of her pre-transition experience that conformed to the dominant masculinity stereotype in the technology industry. She describes the weight **Q of being a transgender woman in technology** “I’ve been on the other side of that (...) Before I transitioned, I was definitely bathing in the toxic masculinity that constitutes the tech industry. I spoke loudly, I was impetuous, I would definitely interrupt when others were speaking... here’s the thing: it was effective.”

The professional brings her considerations the **Q implicit male code in technology** : “There is something present in today’s technology culture that is indescribable, a code of how we act and how we discuss that is implicit (...) and also the **Q low perceived diversity** “ (...) Most of the time, it is just cis men talking to cis men, with no diverse voices in the room to change the pattern of conversation.”. In **D5**, the professional describes the evolution of her professional journey, which goes from frustration with perceived diversity to the pressure of being a minority and having a **Q weight of representation**: “I felt the weight of representing multiple marginalized groups. So I leaned forward, I put my hands on my hips when I addressed the room, I spoke loudly,

⁸ <https://figshare.com/s/f491b3e9d61f65e02898> . Due to a recommendation from the literature (SANTOS et al., 2024; ??), we chose to submit the grey literature synthesis data only for review and to provide only the codebook in the final version. These data obtained from public social networks will not be attached to the final publication.

got serious, smiled less (...)”. The professional also highlights the positive impact of **👉 a supportive and inclusive team environment** “My team was supportive and kind; they guided me through the tech jargon and answered my silly questions with patience and respect. And underscores the significance of **👉 recognizing and valuing effort** and **👉 a learner’s mindset**: “And most of all, they appreciated my efforts to understand their roles...I made up for in genuine curiosity and a willingness to learn.”

D3 emphasizes the importance of intentionally including individuals from under-represented gender identities to **👉 increase diversity**. The specific mention of trans women, non-binary, and intersex people underscores the need to expand beyond traditional diversity categories: “Making sure to include trans women, non-binary and intersex people in the group goes a long way towards inclusivity.” In **E2**, the developer shares that her introduction to the tech industry began at a *bootcamp* focused on LGBTQIAPN+ inclusion. She reports facing **👉 challenges during her learning experience**, particularly about team dynamics. In **E4**, the developers talk about the challenges they faced in learning to code. The reports from the professional highlight the challenges transgender individuals face in agile software development teams, including **👉 psychological insecurity**, **👉 fear of prejudice**, and **👉 concerns about professional growth, team dynamics, and engagement**.

In **E5**, a developer talks about feeling motivated to participate with others LGBTQIAPN+ in a *hackathon* but also the uncertainty about whether their experience aligns with standard hackathon dynamics - **👉 uncertainty about norms**. The person describes **👉 positive outcomes through experience and networking**: “I’m not sure if this experience is typical of hackathons... The experience and networking I sought were great...”

A.2:

Professionals in the tech industry often face challenges such as toxicity, implicit and masculine codes of conduct, discrimination, and impostor syndrome. There are also expectations for greater diversity, more inclusive teams and job interviews, support for underrepresented minorities—including transgender and non-binary people—and the elimination of gender bias.

Themes associated with developers’ expectations are marked with the symbol **👉**, while themes related to challenges are marked with **😬**.

In **D1**, the professional reports fear due to **😬 suffering discrimination** in the workplace: “Just because I don’t have an engineering degree doesn’t mean I don’t know anything about technology (...) I’m scared to be in the room with you. (...) Being transgender in tech is even harder.”. In **D7**, an episode of discrimination is reported. “I have suffered discrimination (...)”. In **D1** and **D5**, **😬 impostor syndrome** is reported as a challenge in the professional journey.

In **D8**, the LGBTQIAPN+ developer’s expectations involve positive expectations

regarding **☑ support for LGBTQIAPN+**. In **D9**, the developer reports positive expectations around the **☑ expansion of gender in technology movements**, which includes being a non-binary person.

In **E1**, the developer (*Queer*) reports that her journey in the technology area is lonely and faces several challenges, despite reporting support from members within the team. There are **☹ social isolation and exclusion** “*Still, I feel lonely in the tech scene as an openly queer man (...)*”, **☹ contrast between negative experiences and support** “*I tend to get a front row seat to the sexism, anti-queerness, and toxic masculinity that tech spaces have gotten a bad rap for (...) My colleagues were always there to support me...*”

In **E3**, a transgender and non-binary developer shares their transition and challenges in the tech industry, addressing **☹ discomfort with incorrect pronouns**: “*Listen to us and what we have to say. Believe us when we tell you about our experiences. Make space for us. Especially for non-binary people (...)*”. In **E4**, reported expectations include **☑ more diverse environments**, inclusion of non-binary and transgender individuals, **☑ diversity-focused initiatives**, **☑ career growth opportunities** in software, and greater **☑ acceptance of diverse gender identities**.

Among the challenges, the inclusion of transgender developers found in the thematic synthesis resonates with data from the literature (PRADO et al., 2020; FORD; MILEWICZ; SEREBRENIK, 2019; SANTOS; MAGALHAES; RALPH, 2023). This underrepresentation in the software industry is challenging for agile teams, as these professionals routinely face transphobia, isolation, and psychological insecurity, affecting retention in teams (PRADO et al., 2020; SANTOS; MAGALHAES; RALPH, 2023; SANTOS; STUART-VERNER; MAGALHÃES, 2023).

A.3:

It's essential to include women, transgender, non-binary, and intersex individuals in professional settings. Efforts should focus on promoting diversity and raising awareness to reduce bias. This involves creating space for LGBTQIAPN+ professionals, eliminating assumptions about women, addressing unconscious biases, and challenging the belief that leaders must be men.

Considering the DX dimensions and the documents we derived the following recommendations: Regarding **conation**, **D3** emphasizes the inclusion of trans women, non-binary, and intersex individuals as a step toward actively embracing equality in the tech industry. Encourage companies and teams to include underrepresented groups in their initiatives actively. **D7** prioritizes awareness and educational efforts in the workplace to reduce unfounded fears and prejudices against underrepresented groups in technology. Promote structured training and workshops to address biases and foster inclusivity. Finally, **E6** addresses unconscious biases in hiring practices, such as assump-

tions about women’s technical capabilities, to lower artificial barriers for underrepresented groups in the technology sector. Create actionable plans to eliminate biases in executive and senior leadership expectations.

Concerning **cognition**, **D6** acknowledges the impact of non-inclusive language in team settings. If a term or phrase makes someone feel excluded, replace it with a more inclusive alternative. Foster an environment where language evolves to accommodate all team members. **D7**, highlight the significance of awareness-raising actions and educational work to combat prejudice. Encourage team discussions and learning sessions to address the root causes of workplace biases. **E4** recommends focusing on creating space and genuinely listening to LGBTQIAPN+ individuals, especially non-binary and transgender professionals, to better understand their experiences and needs in the technology industry.

About **affect**, **D4** recommends creating an atmosphere where all individuals feel genuinely welcome, rather than targeting specific proportions of “diverse” participants. Prioritize inclusion as a cultural value that transcends numerical representation. When organizing events, as discussed in **D4**, aim to include all programmers without fragmenting into overly specific groups, while ensuring that diverse identities feel represented and supported. Then, **D6** addresses the emotional toll of microaggressions faced by underrepresented groups, such as being undervalued despite expertise. Encourage teams to support actively and uplift colleagues who experience these subtle but harmful behaviors.

3.6 Discussion and Practical Actions

The triangulation of (A.1) findings show that diverse teams demonstrate higher productivity and resilience due to the unique perspectives of their members. SLR studies, such as S1 and S10, highlight these benefits, corroborated by GLR documents like D5 and E5, which emphasize the positive impact of inclusive team environments and events, such as hackathons, on LGBTQIAPN+ professionals’ collaboration.

Psychological safety and identity management emerged as crucial factors for LGBTQIAPN+ professionals **at the individual level**. SLR findings (S2) underline the advantages of remote work, which allows individuals to control the disclosure of their identity, enhancing their integration into teams. However, persistent challenges such as invisibility and isolation were noted. Similarly, GLR accounts (D1, E2, E3) reflect these dynamics, indicating that while remote work supports identity management, it does not address the emotional toll of isolation.

At the team level, implicit cultural codes and toxic masculinity in agile environments present significant barriers to inclusion. Studies (S7, S8) and GLR sources (D2) report that these norms stifle diverse conversations and create challenges for LGBTQIAPN+

professionals. Addressing these cultural issues requires targeted interventions, such as conducting regular diversity and inclusion (D&I) workshops to dismantle toxic behaviors and foster allyship. Introducing team rituals and norms that encourage inclusive communication and collaborative problem-solving can also promote a more welcoming environment. Furthermore, implementing visibility measures, such as recognizing LGBTQIAPN+ contributions in team discussions and events, enhances the sense of belonging.

Visibility and diversity are crucial for inclusive team dynamics. S1 highlights issues like poor communication channels, while GLR (D3, E4) stress the need for active representation, especially for transgender and non-binary professionals. Teams can address this by implementing structured onboarding to introduce D&I policies and resources. Regular events, like inclusive hackathons, reinforce inclusion and build community.

At the organizational level, systemic barriers such as invisibility and isolation persist, particularly in remote settings. Both SLR (S2) and GLR (D1, E2) findings underscore the need for proactive strategies to improve team integration and engagement. Organizations should develop and enforce comprehensive D&I policies that address specific challenges faced by LGBTQIAPN+ professionals. Investing in leadership training to cultivate inclusive managers who actively promote psychological safety and visibility within their teams is equally important. Finally, fostering partnerships with LGBTQIAPN+ advocacy organizations enhances representation and provides access to external support networks, reinforcing the organization's commitment to diversity and inclusion.

Concerning (A.2), LGBTQIAPN+ professionals often expect inclusive environments with effective D&I policies, representation, and psychological safety. S1, S6, S10 highlight the value of team acceptance and inclusive leadership, while GLR (D3, E4) emphasize equitable treatment, especially for non-binary and transgender individuals. However, recurring challenges include discrimination, microaggressions, and the toll of identity management. SLR (S2, S4, S7, S8) report bias in team interactions, weak D&I initiatives, and the emotional burden of representing multiple marginalized identities. GLR (D1, D7, E1, E3) echo these, noting exclusion, toxic behaviors, and discomfort with misused pronouns, which foster isolation and hinder growth. **At the individual level**, organizations can implement strategies to mitigate these barriers. Providing mentorship programs that help LGBTQIAPN+ professionals navigate workplace challenges and foster a sense of belonging is critical. Additionally, offering resources such as LGBTQIAPN+ employee networks, support groups, and access to inclusive mental health services can promote psychological well-being. Encouraging tailored career development plans that recognize individual LGBTQIAPN+ experiences and aspirations.

At the team level, fostering inclusivity is key to overcoming systemic barriers. SLR findings (S2, S10) highlight the need to give LGBTQIAPN+ professionals control over identity disclosure, while GLR accounts (D5, E3) stress the tension between authen-

ticity and self-disclosure risks. Impostor syndrome, especially for transgender and non-binary developers, adds further challenges (SLR S6, GLR D1, D5). Teams can address these by conducting D&I workshops on allyship and inclusive communication, celebrating diversity with team rituals, and ensuring structured onboarding covers D&I policies and pronoun usage to support new members.

Despite challenges, remote and hybrid work models help mitigate negative experiences. SLR (S2, S11) discuss the safety and flexibility they provide, while GLR sources (D3, E4) emphasize greater autonomy and protection from harmful interactions. ***At the organizational level***, systemic change is essential to foster inclusivity. Key steps include developing robust D&I policies addressing gender identity and expression, training leaders to create safe spaces for identity-related discussions, and partnering with LGBTQIAPN+ advocacy groups to enhance representation and access to resources. These actions reinforce the organization's commitment to inclusivity.

When discussing (A.3), recommendations can be divided into short-term and long-term strategies. ***In the short-term***, organizations should prioritize offering remote and hybrid work options, enabling LGBTQIAPN+ employees to control their environments and disclosure preferences while mitigating risks such as microaggressions and discrimination (SLR: S2, S8, S10; GLR: D3). Transparent anti-discrimination policies with clear reporting protocols must be drafted and shared publicly to address harassment and bias effectively (SLR: S2, S7, S8; GLR: D4, E3). Training on inclusive language and pronoun usage should be implemented, alongside audits to remove exclusionary terminology (GLR: D3, D6). Diversity can be celebrated through initiatives like Pride Month events and storytelling sessions, fostering team cohesion (GLR: D5, E6). Establishing peer support groups or committees for LGBTQIAPN+ professionals further promotes safe spaces and reduces isolation (SLR: S2, S8, S10; GLR: D7).

Long-term strategies should focus on systemic changes that embed inclusivity into the organization's culture. Recruitment and onboarding processes should emphasize transparency and inclusivity by explicitly mentioning diversity commitments and offering tailored mentorship for LGBTQIAPN+ employees (SLR: S8, S10; GLR: D3, E4). Leadership development initiatives should actively involve LGBTQIAPN+ individuals in decision-making roles while providing diversity training for all leaders to address unconscious biases and foster supportive team environments (SLR: S8; GLR: D3, E6). Inclusive event organizations, such as hackathons, should ensure participation from diverse groups and adopt codes of conduct to promote a welcoming atmosphere (SLR: S7, S8; GLR: E4). Comprehensive Diversity and Inclusion (D&I) programs with measurable long-term goals should be established and regularly assessed for effectiveness (SLR: S7, S10; GLR: E6). Organizations should also integrate diversity into strategic goals as a driver for innovation and collaborate with external experts to implement best practices

(SLR: S10; GLR: D3).

Invisibility and isolation can be mitigated by mentoring programs and inclusive team-building activities that enhance visibility and engagement (SLR: S2; GLR: D7). Toxic work environments require training for managers and employees to recognize and address microaggressions, foster accountability, and support affected individuals (SLR: S7, S8; GLR: D4). Policies and tools that empower LGBTQIAPN+ professionals to manage identity disclosure can reduce emotional and professional risks, ensuring psychological safety and autonomy (SLR: S2, S8; GLR: E3, E4). By implementing these strategies, organizations can create inclusive environments that improve the experiences of LGBTQIAPN+ professionals and leverage the innovation potential of diverse agile teams.

3.7 Threats to validity

The limited number of relevant studies poses challenges in gathering evidence on underrepresented populations, such as non-binary and transgender individuals, within the LGBTQIAPN+ community. To address this, both SLR and GLR were conducted to enhance the reliability of the results. Combining these approaches ensured broader coverage of available and published information. Another threat to validity lies in the small amount of material identified based on the criteria for synthesizing grey literature. To mitigate this, three established recommendations from the literature ([KAMEI et al., 2021](#)), ([GAROUSI; FELDERER; MÄNTYLÄ, 2019](#)), ([GAROUSI et al., 2020](#)) were followed. Additionally, two web search strategies, Strategy A and Strategy B (Section 3.5.1), were defined to gather comprehensive material. This careful process was crucial to maintaining the quality of the results. The integration of data from industry professionals may be influenced by personal biases linked to their positions and contexts. Unfortunately, this threat could not be mitigated.

3.8 Conclusion and Future work

This research focused on gathering evidence on the experiences of diverse sexual and gender identities within the community of industry professionals who identify as members of the LGBTQIAPN+ population. However, existing literature highlights the need to explore the intersections of this population with race, individuals with disabilities, and neurodivergent individuals. Future studies could collect data on these intersections and examine their implications for the experiences of LGBTQIAPN+ professionals.

4 Investigating the Developer Experience of LGBTQIAPN+ People in Agile Teams

Research on underrepresented populations is essential for fostering greater diversity within the software industry. Team diversity is important for reasons that go beyond ethics. Diversity contributes to greater innovation and productivity, helping decrease turnover rates and reduce team conflicts. Within this context, LGBTQIAPN+ software engineering professionals face unique challenges, e.g., self-isolation and invisibility feeling. Developer Experience (DX) encompasses cognitive, emotional, and motivational considerations, supporting the idea that improving how DX can enhance team performance, strengthen collaboration, and lead to more successful software projects. This study aimed to examine traditional and grey literature data through a Multivocal Literature Review focused on the DX of LGBTQIAPN+ professionals in agile teams. Our findings reveal that issues such as invisibility, prejudice, and discrimination adversely affect their experiences, compounded by the predominance of heterosexual males in the field. Conversely, professionals who feel welcomed by their teams and organizations, especially in processes tailored to their needs, report more positive team dynamics and engagement.

Keywords: *LGBT , LGBTQIAPN+ , diversity , developer experience , agile*

4.1 Introduction

The software industry recognizes the value of diversity, as diverse teams provide significant advantages for companies (GRUNDY et al., 2024). Although differences can lead to conflicts and challenges, the benefits of diversity often outweigh these issues (SANTOS; MAGALHAES; RALPH, 2023; HOFFMANN et al., 2022; PRIKLADNICKI; AUDY, 2005; MIRANDA; PRIKLADNICKI, 2020). The opportunities for improvement in team management can be identified to enhance the retention of professionals (SANTOS; MAGALHAES; RALPH, 2023), since developer satisfaction directly contributes to increased daily productivity (HOFFMANN et al., 2022; PRIKLADNICKI; AUDY, 2005; MIRANDA; PRIKLADNICKI, 2020).

In agile software development teams, trust is essential. Communication and context form the foundation of effective collaboration, and a lack of trust can lead to irreversible consequences, such as reluctance to share information and a decline in product quality (SANTOS; MAGALHAES; RALPH, 2023; SILVEIRA; PRIKLADNICKI, 2019). From this perspective, one of the core principles of the Agile Manifesto is *Individuals and Interactions Over Processes and Tools*, which emphasizes the importance of constructing projects around motivated individuals. Additionally, professionals must receive adequate support to foster confidence in their ability to perform their tasks effectively (PRIKLADNICKI; AUDY, 2005; FOWLER; HIGHSMITH et al., 2001).

Dissatisfied software professionals often perceive their productivity as lower than their potential, leading to regrets about the quality of the products generated by their work. Moreover, individuals who are unhappy with their outputs and roles may make work-related decisions that negatively affect software quality and the delivery of value to customers (GIRARDI et al., 2021; JUÁREZ-RAMÍREZ et al., 2021; BORG; GRAZIOTIN, 2024; GRAZIOTIN; WANG; ABRAHAMSSON, 2014; GRAZIOTIN et al., 2017a; FAGERHOLM; MÜNCH, 2012; WAZLAWICK, 2019).

Discrimination and invisibility (SANTOS; ADISAPUTRI; RALPH, 2023), low perceived diversity, and harassment (PONCELL; GAMA, 2022) are factors that adversely impact the experiences of LGBTQIAPN+ professionals in the software industry (SANTOS; MAGALHAES; RALPH, 2023). Current research underscores the importance of research focused on the LGBTQIAPN+ population (Lesbians, Gays, Bisexuals, Transgender individuals, and other groups who do not conform to traditional gender and sexual norms) within the software industry (SANTOS; MAGALHAES; RALPH, 2023) and in Software Engineering (BOMAN; ANDERSSON; NETO, 2024). Research conducted by Ford et al. (FORD; MILEWICZ; SEREBRENIK, 2019) emphasizes the need to develop practices that enhance LGBTQIAPN+ visibility among employees in technology companies.

In this context, it is crucial to investigate the aspects of Developer Experience

(DX) for this population to identify solutions that can enhance their satisfaction. As noted by Silveira and Prikladnicki ([SILVEIRA; PRIKLADNICKI, 2019](#)) in a systematic mapping study, "*There are research studies about Diversity in Software Engineering, but the literature is missing papers on how Diversity impacts Agile Methodologies*". In this study, we conducted an interpretive opinion survey with 40 participants to answer "*What are the perceptions of LGBTQIAPN+ software developers about their DX within agile teams?*". We discovered evidence of:

- LGBTQIAPN+ professionals thrive in teams where diversity is actively embraced, psychological safety is ensured, and discriminatory behaviors are swiftly addressed. Organizations should develop inclusive policies and provide training to support diverse team dynamics, enabling all professionals to contribute effectively;
- Agile practices such as retrospectives, pair programming, and daily meetings are effective in enhancing team collaboration and mitigating biases. These practices should be tailored to address challenges faced by underrepresented groups, creating a culture of mutual respect and openness;
- Remote work models demonstrate significant benefits, including improved productivity, psychological comfort, and work-life balance for LGBTQIAPN+ professionals. However, organizations must also address challenges like isolation by fostering strong virtual team interactions and ensuring an inclusive environment in hybrid and on-site settings.

4.2 Background and Related Work

4.2.1 Developer Experience (DX)

Fagerholm and Münch (2012)([FAGERHOLM; MÜNCH, 2012](#)) define Developer Experience (DX) as a concept that captures developers' perceptions—how they think and feel about their activities within the work environment, their teams, and the software development processes they engage in. Enhancements in DX can have a positive impact on the outcomes of software development projects. Therefore, promoting improvements in the DX of software professionals is essential for delivering value ([KLOTINS; GORSCHKE; WILSON, 2023](#); [GREILER; STOREY; NODA, 2022](#); [KROPP et al., 2020](#)).

Furthermore, research ([DUTRA; DIIRR; SANTOS, 2021](#); [MACHUCA-VILLEGAS et al., 2022](#); [PRIKLADNICKI; AUDY, 2005](#)) has highlighted the influence of non-technical aspects, including human and social factors, on productivity and value delivery in agile software development. Among these factors, communication, collaboration, knowledge sharing, and motivation significantly impact team dynamics.

There is an emerging body of research in the literature that identifies various factors influencing DX, often referred to as DX Factors. These factors can be categorized into three dimensions: conation, affect, and cognition (GREILER; STOREY; NODA, 2022; FAGERHOLM; MÜNCH, 2012; D'ANGELO et al., 2024). A systematic review of the literature (SLR) conducted by Razzaq (RAZZAQ et al., 2024) discusses elements that affect and improve DX. Among the motivations and DX factors highlighted, non-technical aspects such as psychological safety and psychological distress are noted as significant influences on the experiences of professionals in the field.

4.2.2 Diversity and Inclusion in Software Engineering

Perceived diversity is a concept that helps researchers examine how low-diversity environments impact the experiences of professionals in the industry (RODRÍGUEZ-PÉREZ; NADRI; NAGAPPAN, 2021; PONCELL; GAMA, 2022). This concept can be utilized to gather evidence regarding diversity in the software industry and to assess its effects on professional satisfaction within teams and organizations.

Environments lacking in diversity can perpetuate gender and sexual biases that negatively affect underrepresented populations, such as the LGBTQIAPN+ community. In the software industry, the presence of unconscious biases can hinder the inclusion, participation, and productivity of these underrepresented groups (SOUZA; GAMA, 2020; PRANA et al., 2021). Research has demonstrated that unconscious gender biases can undermine women's contributions and participation in teams, adversely affecting their overall experience and inclusion in the software industry (TORO et al., 2024; IMTIAZ et al., 2019; KANIJ; GRUNDY; MCINTOSH, 2024; TRINKENREICH et al., 2022b).

This scenario underscores the obstacles present in the software industry, particularly the challenges of including underrepresented groups due to hiring preferences in a market dominated by white male workers (WEISSHAAR; CHAVEZ; HUTT, 2024; HUSSAIN et al., 2020; TRINKENREICH et al., 2022a; CAMPERO, 2021). Consequently, research on diversity and inclusion is gaining traction by focusing on the underrepresentation of minority groups, particularly regarding gender and race (RODRÍGUEZ-PÉREZ; NADRI; NAGAPPAN, 2021; CANEDO et al., 2021; BREUKELLEN et al., 2023; TRINKENREICH et al., 2022a; GAMA et al., 2024; DAGAN et al., 2023; ALBUSAYS et al., 2021; SÁNCHEZ-GORDÓN; COLOMO-PALACIOS, 2021; RICHARD; TRIANA; LI, 2021; GÜNAY et al., 2020; VERWIJS; RUSSO, 2023).

Moreover, since the onset of the Covid-19 pandemic, the inclusion of minority groups, including the LGBTQIAPN+ population, has led to the formation of more diverse teams (SANTOS et al., 2024; EZEILO; GREEN-MCKENZIE, 2023; SANTOS; MAGALHAES; RALPH, 2023). As a result, new challenges regarding the inclusion of this population in agile teams have become a focal point for researchers. This community is

often marginalized and historically discriminated against, which adversely affects their inclusion in formal employment and retention within the industry (SANTOS; ADISAPUTRI; RALPH, 2023; SANTOS; MAGALHAES; RALPH, 2023).

4.2.3 Work models

4.2.3.1 Remote Work

In a study carried out on job offers in startups, the authors report that the offer of remote jobs attracts more experienced and diverse candidates, belonging to under-represented minority groups (HSU; TAMBE, 2024). In this context, gender, racial, and sexual diversity is the subject of analysis for current research (SANTOS; MAGALHAES; RALPH, 2023), (FORD; MILEWICZ; SEREBRENIK, 2019), (NICHOLSON et al., 2022).

This reality allows teams with diverse compositions to be composed of LGBTQIAPN+ professionals. A study conducted by de Souza-Santos et al. (SANTOS; MAGALHAES; RALPH, 2023) points out that the benefits (control of identity, identity sharing control, psychological and physical safety) outweigh the limitations (invisibility and isolation) that involve the experience of these software professionals.

4.2.3.2 Onsite and Hybrid Work

In the post-pandemic scenario, studies have focused on assessing the resilience and adaptation of professionals in hybrid work environments. Research demonstrates the difficulties (LI et al., 2024), (SANTOS; ADISAPUTRI; RALPH, 2023), (NICHOLSON et al., 2022) faced by underrepresented populations and highlights the need for support from corporations to maintain and promote diverse teams.

The difficulties faced by the LGBTQIAPN+ population in the software industry include sexual, moral and psychological harassment, discrimination and isolation, as well as the fear of physical violence in the workplace. Thus, these factors become stressors and can affect the experience of these professionals, especially transgender professionals (FORD; MILEWICZ; SEREBRENIK, 2019), (PONCELL; GAMA, 2022), (SANTOS; ADISAPUTRI; RALPH, 2023), (SOUZA; GAMA, 2020), (NICHOLSON et al., 2022).

4.2.4 Developer Experience (DX) of LGBTQIAPN+ people

In the daily operations of software developers, the importance of culture and collaboration is crucial, as these elements are fundamental to DX. They have a direct impact on both productivity and well-being. Key components (GREILER; STOREY; NODA, 2022) include support from colleagues, occasional frustrations, the connections among team members, the use of agile collaboration practices, and the assistance provided in managing the demands and workflows that come with team dynamics.

Opinion surveys support assessing inclusion in software engineering (JOHNSON, 2024). They offer valuable insights into underrepresented communities, including women, ethnic minorities, gender-diverse groups, and neurodivergent individuals. To achieve this, it is important to utilize tools that effectively capture subjective factors such as "flow," where developers are fully engaged, and "focus," which relates to maintaining concentration on tasks (D'ANGELO et al., 2024).

Greiler (GREILER; STOREY; NODA, 2022) presents a framework for understanding and improving the developer experience (DX) of software professionals. Among the DX factors identified by the authors are support, feeling connected, collaboration and culture, and having aligned values. In this context, using surveys can be an effective strategy to capture these elements and evaluate DX from the perspective of specific contexts and cultures, within underrepresented developers, such as the LGBTQIAPN+ community.

4.3 Research Method

4.3.1 Goal and Research Questions

We performed an interpretive opinion survey with a quantitative and qualitative paradigm following the guidelines described by Mollieri et al. (MOLLÉRI; PETERSEN; MENDES, 2016). The GQM (BASILI, 1994) was used to construct the research questions to capture elements about the developer experience of LGBTQIAPN+ people in agile teams.

RQ: What are the perceptions of LGBTQIAPN+ software developers about their DX within agile teams? Rationale: We aim to investigate the specific perceptions of LGBTQIAPN+ software developers regarding their DX within agile teams, given the unique challenges they face, such as discrimination, psychological discomfort, and inadequate inclusion policies (SANTOS; MAGALHAES; RALPH, 2023). Agile methodologies emphasize collaboration and team dynamics, making it crucial to understand how these factors intersect with the experiences of underrepresented groups.

To answer this research question, we developed auxiliary questions to capture the factors influencing DX based on the work of Greiler (GREILER; STOREY; NODA, 2022) and Fagerholm and Munch (FAGERHOLM; MÜNCH, 2012). We used the influence factors categorized into three dimensions (affect - how developers feel about their work; conation - How the developers see their values embodied in experiencing some objects or processes/methods/activities they perform; cognition - refers to how developers perceive objects, such as tools, techniques, technical environment) by Razzaq et al. (RAZZAQ et al., 2024) (Table 1).

- A1: What is the perception of LGBTQIAPN+ developers regarding growth oppor-

tunities within the company and the factors that influence their career trajectories?

- *A2*: What are the main factors affecting the engagement and perception of LGBTQI-APN+ developers about their teams and work processes?
- *A3*: How do agile practices and different work models influence the DX of LGBTQI-APN+ developers in the corporate environment?

Table 5 – Research Questions - DX Factors

RQ	DX Factors	Description	Dimension
A1	Motivation;	Career opportunities, Working conditions, Participation;	Conation, affect;
A2	Motivation, Team Work, Developer Attributes;	Defined team culture, Team Collaboration, Team maturity, Supportive relationships, Team structure and more expertise, Conflicts/ congruence, Psychological distress, Avoiding Collaborating Conflicts, Pair Programming, Sprint Planning Sessions, Psychological Safety;	Conation, Affect, Cognition;
A3	Motivation, Team Culture;	Work-Life-Balance, Working conditions, Global distance, Psychological safety;	Conation, Affect;

4.4 Survey Design

4.4.1 Instrument Design

We developed the survey following the recommendations in Mollieri et al. (MOLLÉRI; PETERSEN; MENDES, 2016). Initially, an early version of the survey was created and iteratively refined. This version was then subjected to a pilot test with six participants, including researchers and postgraduate students. Based on their feedback, the adjustments were made to build the current survey version.

The survey¹ consisted of two types of questions: quantitative and qualitative. The quantitative questions included single-choice options and questions using a Likert scale. The qualitative component was made up of open-ended questions. Each section of the form contained both types of questions. To ensure participants' comfort, they were allowed to skip questions that did not apply to their professional context, avoiding forced responses.

The first page of the survey provided a summary of the research along with a consent form for participants to review. The **first two sections** cover questions aimed at characterizing participants based on their demographic information (seniority, gender identity, sexuality, and work model). **The third section** focused on the characteristics of the team in which the participants either currently work/worked (i.e., Team categories / Team formation phase) as follows:

4.4.1.1 Team categories

To categorize the teams for subsequent data analysis, two classifications were used, present in (KATZENBACH; SMITH, 2001; LIBOREIRO; GUIMARÃES et al., 2018; MONTANARI et al., 2011; SANTOS; MOURÃO; NAIFF, 2014). The first category was intended to classify the team's performance. Otherwise, the second aimed to categorize the growth state of the team. The first one provides five classifications: *Workgroup*: In this group, each person has individual responsibilities and objectives and they do not yet identify a reason for being a team. Absence of collective performance requirements. *Pseudo-team*: This group have the worst performance, as individual performance is highlighted, and the results obtained together are inferior to individual performance. *Potential team*: This group works together on its deliveries, but its members need to understand its purpose, its objectives, its products, and its tasks. *Real team*: A real team is made up of people with complementary skills and committed to each other through a common goal and well-defined work approaches. *High-performance team*: A high-performance team, in addition to having all the requirements of a real team, its members are committed to the personal growth and success of each team member.

4.4.1.2 Team formation phase

To classify the team according to the team's current formation phase, the following categories were used: *Formation*: This is the initial formation of the team, in which members are beginning to interact. It is characterized by feelings of insecurity and uncertainty regarding the group's goals, structure, and leadership. *Confusion/Conflict*: it is characterized by the occurrence of various conflicts in the group. It is a period of confrontation, disunity, tension, and hostility. *Normalization*: Cohesion begins to emerge in the group's behavior, bringing members closer to one another. At this stage, the team develops basic

¹ bit.ly/3YiMrQx

rules or norms for working together. *Performance*: the stage in which the group structure is functional and accepted. At this stage, the group is cohesive, and its energy is focused on the tasks. *Disintegration*: the final stage of group development. Since the activities must be completed and the group dissolved, the focus is no longer on task performance but on completing the work.

The **fourth section** addressed the company's approach to handling bias and how this approach impacts employees' experiences. The **fifth section** explored the participant's relationship within their team. The **sixth session section** asks participants about recommendations for agile practices that help reduce barriers, capturing professionals' opinions on recommendations to reduce bias in the job market.

4.4.2 Participants

Regarding this point, we present our adherence to reporting and conducting sampling recommended by Baltes and Ralph (BALTES; RALPH, 2022):

Philosophical position. We employed the interpretivism paradigm that focuses on understanding social phenomena from the perspective of individuals, aiming to interpret their experiences, meanings, and contexts.

The purpose of sampling. To address challenges associated with sampling hidden or underrepresented populations, we adopted a respondent-driven sampling (RDS) strategy as outlined by Baltes and Ralph (BALTES; RALPH, 2022) and Santos and Gama (SANTOS; GAMA, 2024). RDS mitigates traditional sampling biases by initiating recruitment with diverse "seeds" from the target population and leveraging participants' social networks for referrals, with controlled recruitment waves to limit the overrepresentation of highly connected individuals. It allowed us to sample to obtain initial data, generate hypotheses, or discover new patterns, and not with the goal of generalization.

Selecting our sample. The survey was distributed during November 2022 and April 2024. It was distributed through direct email invitations to eligible participants as well as shared across software development communities on LinkedIn, Twitter, and the Dev Community². Additionally, we reached out to researchers in the field who specialize in the human aspects of software engineering (SE), and they assisted in distributing the survey within their professional networks. Additionally, researchers in the field who work on issues related to the human aspects present in SE were contacted and helped distribute the form in their professional networks.

With these recommendations, we reached out to 43 participants completing the survey, resulting in a response rate of 22%. Three responses were discarded after demo-

² <https://dev.to/>

graphic checks, we identified that the participants were heterosexual and had no identification with the LGBTQIAPN+ community.

4.5 Data analysis

For data analysis, the data were prepared in spreadsheets³ and split into quantitative and qualitative data. From this, for quantitative sampling analysis, subgroups were constructed according to sexual orientation, gender, category and status of the team, and work model.

To analyze the *quantitative* data collected, we calculated the overall agreement for the general group by averaging the agreement of all participants on each issue. Subsequently, we compared the agreement levels across various subgroups, which were formed based on the participants' demographics and team categorizations. For the questions using a 5-point Likert scale, we categorized responses into levels of disagreement (partial disagreement + strong disagreement) and levels of agreement (strong agreement + agreement) to represent the general tendencies towards disagreement or agreement.

For the *qualitative* analysis, open-ended questions allowed us to explore participants' justifications for their choices on simpler questions, as well as to gather evidence about their satisfaction and perceptions regarding their experiences within the team and the company. The thematic synthesis methodology was used following the recommendations presented by Cruzes and Dyba (CRUZES; DYBA, 2011). An example of the processing of data extracted from participants is shown in **Table III**.

The process of extracting keywords and excerpts of interest, open coding, and extracting subthemes was carried out manually. For theme extraction, we used the support of an LLM (Large Language Model) tool (ChatGPT-4) following the recommendations in (ROBERTS; BAKER; ANDREW, 2024; YAN et al., 2024) which is used as an efficient tool for theme extraction. The prompt used in this study is based on "structured task description" and "Input-Process-Output (IPO)" patterns. It is described below.

I am performing a thematic synthesis process based on the responses to a survey. I will provide the questions, subthemes, and manually extracted codes, then I will ask you to generate possible themes from the codes and subthemes.

Question (Q1) - Description of the question;

Associated codes - Sequence of manually extracted codes;

Subthemes - Sequence of subthemes;

³ <https://figshare.com/s/4ba1a4048cc17148a1ba>

4.6 Results

This section presents the main findings of the quantitative and qualitative questions that help answer the auxiliary research questions. Regarding the *Demographics*, the sample of participants showed male dominance, a fact that is present even in this underrepresented group. Most professionals work remotely (70%) and there was little participation in Gender Nonconforming (GNC - transgender/non-binary) groups, only four professionals indicated that they were part of this population. This data is shown in the table **Table II**.

The qualitative results presented were obtained through thematic synthesis. To address the auxiliary research questions, the findings are organized according to the open-ended questions in the questionnaire⁴. Corresponding codes identify relevant excerpts from participants' responses. Each respondent is designated by an identifier (P) followed by a number indicating the sequence of their response.

4.6.1 (A1) What is the perception of LGBTQIAPN+ professionals regarding growth opportunities within the company and the factors that influence their career trajectories?

The perceptions regarding professional growth opportunities within the company reveal a generally favorable outlook among participants. 64.1% (25) of the group agreed, indicating a positive view, while 25.6% (10) disagreed, and 10.3% (4) remained neutral. Notably, members of real teams demonstrated an even stronger agreement rate of 70.5% (12), with only 17.7% (3) disagreeing. In comparison, potential team members showed a lower agreement rate of 66.6% (6) and a higher disagreement rate of 33.3% (3). It can suggest that established teams may provide clearer professional development pathways compared to those still forming.

The participants perceive the alignment of interests with the company they are part of as positive. 62.5% (25) agreeing and only 20% (8) disagreeing; 17.5% (7) indicating neutrality. Among real team members, the agreement rate was slightly higher at 70.58% (12), and only 5.88% (1) expressed disagreement, although a notable 23.52% (4) remained neutral. This indicates that while there is a consensus about alignment with company interests, the higher neutrality among real team members suggests that further efforts may be necessary to strengthen this alignment and ensure all team members feel equally connected to the company's goals.

The professional journey for the participants has been marked by a welcoming atmosphere and increased opportunities. Diversity has increasingly been recognized as

⁴ bit.ly/3YiMrQx

a crucial market strategy, driving improvements in acceptance, reducing conflicts, and enhancing the evolution of the work environment. This shift has fostered the development of inclusive policies and a culture that promotes respect for diversity. P13 reports a positive view of the industry being open to diversity *"I believe that the software market is quite open to LGBTQIAP+ people. Opportunities are equal regardless of sexual orientation."* Professionals highlight the company's culture as a central point in this issue, as in the report of P29: *"In general, it is challenging, but it depends exclusively on the company. In my case, the company where I currently work has a very inclusive policy for LGBTQIAP+, which makes the environment more relaxed and welcoming. I have not had any problems regarding my orientation and have always been well received by the teams I have worked for, but this is due to the culture of the company where I work."*

In contrast, there are frustrations due to the dominance of heterosexual male culture within the workplace. It leads to uncomfortable situations involving integration during agile ceremonies, low tolerance for mistakes, and experiences of jokes and discrimination. These challenges are denoted by P21: *"Full of 'obstacles' (prejudices beyond the obstacles of the area itself and many jokes disguised as pranks), and always facing distrust of its capacity and competence."* also in P2: *"...more challenges than heterosexual cis men in their daily lives. The moments when these challenges are most pronounced are in planning and discussing functionality. It is much more common for there to be unfounded disagreements, and mistakes are much less acceptable."* Participants also noted inequalities in hiring practices, work overload, and fears of social or professional retaliation. P16 captured this toxic environment, stating: *"...in the last company before, heavy atmosphere mainly in calls transphobic, xenophobic jokes and laughter against diversity and inclusion."*

4.6.2 (A2) What are the main factors affecting the engagement and perception of LGBTQIAPN+ professionals about their teams and work processes?

Regarding team classification, 42.5% (17) participants identified as belonging to a Real Team, while 25% (10) categorized themselves as part of a Potential Team. 15% (6) reported being in a High-Performance Team, and 15% (6) indicated they were part of either a Working Group or a Pseudo Team.

Concerning the team's development phase, 45% (18) of participants reported being in the Performance Phase, suggesting that many teams have reached a level of effectiveness characterized by cohesive structures and a focus on task completion. Meanwhile, 35% (14) were in the Normalization Phase, indicating ongoing adjustments and the establishment of collaborative norms. However, 10% (4) indicated being in the Formation Phase or experiencing Confusion/Conflict, highlighting that a minority of teams are still grappling

with initial stages of development that involve uncertainty and potential discord.

Positive experiences related to team characteristics are closely tied to several key factors that contribute to an effective team environment. Participants highlighted the importance of identifying issues during retrospectives, achieving efficiency through well-structured planning, and leveraging new technologies that complement the team's expertise. Other critical aspects include team commitment, mutual respect, internal support, collaborative task execution, diverse skill sets, trust in overcoming challenges, and fostering professional growth. Together, these elements enhance teamwork and strengthen the team's overall performance. P17 reports the benefits of diversity and collaboration: *"My team has diverse skills and we can rely on each other to make up for our shortcomings."*

Positive experiences related to the team phase are characterized by supportive and collaborative factors. Participants explored the smooth integration of new members, efforts to improve processes, and the absence of fear when admitting technical debt, regardless of seniority. Other key aspects included mutual collaboration towards a common goal, clear hierarchy and alignment, a solid team foundation, and good relationships among team members. These elements foster a productive and cohesive working environment, allowing teams to function more effectively. An example of this is in P5's report: *"...consider my team as real, we support each other in what we need and fight for the same goal. Each person has a skill that the other does not have or has to a lesser degree, we complement each other..."*

Frustrations about team dynamics, however, were connected to more negative aspects such as coercion, poor management, disorganization, individualism, gender bias, collaboration difficulties, task isolation, and limited communication within the team. Participants from less structured teams highlighted these challenges, as reflected in P4's statement: *"Employee performance is great, but poor management is not limited to coercion or negative feedback, it is also disorganized, which means employees do not know what they have to do or how they have to do it, and even so, what has to be done needs to be and is done."* This sentiment underscores how poor management practices can create confusion, yet tasks are still completed despite the disarray.

Frustrations about the team phase were tied to negative dynamics, such as disputes over voice and power in decision-making, fear within the decision process, challenges of centralized decision-making, and unresolved technical debt. Some participants, like P4, pointed to the lack of structure as a source of dissatisfaction: *"There is usually a dispute over voice or power over decisions regarding the specified products. Developers and designers are united, as fear allows, but there is no single person who makes decisions."* Additionally, frustration due to the immaturity of the team was noted by P38, who expressed concern over the team's lack of process knowledge: *"I think the main problem with my team is the lack of knowledge of the processes and formal knowledge of how a*

software team works."

Recent team changes were marked by continuous adaptations, as highlighted by participants. These changes included team growth, the integration of new members, and adjustments to evolving group dynamics. Despite these transformations, there was a sense of unity as teams worked through the challenges of adaptation, fostering an environment of collaboration and resilience. In terms of additional effort (Q33), participants expressed that gender dynamics and subtle biases required them to exert extra energy to be heard, particularly in Agile ceremonies. Codes such as tone policing, self-policing due to gender differences, and caution in communication were recurrent themes. As P21 described: *"I try to be as objective as possible and set an example to avoid misinterpretations and misunderstandings, and I feel that this is not mutual... I already make an effort to avoid comments and 'providing ammunition' as a pretext for prejudiced and disrespectful jokes, in addition to losing credibility."*

However, some participants, such as P23, indicated no relation between gender issues and additional effort. These individuals managed their identity by carefully separating their personal and professional lives. As P23 explained: *"Not much, but maybe it's because I've always avoided separating my personal and professional life and I talk little or nothing about my sexuality in a professional environment."* This approach allowed them to navigate the workplace with more ease, minimizing the need for additional effort to manage bias.

Regarding the influence of gender and sexuality on software engineering processes it reveals significant insights into team dynamics and inclusivity. Concerning gender influencing team demands, the general group showed a notable disagreement with 62.5% (25) indicating they did not believe gender impacts team requirements. However, the sentiment differed among various team classifications. For instance, 66.66% (2) of pseudo-team members agreed that gender influences demands, suggesting that less structured teams may be more susceptible to gender biases. Additionally, transgender and non-binary professionals reported mixed responses, indicating a potential sensitivity to gender biases that could impact their experiences in the workplace.

When exploring the influence of sexuality on team demands, a similar pattern emerged. Only 12.5% (5) of the general group agreed that sexuality influences team requirements, with a substantial 72.5% (29) disagreeing. Interestingly, among professionals identifying as women, 69.2% (9) agreed, contrasting sharply with the responses of men, where only 12% (3) agreed. This disparity suggests that perceptions of sexuality's influence may vary based on gender identity, indicating that women may feel more impacted by sexual orientation in team settings.

When asked if they consider changing projects due to experiences of sexual or gender discrimination, the responses further underscored the experiences of women and trans-

gender professionals. For instance, among pseudo team members, 66.66% (2) indicated they would consider changing projects due to discrimination, highlighting the adverse effects of less cohesive team structures on marginalized professionals. In contrast, 83.33% (5) of high-performance team members responded negatively, suggesting that supportive teams may mitigate the negative impacts of discrimination.

In terms of identity-sharing control, participants reported managing their identity by keeping their sexuality unexposed in the workplace. This approach allowed them to navigate professional settings without drawing attention to their sexual identity, As P28 describes: *"I have always been a little afraid to talk about my sexuality and dating in the workplace. Even though the team members never made prejudiced comments, I was afraid to expose myself, especially because my team is all men and all are straight..."*. Frustration when sharing control was primarily linked to gender bias and the need for more efficient communication, particularly in environments where masculine language dominated. Some participants experienced discomfort due to discriminatory jokes or biased comments, which affected team dynamics. As P4 described: *"Organization, tact, and care for the team or demands usually fall to the female figure whenever possible. Patriarchal inheritance of women's roles as secretaries, nurses, or housewives (who put everything in order, in addition to the house, the man's emotions and psychology)..."*.

On the positive side of sharing control, some participants recognized that their sexuality could contribute to better communication and understanding in software processes, particularly by fostering inclusivity and empathy within teams, exemplified in the account of P22 *"I opened up to the team in a relaxed conversation, saying that my boyfriend was also a developer. The team received the information naturally and never questioned me about anything. On the contrary, I got closer to them and became true friends with two people, in addition to my manager..."*.

The engagement of LGBTQIAPN+ professionals within teams is influenced by factors related to performance, tone adjustment, and team belonging. Concerning the impact of jokes and sexual discrimination on performance, 25% (10) participants agreed that such issues negatively affected their performance, while a notable 60% (24) disagreed, suggesting a prevailing belief that these factors do not significantly hinder productivity. However, there were important differences across demographic lines; for instance, 53.8% (7) of women (cisgender and transgender) acknowledged a negative impact, contrasting sharply with 24% (6) of men (cisgender and transgender). Junior professionals appeared more sensitive to these issues, with 28.57% (4) agreeing compared to only 6.66% (1) among senior professionals, highlighting a potential gap in experience and exposure to workplace discrimination.

Among the participants, 40% (16) believed that tone adjustments were necessary, indicating perceived pressure to modify their communication style based on team dynam-

ics. This perception varied notably in high-performance teams, where 83.33% (5) disagreed with the need for tone adjustment, suggesting that such teams may cultivate a more confident and cohesive atmosphere. In contrast, 66.66% (2) of professionals in workgroups agreed with the necessity of tone adjustments, pointing to potential communication challenges in less structured environments. This discrepancy emphasizes the varying demands placed on professionals depending on their team context. Among the participants identifying as women, 38.5% (5) acknowledged the need for tone adjustments, while 41.7% (10) of those identifying as homosexual expressed similar sentiments. The data suggest that communication styles and the pressure to conform to team norms significantly impact the engagement of LGBTQIAPN+ professionals.

In cases where performance was perceived as unaffected, participants credited the absence of discriminatory comments and the existence of a respectful work environment. Factors such as identity-sharing control, respect among all employees, and the possibility of reporting and punishing aggressors were highlighted. HR efforts, policies against sexual and gender discrimination, a safe work environment, and a clear establishment of boundaries further contributed to this positive perception.

Frustrations that affect performance emerged when prejudiced comments, jokes, and attacks on integrity occurred, particularly affecting LGBTQIAPN+ professionals. These incidents often involved transphobia, sexism, and inappropriate behavior from management or customers, leading to a decrease in performance and uncomfortable situations. Low perceived diversity and limited efforts to hire minorities were additional sources of dissatisfaction. As P35 recounted: *"Recently, I suffered a type of transphobic attack from one of the people on the team. I received support from my leader, who was able to act quickly and try to resolve the situation. But it destabilized me and affected my progress."* This underscores how such incidents can deeply impact individuals and hinder their performance, even with supportive leadership.

4.6.3 (A3) How do agile practices and different work models influence the experience of LGBTQIAPN+ professionals in the corporate environment?

When discussing positive aspects of in-person work, participants highlighted the benefits of interacting with team members, maintaining a clear separation between personal and professional life, and having more direct communication. On the other hand, dissatisfaction with in-person work was more pronounced, with participants pointing to unproductive environments, the formation of social silos, and exposure to prejudiced behavior such as sexism and misogyny. Some felt psychological discomfort due to these factors, with P12 sharing: *"Unfortunately, I have had the experience of working in a highly sexist and misogynistic environment before, and it was not at all comfortable."* Additionally, the need for commuting, lack of flexibility, and reduced focus in the of-

office environment contributed to a perception that in-person work was less necessary and more stressful. Conflicts and pressures associated with in-person work were also noted, including micromanagement, excessive demands, and the need for constant self-policing, as P19 stated: *"I've never worked in person... but I always felt very nervous and had to watch myself even more."* Psychological discomfort and the inability to adapt to noisy, high-pressure environments were common sources of frustration for many professionals.

In terms of positive experiences with remote work, professionals emphasized improved productivity and time management. The flexibility and freedom provided by remote work allowed for better work-life balance, reduced stress, and enhanced overall well-being. Participants appreciated not having to commute, experiencing fewer discomforts, and enjoying a safer, more interactive environment. Despite initial challenges and feelings of isolation, satisfaction with remote work remained high, as P21 noted: *"Much more comfortable working, more productive, and with a better quality of life."* However, dissatisfaction with remote work was also expressed, primarily due to the lack of socialization and feelings of isolation. For those who valued team interaction and collaboration, the absence of in-person contact was a challenge.

Agile practices have been identified as key mechanisms for reducing barriers within teams, with pair programming, retrospectives, and daily meetings playing significant roles. These practices enhance team dynamics and facilitate a whole product vision while fostering a safe agile environment. The need for a robust organizational agile culture is crucial. It involves strengthening team relationships, ensuring positive communication, and establishing respect as a foundational element. Inclusion policies and a culture grounded in Scrum can help reduce prejudice against LGBTQ+ individuals. P9 encapsulated this by stating, *"I consider pair programming, especially if it is with a leader, a great time to improve the relationship and really show your difficulties. But in reality, it is very subjective and depends a lot on each person. No practice will be useful if the leader or any other team member is not approachable, humble and professional."*

To promote inclusion and diversity in agile teams, participants discuss the importance of implementing quotas for transgender individuals, providing education on diversity, and offering training for leaders and teams. They emphasized the necessity of normalizing the presence of LGBTQIAPN+ leaders in the workplace. Furthermore, creating anonymous channels for reporting discrimination, implementing swift disciplinary measures, and fostering cultural change within companies are critical steps. As noted in P3, *"I think the simplest thing that can be worked on is the quota system, especially for transgender people, followed by education work on diversity and forms of treatment. Also being stricter when receiving reports of discrimination."*

4.7 Discussion

We discuss the results from the lens of the agile pillar “Individuals and Interactions over processes and tools” and DX factors—such as psychological safety, psychological distress, engagement, motivation, developer attributes, software processes, and organizational culture—we compared these findings with our research findings, as well as primary studies focused on the LGBTQIAPN+ community and the factors that influence software professionals’ productivity and engagement.

4.7.1 (A1) Growth Opportunity and Factors that influence career

The participants’ positive outlook on professional growth opportunities and alignment with company interests reflects the importance of fostering effective interpersonal relationships, a core tenet of Agile methodology. The data reveals that established teams exhibit stronger alignment and agreement on professional development compared to potential teams, suggesting that clear communication and strong interpersonal dynamics play a crucial role in the professional growth of individuals. This observation is consistent with Agile’s emphasis on the value of individuals and the quality of their interactions on a diversity perspective (SILVEIRA; PRIKLADNICKI, 2019).

On the other hand, the frustrations highlighted in the results—such as the dominance of a heterosexual male culture, discrimination, and a lack of tolerance for mistakes, stand in stark contrast to the Agile pillar of prioritizing individuals and interactions over processes and tools. These cultural and systemic issues not only undermine open and respectful communication but also stifle collaboration, both of which are essential for fostering high-functioning Agile teams. Smite et al. (ŠMITE; MOE; GONZALEZ-HUERTA, 2021) further emphasize how cultural barriers, including the reluctance to expose problems and discuss failure, obstruct an organization’s ability to fully embrace agility. Discriminatory behaviors and a toxic work environment prevents trust, stifling the healthy interactions that agile methodologies prioritize. Moreover, the concerns about inequalities in hiring practices, work overload, and fear of retaliation emphasize an organizational focus on hierarchical or procedural concerns at the expense of individual well-being and inclusivity. Sarker (SARKER, 2022) argues that developers who experience demotivation and frustration due to harmful interactions—such as verbal abuse, intimidation, or inappropriate behavior from colleagues—may choose to exit an organization .

Regarding career growth opportunity and career path, we found that while there is general agreement between the interests of the professionals and those of the organization, members of less structured teams expressed some disagreement on this topic. On the career’s positive experiences: in technology environments where professionals report having a good experience, there tend to be more opportunities and a welcoming environment.

4.7.2 (A2) Engagement and perception about their teams and work processes

Collaboration and increased productivity are often found in more structured teams. There is already literature discussing team structuring and its relationship with team productivity, such as the work of Riaz et al. (RIAZ; BURIRO; MAHBOOB, 2019). Our approach focused on investigating developers' perceptions of their teams and being able to identify their maturity and performance. When team members feel comfortable discussing technical debt and are committed to improving these challenges, they create a supportive environment that enhances collaboration and teamwork. Situations, where individuals must adjust their tone or hide aspects of their identity (e.g., gender, sexuality), illustrate that a lack of a psychologically safe environment undermines effective collaboration. Agile's emphasis on "individuals and interactions" implies that every team member should feel comfortable and respected, suggesting these biases directly contradict the principle. The literature addresses the impacts of criticism on inclusion, Gunawadena et al. (GUNAWARDENA et al., 2022) suggest criticism as a factor that impacts the experience of professionals.

Negative experiences like coercion, disorganization, gender bias, and poor communication often stem from breakdowns in human-centered interactions, causing friction and confusion. Even with formal processes, poor interpersonal practices can derail team cohesion, emphasizing that interpersonal respect and clarity outweigh detailed management structures. These challenges, including gender bias, are discussed in works like Poncell and Gama (PONCELL; GAMA, 2022), Ramos and Gama (SOUZA; GAMA, 2020), and Trinkenreich et al. (TRINKENREICH, 2021), which highlight its impacts, particularly on women. Souza Santos et al. (SANTOS; MAGALHAES; RALPH, 2023) also address isolation and fear in SE environments. Furthermore, changes in team dynamics and poor understanding of software processes exacerbate frustrations, as noted by Meyer et al. (MEYER et al., 2014) and Ahmad et al. (AHMAD et al., 2024), with such frustrations negatively impacting developers' happiness (GRAZIOTIN et al., 2017b).

Communication-related frustrations, such as tone policing and gender-based self-policing, can be mitigated through direct communication and boundary-setting between personal and professional life. Gender roles, like team care and work overload, often exacerbate challenges for female professionals. Steinmacher et al. (STEINMACHER et al., 2024) highlight the additional effort women make to be heard in male-dominated environments, while Outão et al. (OUTÃO et al., 2023) reveal how persistent sexism and microaggressions, such as ignoring women's input, act as barriers to their inclusion.

4.7.3 (A3) Influence of agile practices and different work models

Participants highlight the value of identifying issues during retrospectives, giving and receiving mutual support, and fostering diverse skill sets and trust. These practices

exemplify placing individuals and interactions at the forefront, as the personal commitment and openness in retrospectives typically drive improvement more effectively than any rigid protocol.

Teams that prioritize continuous agile practices, along with process improvement and planning, tend to foster greater engagement among LGBTQIAPN+ developers. Furthermore, teams with a clear division of tasks tend to achieve more cohesion and alignment with their objectives. This data is consistent with the literature in the works carried out by Meyer et al. (MEYER et al., 2019), (MEYER et al., 2014) and Fontão et al. (FONTÃO et al., 2023). P9's comment highlights that the approachability and professionalism of individuals in these interactions are pivotal to the effectiveness of Agile practices, aligning with the emphasis on personal relationships over rigid tools or processes.

Professionals highlight that the flexibility of remote work when compared to other work models, promotes a better work-life balance. It can lead to increased productivity, environmental control, psychological safety, and an interactive atmosphere while reducing stress. However, remote work is not without its challenges. Many individuals experience feelings of isolation and lack of team interaction, which can create difficulties. This data corroborates the work of Souza Santos et al. (SANTOS; MAGALHAES; RALPH, 2023) that explores the limitations of remote work, as well as its advantages for LGBTQIAPN+ professionals. While remote work fosters productivity and flexibility, the reported feelings of isolation highlight a potential gap in interactions. Agile teams rely on frequent and meaningful collaboration, which may require intentional practices to bridge the gap between remote and in-person interaction dynamics.

In-person work also presents its own set of challenges. P12's and P19's comments underscore environments where interactions are harmful or stress-inducing, which directly contrasts with Agile's emphasis on nurturing positive and meaningful human relationships. Professionals may face issues such as the formation of social silos, decreased productivity, increased stress and psychological insecurity, and exposure to a discriminatory environment with limited control over the environment. This data is also found in the literature (SANTOS; MAGALHAES; RALPH, 2023), (SANTOS; ADISAPUTRI; RALPH, 2023) where it is pointed out that psychological discomfort and exposure to situations that cause psychological suffering and fear for safety permeate the experience of these professionals in face-to-face work.

4.8 Implications for Practice

This study provides actionable insights for fostering inclusivity and improving the developer experience (DX) of LGBTQIAPN+ professionals in agile teams. The findings emphasize the critical role of psychological safety, trust, and open communication in cre-

ating inclusive work environments. Organizations can achieve this by investing in diversity and inclusion training, establishing anonymous reporting mechanisms, and strictly enforcing anti-harassment policies. These initiatives not only reduce psychological distress but also cultivate an atmosphere of openness essential for effective collaboration and productivity.

Agile practices, such as retrospectives and pair programming, emerged as valuable tools for building trust and collaboration. Their effectiveness, however, depends on the inclusivity and professionalism of team members and leaders. Companies should adapt these practices to address the unique needs of diverse teams by incorporating mentorship programs and collaborative workshops. Flexible work models, particularly remote and hybrid arrangements, offer significant psychological comfort and productivity benefits, helping LGBTQIAPN+ professionals feel supported while maintaining team cohesion.

The findings also highlight the need to address structural and cultural barriers, such as heteronormative biases and insufficient inclusion policies, which hinder professional growth and engagement. Targeted interventions like diversity quotas, inclusive hiring practices, and leadership development for underrepresented groups are essential to fostering equity and dismantling systemic barriers. Aligning career development opportunities with team and organizational goals through agile ceremonies further supports both individual growth and team cohesion, ensuring diverse teams can thrive in inclusive and high-performing environments.

4.9 Conclusion and Future Work

This study explored the developer experience (DX) of LGBTQIAPN+ professionals in agile teams. Our findings reveal that while agile methodologies emphasize individuals and interactions, structural and cultural barriers—such as discriminatory behaviors and the dominance of heteronormative culture—persist in less mature teams. These challenges undermine trust, collaboration, and psychological safety, hindering team cohesion and productivity.

This research highlights the importance of adapting agile practices to the needs of diverse teams, emphasizes the value of flexible work models in promoting inclusivity, and offers actionable strategies for addressing barriers faced by LGBTQIAPN+ professionals. These insights are not only relevant for improving individual and team performance but also for advancing organizational diversity and inclusion efforts.

However, the study's scope is limited to the perceptions of LGBTQIAPN+ professionals in a specific context, and further research is needed to generalize these findings across broader populations. Future studies could investigate the intersectionality of underrepresented groups, assess the scalability of inclusive practices in larger organizations,

and explore the long-term impacts of diversity initiatives on agile methodologies.

4.10 Threats to validity

In this section, we examine the types of validity commonly associated with survey research (LINÅKER et al., 2015) and the reliability of our study. We also outline the mitigation strategies implemented to address threats.

Content Validity. We developed instruments for the opinion survey and refined them through three iterative pilot tests. This iterative approach allowed us to identify and address ambiguities, ensuring that the survey accurately captured the constructs under investigation. Input from subject matter experts was also sought to evaluate and refine the survey questions, aligning them closely with the study’s objectives.

External Validity. It concerns the representativeness of the sample. To address this, we ensured that our sample size of 40 participants exceeded the saturation threshold recommended by Guest et al. (GUEST; BUNCE; JOHNSON, 2006). Furthermore, the Respondent-driven Sampling (RDS) approach was carefully managed to account for potential underrepresentation of isolated individuals by selecting diverse initial seeds and conducting targeted outreach to underrepresented subgroups. We also sent periodic reminders to mitigate nonresponse bias. Clear eligibility criteria and upfront communication were established, ensuring a balanced sample and reducing exclusions.

Face Validity. A potential issue with face validity arises when the survey instrument does not align well with the intended audience. To address this, we carried out a pilot study to assess the instrument’s effectiveness. Based on the feedback, we made minor adjustments to enhance its clarity.

Internal Validity. Interpretive validity was a key concern for our study, as it involves the risk of misinterpreting participants’ perspectives. To mitigate this, we paraphrased key statements from open-ended questions to ensure accurate representation of participant responses. The coding process was primarily conducted by the first author, with iterative reviews and contributions from other researchers to refine emerging codes and themes. Additionally, we maintained a detailed audit trail documenting all coding steps, which was shared among the research team and partially made available as supplemental data to ensure transparency.

Reliability. Ensuring the reliability of our findings was critical. To this end, we implemented a structured iterative coding process for analyzing open-ended questions, ensuring consistency and rigor in data interpretation. Moreover, our reliance on pilot tests helped in identifying potential inconsistencies and improving the reliability of the survey instrument. The comprehensive audit trail served as a record of all methodological

steps, allowing for reproducibility and validation of our findings.

Table 6 – Distribution of participants by gender identity, sexuality, work experience, position, work model, team formation phase, team performance.

participants		Percentage %
Gender Identity	Cisgender Male	60
	Cisgender Female	30
	Transgender Male	2.5
	Transgender Female	2.5
	Non-binary	5
Sexuality	Gay	45
	Lesbian	17.5
	Bisexual	25
	Pansexual	7.5
	Asexual	5
Seniority	Senior	37.5
	Junior	35
	Mid Level	22.5
	Not informed	5
Position	Developer	50
	Product Owner	12.5
	DevOps	7.5
	Quality Assurance	7.5
	Product Designer	5
	UI Designer	5
	Project Manager	2.5
	Tech Lead	2.5
	Team Lead	2.5
	Software Architect	2.5
	Stakeholder	2.5
Work Model	Remote	70
	On-site	15
	Hybrid	15
Team's formation phase	Performance	45
	Normalization	35
	Formation	10
	Confusion/Conflict	10
Team's performance	Real Team	42.5
	Potential Team	25
	High Performance Team	15
	WorkGroup	7.5
	Pseudo-Team	7.5
	Not apply	2.5

Table 7 – Thematic synthesis process

Can you tell us how you consider the career journey of an LGBTQIAPN+ professional in software projects?				
Response	Keyword/excerpts	Codes	Subthemes	Themes
A constant struggle against stupid jokes and uncomfortable situations. Sometimes even the audacity to say who I should date or which colleague I make a cute couple with and should stop being gay.	fight against stupid jokes, uncomfortable situations, and should stop being gay.	Prejudiced jokes; Discomfort; Psychological harassment;	Discrimination at work; dissatisfaction;	Discrimination

5 Towards an applicable and flexible DX model for LGBTQIAPN+ software professionals

This study proposes an applicable and flexible recommendation model to improve Developer Experience (DX) for LGBTQIAPN+ software professionals. First, we synthesize actionable recommendations in the short, medium, and long term. Then, we consolidate these recommendations into a visual model¹ and evaluate their perceived applicability, actionability, and contextual appropriateness through a mixed empirical design: a brief survey administered *before* a walkthrough of the model, followed by semi-structured interviews with LGBTQIAPN+ professionals ($n = 11$). The results converge on eight macrothemes. DX is strongly shaped by the organizational context and team maturity; remote and hybrid work often serve as psychological safeguards but entail trade-offs in visibility and networking; distrust of formal reporting channels limits the effectiveness of policies; leadership representation and allyship catalyze cultural change; agile rituals can be adjusted for inclusion (identity-aware onboarding, camera-optional daily stand-ups, one-on-ones with active listening); collaborative practices and mentoring sustain inclusion; structural barriers affect entry and retention; and identity-management workflows (names, pronouns) are essential for autonomy. The model was found to be adaptable to diverse contexts and usable in daily practice, especially when anchored in measurable D&I goals and supported by transparent governance. **This study remains in progress: interview saturation has not yet been reached, and the evidence reported here reflects an interim analysis of partial data; subsequent waves of data collection and analysis may refine these findings.**

Keywords: *LGBT* , *LGBTQIAPN+* , *diversity* , *developer experience* , *agile*, *Model*, *Recommendations*

5.1 Introduction

The software development industry is facing a diversity crisis (ALBUSAYS et al., 2021), exacerbated by the reduction in support initiatives driven by political and economic decisions (HYRYNSALMI et al., 2025). With the end of the pandemic, the return to in-person work resulted in a wave of layoffs that disproportionately affected minority populations, such as the LGBTQIAPN+ community (WASSOUF-JR; FUKUDA;

¹ <https://figshare.com/s/fb93178264ecbb6fbd4f>

FONTÃO, 2025; SANTOS; ADISAPUTRI; RALPH, 2023). These professionals already face discrimination on a daily basis, highlighting the need for the technology sector to adopt inclusive and effective practices capable of fostering the engagement and retention of these groups in the face of discriminatory challenges that impact their career paths (WASSOUF et al., 2025; WASSOUF-JR; FUKUDA; FONTÃO, 2025; SANTOS; GAMA, 2024; SANTOS; MAGALHAES; RALPH, 2023).

In this context, it is essential to recognize the evidence from recent studies that highlight the challenges faced by this population in the software development industry, such as sexual and gender discrimination, microviolence, experiences of impostor syndrome associated with their identities, prejudice-motivated aggression, and underrepresentation in the sector (WASSOUF et al., 2025; WASSOUF-JR; FUKUDA; FONTÃO, 2025; SOUZA; GAMA, 2020).

The work by (SANTOS; GAMA, 2024) discusses the experience of studying marginalized and hidden populations. In this research, the authors argue that the low participation of hidden populations in software engineering research stems from interconnected factors: the risk and stigma associated with identification, the lack of sampling structures that make it difficult to locate and invite participants, and the exhaustion of revisiting sensitive topics that can reactivate painful memories, leading to refusal or abandonment of participation.

Furthermore, the size of organizations, the maturity of teams, and engagement are factors that cannot be ignored when designing solutions for this population in software development teams. These organizational specificities bring diverse contexts, in remote, hybrid, or in-person work models, as well as the culture of companies (WASSOUF-JR; FUKUDA; FONTÃO, 2025).

By examining the relationship between teams and developer experience, the study conducted by (WASSOUF-JR; FUKUDA; FONTÃO, 2025) shows that team maturity influenced the DX of LGBTQIAPN+ professionals. Among these factors, positive experiences are linked to companies that foster diversity, teams with high cohesion and maturity levels, and a collaborative and supportive culture. Furthermore, the authors also report team maturity, commitment, cohesion, and engagement as factors that influence DX.

However, the authors also argue that less mature teams, a lack of defined processes, the presence of gender bias and discrimination, microaggressions, and team communication issues negatively impacted the experience of this population. Furthermore, they also report that the in-person work environment can pose challenges in interaction dynamics due to the formation of social silos and increase psychological insecurity (SANTOS; MAGALHAES; RALPH, 2023; WASSOUF-JR; FUKUDA; FONTÃO, 2025).

Based on the recommendations in the literature regarding gaps and perspectives

for research on the LGBTQIAPN+ population in software development, this study focused on evaluating the scientific literature’s evidence on recommendations for improving the DX (Developer Experience) of LGBTQIAPN+ professionals, as well as proposing and investigating the applicability of a model based on recommendations evaluated by professionals.

5.2 Background

In a multivocal review focused on the Developer Experience (DX) of LGBTQIAPN+ software professionals (WASSOUF *et al.*, 2025), the authors synthesized evidence on the challenges and perceptions faced by this population in the technology industry. The study followed the Multivocal Literature Review (MLR) guidelines proposed by Garousi *et al.* (GAROUSI; FELDERER; MÄNTYLÄ, 2019). The systematic literature review (SLR) included searches in the ACM Digital Library, IEEE Xplore, and Scopus databases (publications up to 2023). In parallel, the grey literature review (GLR) collected materials from Dev.to. Findings were organized along the three core dimensions of DX (Affect, Conation, and Cognition) and triangulated across the SLR and GLR sources.

Key practical recommendations include:

- **Short term (Affect):** establish safe and anonymous reporting channels; adopt inclusive language and the normalization of pronouns; support LGBTQIAPN+ Employee Resource Groups (ERGs); and promote visibility rituals (e.g., meetings, committee events, and pride celebrations).
- **Short term (Conation):** provide remote or hybrid work options with autonomy regarding identity disclosure; establish explicit codes of conduct for internal events (including hackathons); and integrate diversity and inclusion (D&I) policies and communication etiquette into onboarding.
- **Medium term (Cognition):** train leadership to foster psychological safety and constructive (non-destructive) feedback, including in code reviews; and review recruitment and interview processes to mitigate bias (e.g., pronouns, chosen names, technical criteria).
- **Long term (Systemic):** define measurable D&I goals and metrics; ensure LGBTQIAPN+ representation in committees and decision-making; partner with collectives and NGOs and provide mental health support; and implement periodic training on diversity across in-person, hybrid, and online environments.

A complementary study by Wassouf *et al.* (WASSOUF-JR; FUKUDA; FONTÃO, 2025) examined the DX of LGBTQIAPN+ professionals within agile teams. Through a

survey of 40 software professionals, the study explored perceptions of team dynamics, organizational maturity, and challenges. The results highlight that psychological safety and inclusive policies are crucial for equitable contributions and team cohesion.

Agile practices such as retrospectives, pair programming, and daily meetings, when adapted to the needs of underrepresented groups, have been shown to mitigate bias and strengthen collaboration. Remote work was generally perceived as beneficial, offering greater psychological comfort, increased productivity, and a better work-life balance, although challenges related to isolation and limited virtual interaction still exist. In addition, collaboration and team cohesion foster a more rewarding experience in work dynamics.

In sum, integrating inclusion into both agile practices and organizational policies is key to improving the DX of LGBTQIAPN+ professionals in agile contexts.

5.3 Research Method

5.3.1 Goal And Research Questions

Objective: To evaluate the recommendations presented in the scientific literature on the developer experience (DX) of LGBTQIAPN+ professionals in software engineering, identifying the main factors, challenges, and practical strategies to foster more inclusive, productive, and healthy work environments. Based on this synthesis, a recommendation-based model will be proposed to improve DX, and its perceived applicability will be assessed through interviews with LGBTQIAPN+ professionals.

Research Questions:

RQ1: Is the application of a *flexible and adaptable model* to improve the DX of LGBTQIAPN+ professionals effective in software industry teams (e.g., psychological safety, team integration, collaboration)?

Rationale: To present and integrate evidence-based guidelines (explicitly framed as DX or implicitly applicable) and to assess, in the field, their practical impact on development teams and the feasibility of adoption in the industry.

RQ2: To what extent are the recommendations in the body of knowledge for improving the DX of LGBTQIAPN+ professionals perceived by LGBTQIAPN+ professionals as (a) *flexible* across different organizational contexts, (b) *actionable* in everyday practice, and (c) *credible/validated*?

Justification: To understand how team and organizational contexts shape the real-world applicability of the recommendations, capturing their feasibility, relevance, and perceived conditions for adoption from the perspective of LGBTQIAPN+ professionals.

5.4 Instrumentation

The presentation of the model in interviews using walkthroughs and subsequent processing of the thematic synthesis (CRUZES; DYBA, 2011) allows for the development and improvement of the model, based on preliminary validation in terms of feasibility and adherence to the target audience’s needs.

Recruitment followed the respondent-driven recruitment methodology, starting with a group and seed recommendations (HECKATHORN, 1997). Eleven interviews were conducted for the control group. The stopping criterion (FRANCIS et al., 2010) was established based on the absence of new themes. To date, the saturation goals have not been reached, and the research remains ongoing.

The recommendation model was developed by consolidating recommendations identified in studies addressing Developer Experience of the target population: (WASSOUF et al., 2025) (Chapter 3), (WASSOUF-JR; FUKUDA; FONTÃO, 2025) (Chapter 4), (SANTOS; MAGALHAES; RALPH, 2023), (SANTOS; STUART-VERNER; MAGALHÃES, 2023), and (SANTOS; ADISAPUTRI; RALPH, 2023). Additionally, recommendations specific to agile development contexts were incorporated from two other studies. Together, these sources provide practical recommendations for improving Developer Experience (DX) ².

To extract and systematize the recommendations, we employed the thematic synthesis method (CRUZES; DYBA, 2011), following established best practices. This process involved identifying excerpts, codes, subthemes, and overarching themes, thereby organizing the data around recommendations, gaps, and opportunities.

As a result, we obtained a spreadsheet containing all mapped elements. From this material, we identified the DX factors (**Table 8**) corresponding to the recommendations.

Table 8 – DX factors organized by level

Level	DX Factors
Organizational	Psychological safety; Working conditions; Organizational culture; Career opportunities; Participation
Team	Team culture; Team structure; Team maturity; Collaboration; Teamwork; Supportive relationships; Psychological safety (team level); Participation (involvement)
Individual	Developer attributes; Motivation; Participation (initiative/voice)

Based on these data, we constructed a visual model, which was subsequently presented to participants to assess the applicability and practical feasibility of the proposed

² <https://figshare.com/s/78463ca0da4c890caff8>

recommendations (**Table 9**).

Table 9 – Recommendations

DX Factor	Recommendation	Timeframe	DX Dimension
Psychological Safety	Unconscious bias training for managers	Short Term	Cognitive
Working Conditions	Unconscious bias training for managers	Short Term	Cognitive
Organizational Culture	Unconscious bias training for managers	Short Term	Cognitive
Psychological Safety	Importance of a Code of Conduct to maintain and sustain an inclusive work environment	Short Term	Affective
Working Conditions	Importance of a Code of Conduct to maintain and sustain an inclusive work environment	Short Term	Affective
Organizational Culture	Importance of a Code of Conduct to maintain and sustain an inclusive work environment	Short Term	Cognitive
Psychological Safety	Gender and sexual diversity training for managers	Short Term	Affective
Working Conditions	Gender and sexual diversity training for managers	Short Term	Cognitive
Organizational Culture	Gender and sexual diversity training for managers	Short Term	Cognitive
Psychological Safety	Training to develop diversity-integrative managers	Short–Mid Term	Affective
Working Conditions	Training to develop diversity-integrative managers	Short Term	Cognitive
Organizational Culture	Training to develop diversity-integrative managers	Short Term	Cognitive
Retrospectives	Space for discussing perspectives and flexibility to revise processes	Short Term	Cognitive
Retrospectives	Strategic alignment to meet deadlines that support team integration	Short Term	Cognitive

continued on next page

Table 9 – continued from previous page

DX Factor	Recommendation	Timeframe	DX Dimension
Identity Disclosure Control	Enable professionals to choose how to share their identity, gender, and pronouns in work tools	Short Term	Cognitive
Identity Disclosure Control	Allow camera-off participation in calls (especially for non-binary and transgender professionals)	Short Term	Cognitive
Psychological Safety	Rapid action to mitigate discriminatory or exclusionary remarks	Short Term	Cognitive–Affective
Team Culture	Rapid action to mitigate discriminatory or exclusionary remarks	Short Term	Affective
Psychological Safety	Providing listening support to LGBTQIAPN+ professionals experiencing discrimination	Short Term	Cognitive
Team Culture	Providing listening support to LGBTQIAPN+ professionals experiencing discrimination	Short Term	Affective
Practical Actions	Encourage the hiring of LGBTQIAPN+ professionals for management roles	Short Term	Cognitive
Practical Actions	Encourage hiring LGBTQIAPN+ speakers for technical training sessions	Short Term	Cognitive
Practical Actions	Encourage hiring managers from underrepresented groups	Short Term	Cognitive
Practical Actions	Encourage hiring managers from underrepresented groups	Short Term	Cognitive

Subsequently, the processed data informed the design of a survey aimed at characterizing professionals’ work practices and challenges. The survey served both to collect empirical evidence of their Developer Experience and to establish contextual grounding for conducting walkthrough-based interviews. This design allowed for the systematic triangulation of survey responses with insights obtained from the semi-structured interviews.

5.5 Survey and Interview

The interview was initially constructed using a combined survey and walkthrough strategy to answer RQ2, systematically capturing LGBTQIAPN+ professionals’ percep-

tions of work contexts, barriers, organizational support, and effects on the developer experience (DX). The instrument's central focus is to identify contextual conditions (e.g., company size and practices, adoption of agile methods, inclusion initiatives, bias events, and support for neurodivergence) that may facilitate or limit the applicability of a recommendation model.

To ensure clarity, methodological rigor, and representativeness of the intended audience, the interview protocol was reviewed by four evaluators with complementary expertise: two senior researchers with experience in Human-Computer Interaction, Software Engineering, and Diversity & Inclusion studies, and two postgraduate students (master's/PhD level) accustomed to applying and analyzing the specific qualitative and mixed methods used in this study. Their feedback helped refine question wording, ordering, and alignment with the research goals, as well as assess the clarity and feasibility of the walkthrough activities.

5.5.1 Structure and Response Types

The instrument is organized into six sections, combining single-select categorical items, open-ended questions, and dichotomous items with optional comment space:

Section: Demographic Profile (Items 1–6) Captures self-reported characteristics of age (1), company location/country (2), educational background (3), gender identity (4), race/ethnicity (5), and sexual identity (6). These items allow us to describe the sample and, above all, qualify intersections (gender, race, sexuality) that may influence DX and the perceived applicability of the recommendations. Responses are mostly categorical, with open-ended fields where applicable (e.g., gender identity not listed).

Section: Professional Experience (Items 7–8) Collects length of experience/seniority (7) and time/position at the current company (8). These are trajectory variables that help interpret how career stage and organizational tenure modulate perceived barriers, support needs, and receptiveness to the model's recommendations.

Section: Perceptions of the Company (Items 9–12) Collects team size (9), company size (10), GPTW certification (11), and adoption of agile methodologies (12). These items map organizational conditions and process practices associated with DX.

Section: Labor Market and Inclusion (Items 13–14) Verifies the existence of inclusion initiatives (13) and requests open-ended reporting on barriers to entry and retention for LGBTQIAPN+ professionals (14).

Section: Sexual, Racial, and Gender Bias (Items 15–16) Dichotomous questions with open-ended follow-up on episodes of LGBTQI-phobia/gender bias (15) and racism/xenophobia (16), including perceived effects on performance.

Section: Neurodivergence (Items 17–19) Explores diagnosis (17), safety in disclosing to staff (17), process adaptation (18), and organizational support (19). This section allows for the identification of systemic barriers and best practices for accommodation that align with the model’s recommendations (e.g., process adjustments, tools, communication).

Section: Professional Challenges and expectatios about career (Items 20–23) Addresses "impostor syndrome" (20), comparisons based on seniority (21), complex tasks without support (22), and possible interactions with gender/sexuality identity and neurodivergence (23), goals (24).

For the analysis of demographic data, we enumerated the first questions with the prefix A, followed by the open-ended questions with the prefix Q. The questions with the prefix Q went through the thematic synthesis process (**Table 10**).

Table 10 – Survey questions

ID	Question
A1	What is your age?
A2	What is your location? (Referring to your company: state, country, or province)
A3	What is your educational background? (e.g., higher education degree completed; field of study)
A4	What is your gender identity? (Information about cisgender and transgender identity is important for the visibility of these professionals, including gender non-conformity)
A5	What is your self-declared race/ethnicity? (In your country of origin)
A6	What is your sexual identity? (Commonly referred to as sexual orientation)
A7	What is your level of experience? Junior, mid-level, or senior? (Additional information: how many years in your career)
A8	How long have you been at your current company, and what is your role? (Time and position)
A9	What is the number of employees in your current team?
A10	What is the size of your company? (Small: fewer than 50 employees; Medium: more than 50 but fewer than 500; Large: more than 500 employees)
A11	Is your company certified as a GPTW “Great Place to Work”?
A12	Does your company adopt agile methodologies? (sprints, Kanban, delivery-centered development, delivering value to stakeholders/clients)
A13	Does the company have inclusion initiatives for minorities?
Q0	In your experience, what professional barriers do LGBTQIAPN+ software professionals face to enter and remain in the technology industry?

Table 10 – Survey questions

ID	Question
Q1	Have you ever experienced an episode of LGBTQphobia in the team or gender-based prejudice? If so, did it affect your performance?
Q2	Have you ever experienced an episode related to racism or xenophobia in the workplace? If so, how did it affect your performance?
Q3	Do you have any neurodivergence diagnosis (e.g., ASD: Autism Spectrum Disorder; Asperger’s Syndrome; ADHD)? Do you feel safe sharing this with the team?
Q4	Are development processes flexible and adapted to your needs?
Q5	Does the company offer any support for this condition? Is it part of the company culture?
Q6	Have you ever experienced “impostor syndrome” (commonly referred to as the impostor phenomenon)?
Q7	Regarding these episodes, have you compared yourself with professionals of other seniority levels and skill sets?
Q8	In this context, have you ever faced complex tasks where you had to turn to the team but did not receive support?
Q9	Do you perceive any relationship between your gender/sexual identity and neurodivergence with these episodes?
Q10	Do you feel you are closer to your professional goals? (Career plans, goals, and aspirations in technology and software development)

5.5.2 Survey and interview Administration

5.5.2.1 Recruitment

The presentation of the survey and the model in interviews using *walkthroughs* and subsequent processing of the *thematic synthesis* (CRUZES; DYBA, 2011) allows for the development and improvement of the model, based on preliminary validation in terms of feasibility and adherence to the target audience's needs.

Recruitment followed the respondent-driven recruitment methodology, starting with a group and seed recommendations (HECKATHORN, 1997). Eleven interviews were conducted for the control group. The stopping criterion (FRANCIS et al., 2010) was established based on the absence of new themes. To date, the saturation goals have not been reached, and the research remains ongoing.

5.5.2.2 Administration

The survey was administered synchronously during the semi-structured interview. Each participant received a **P** code followed by a **number**. The researcher introduced each item, clarified terms when necessary, and the participant recorded their responses without interference or visualization during the interview. This combined administration served two purposes: (i) to minimize ambiguity in understanding the questions and (ii) to ensure an environment of anonymity and security. Immediately after completing the survey, participants were guided through a *walkthrough* of the recommendation model.

During this stage, they assessed the applicability of the model to their situation, providing concrete examples from their team and company. Thus, the data collected in the survey, in addition to the categorical/open-ended responses, also captured contextual elements that could be combined to extract the codes and themes generated in the thematic synthesis applied later.

5.6 Survey Results

5.6.1 Demographics: Sample Overview

To contextualize subsequent findings on Developer eXperience (DX), we first describe the demographics of the LGBTQIAPN+ software professionals who participated in the study. Demographic data are relevant to: (i) characterize the diversity of backgrounds represented, (ii) identify potential confounders such as professional seniority, organizational size, or team structure, and (iii) support judgments of transferability and external validity.

We collected **11 valid responses**. Unless otherwise indicated, percentages are

reported with respect to the number of valid answers for each item (n varies by question: *experience*, $n = 10$; *company size*, $n = 9$).

5.6.1.1 Age

Participants were primarily early to mid career professionals. Reported ages ranged from 26 to 39 years (mean 31.18; median 30; mode 30, representing 27.27% of the sample). The relatively narrow distribution suggests a homogeneous life-stage cohort.

5.6.1.2 Geography and Education

Geographic distribution indicates concentration in Latin-speaking countries: 45.45% from Brazil and 18.18% from Portugal. The remaining participants reported Canada, Estonia, Germany, and the United States (each 9.09%). As expected for software professionals, most respondents reported completed higher education (72.73%).

5.6.1.3 Gender Identity, Sexual Identity, and Race/Ethnicity

Gender identities were diverse. Cisgender women composed 27.27% of the sample, non-binary and gender-non-conforming individuals together 36.36%, trans women 18.18%, and one trans man and one unspecified cisgender respondent contributed the remaining 18.18%.

Sexual identity was also heterogeneous: pansexual (27.27%), lesbian (18.18%), homosexual (18.18%), heterosexual (18.18%), and bisexual (9.09%). It is important to note that the presence of heterosexual participants does not indicate the inclusion of cisgender heterosexual individuals. Some transgender participants identified their sexual orientation as heterosexual, and therefore their data were included while still ensuring that no cisgender heterosexual participants were part of the sample.

Regarding race/ethnicity, self-identifications included White (72.73%), “Brazilian Latin” (18.18%), and “Brown people” (9.09%). Because labels intermingle national, ethnic, and racial categories, comparability across countries should be interpreted with caution.

5.6.1.4 Seniority, Tenure, and Professional Roles

Professional experience skewed senior: of 10 valid responses, six participants classified themselves as Senior (60%), with the remainder evenly split between Junior (20%) and Mid-level (20%). Median tenure at the current company was 36 months. Reported roles spanned software engineering, data analysis, QA, DevOps, project management, and product management, providing perspectives from different points of the software delivery pipeline.

5.6.1.5 Team and Company Size

Team sizes varied from 3 to 47 members (mean 14.9; median 11), indicating a right-skewed distribution affected by a few large teams. Company size ($n = 9$) was predominantly large (77.78%), with one medium (11.11%) and one small company (11.11%). Nearly half of respondents reported that their organizations held *Great Place to Work* certification (45.45%).

5.6.1.6 Organizational Processes and Inclusion Practices

All respondents reported working within agile processes (100%), suggesting comparability in software development context. With respect to diversity and inclusion practices, 54.55% affirmed the existence of inclusion initiatives at their company, 36.36% reported none, and 9.09% were unsure. This variation points to uneven institutionalization of inclusion efforts across organizations.

5.6.1.7 Implications

The dataset reflects a cohort of predominantly senior professionals working in large, agile-mature companies, while also encompassing diverse gender and sexual identities. This composition informs interpretation of DX findings by clarifying the organizational and professional contexts in which participants operate. It also highlights both areas where transferability is more plausible (e.g., large agile teams) and where generalization requires caution (e.g., racial/ethnic representativeness and inclusion practices).

5.6.2 Demographics

Questions A1 to A13 are presented in table format.

Table 11 – Responses to: What is your age?

Response	Count	Percentage (%)
26	1	9.09%
28	1	9.09%
29	1	9.09%
30	3	27.27%
31	1	9.09%
32	1	9.09%
33	1	9.09%
35	1	9.09%
39	1	9.09%

Table 12 – Responses to: What is your location? (Company location: state, country, or province)

Response	Count	Percentage (%)
Brazil	5	45.45%
Portugal	2	18.18%
Canada	1	9.09%
Estonia	1	9.09%
Germany	1	9.09%
USA	1	9.09%

Table 13 – Responses to: What is your educational attainment? (e.g., completed or incomplete higher education)

Response	Count	Percentage (%)
Completed higher education	8	72.73%
Incomplete higher education	3	27.27%

Table 14 – Responses to: What is your gender identity?

Response	Count	Percentage (%)
Gender non-conforming	2	18.18%
Cisgender woman	3	27.27%
Non-binary	2	18.18%
Trans woman	2	18.18%
Trans man	1	9.09%
Cisgender (unspecified)	1	9.09%

Table 15 – Responses to: What is your race/ethnicity? (in your country of origin)

Response	Count	Percentage (%)
White	8	72.73%
Brown people	1	9.09%
Brazilian Latin	2	18.18%

Table 16 – Responses to: What is your sexual identity? (commonly called sexual orientation)

Response	Count	Percentage (%)
Lesbian	2	18.18%
Bisexual	1	9.09%
Homosexual	2	18.18%
Pansexual	3	27.27%
Gay	1	9.09%
Heterosexual	2	18.18%

Table 17 – Responses to: What is your level of experience? (Junior, Mid-level, or Senior; and years in career)

Response	Count	Percentage (%)
Senior, 6 years	1	10.00%
Junior	1	10.00%
Senior	1	10.00%
Senior, 8 years	1	10.00%
Senior, 7+ years	1	10.00%
Junior, 3 years of experience	1	10.00%
Senior, 19 years	1	10.00%
Mid-level (career start in 2018)	1	10.00%
Senior, 12 years in IT	1	10.00%
Mid-level, 4 years	1	10.00%

Table 18 – Responses to: Tenure at current company and job function (tenure and role)

Response	Count	Percentage (%)
3 years	1	9.09%
3 years, Data Analyst	1	9.09%
3 years, DevOps Engineer	1	9.09%
1 year, Senior QA Analyst	1	9.09%
1 year 7 months, System Engineer	1	9.09%
4 months, Software Engineer	1	9.09%
1.5 years, Junior Data Analyst	1	9.09%
1 year 6 months	1	9.09%
3 years, Project Manager	1	9.09%
5 years, Product Manager	1	9.09%
4 years, Software Engineer	1	9.09%

Table 19 – Responses to: Number of employees in current team

Response	Count	Percentage (%)
12	2	18.18%
10	2	18.18%
11	1	9.09%
7	1	9.09%
3	1	9.09%
47	1	9.09%
30	1	9.09%
13	1	9.09%
9	1	9.09%

Table 20 – Responses to: Company size (Small: <50 employees; Medium: 50–499; Large: 500+)

Response	Count	Percentage (%)
Large	7	77.78%
Medium	1	11.11%
Small	1	11.11%

Table 21 – Responses to: Is your company a GPTW “Great Place to Work”?

Response	Count	Percentage (%)
No	6	54.55%
Yes	5	45.45%

Table 22 – Responses to: Does your company adopt agile methodologies? (sprints, Kanban, delivery-centered development, value to stakeholders/customers)

Response	Count	Percentage (%)
Yes	11	100.00%

5.7 Survey - Open Questions

The analysis of the responses[Q0 - Q10]³ reveals a complex panorama of the experiences of LGBTQIAPN+ professionals in the technology industry.

Systemic and Intersectional Barriers (Q0, Q1): Perceptions regarding entry and retention barriers diverge. Participant P1 states that, in their experience, technical competence outweighs other issues, suggesting a meritocratic environment. This view contrasts strongly with most of the accounts. Participant P2 identifies LGBTQphobia as an initial barrier, highlighting the challenges faced by transgender people. P4 expands on this issue, describing environments dominated by "white cis men," where it is necessary to "suppress identity/orientation and adapt to the dominant class communication style" in order to stand out, which constitutes moral harassment.

The **gender bias** emerges as a recurring and explicit theme. Participant P5 states that "*requirements for hiring and promotion are stricter for women*," while P6 reports having their opinion dismissed by a manager due to their gender. P7 synthesizes structural inequality, mentioning the "*preference for white cis men*", the normalization of abuse, and

³ <https://figshare.com/s/74bf18b02dc44e9fb39c>

Table 23 – Responses to: Does the company have inclusion initiatives for minorities?

Response	Count	Percentage (%)
Yes	6	54.55%
No	4	36.36%
Not informed	1	9.09%

the constant need for extra effort to gain recognition. Insecurity about when and how to share one's identity is a central issue, as P10 notes, feeling the "need to control the presentation and disclosure of orientation and sexuality."

Impact of Discrimination (Q1, Q2, Q3, Q4): When addressing direct episodes of prejudice, the accounts reinforce the prevalence of gender bias over explicit LGBTQ-phobia. P2 states they did not experience LGBTQphobia but felt that their "opinion did not matter and was interrupted several times." Microaggressions and implicit biases have concrete consequences; P3 states that the subtle devaluation of their work affected them to the point of resigning. Conversely, P5 reports a case of explicit xenophobia that made remaining in the company unsustainable, leading to their departure.

The issue of **neurodiversity** reveals an additional layer of vulnerability. Participants P2, P4, and P6 state that they have diagnoses (ADHD and Bipolar Disorder II) but do not feel safe disclosing this information in the workplace. This insecurity is justified by the lack of adapted processes. P2 (with ADHD) mentions that the rigidity of processes does not consider their "fluctuations in productivity," while at the same time, the lack of structure, such as well-defined requirements, hinders them. In contrast, P3 reports a positive experience, where the company "provides support and listens."

Impostor Syndrome as a Symptom of Team Dynamics (Q6, Q7, Q8, Q9): Impostor syndrome (IS) is a common phenomenon among participants. P3 states they experience it "all the time." P5 expands the definition, describing it not as isolated episodes but as a "feeling of not being good enough." External factors intensify IS: P10 correlates burnout with the loss of confidence in their decisions. Comparison with peers is a common trigger, whether due to seniority, as noted by P2, or delivery speed, as reported by P3.

Participants connect impostor syndrome (IS) directly to their identities. P3 describes how the dynamics of a meeting "change when I arrive", a constant reminder that she is the "only woman on the team." P5 affirms perceiving a clear "relationship between my gender identity and the episodes." This suggests that IS is not merely an individual insecurity but a response to an environment that systematically delegitimizes and invalidates certain groups.

Career and Goal Reassessment (Q10): Finally, lived experiences lead to a redefinition of professional success. P5 states that, after a burnout episode, they began to prioritize mental health. The pursuit of career goals, such as the academic path mentioned by P2 or the technical specialization cited by P3, continues but is now mediated by the need for well-being in a work environment that has proven, for many, to be hostile and exclusionary.

5.8 Walkthrough - Interview Results

Based on the thematic synthesis⁴ (CRUZES; DYBA, 2011) of the interview transcripts during the model walkthrough, the subthemes and codes were related to a macrotheme. The macrothemes encompass the subthemes and the levels and items analyzed in the model. The step-by-step process of this thematic synthesis, including the mapping from responses to excerpts, codes, subthemes, and macrothemes, is detailed in (Table 23).

Table 24 – Thematic synthesis process

How do organizational factors shape inclusion mechanisms for LGBTQIAPN+ professionals in software teams?			
Response	Keyword/excerpts	Codes	Subthemes
P1: “These listening channels, codes of conduct, and training are essential but depend on the company; in small firms they can create an unfavorable environment.”	listening channels, code of conduct, training, company dependence	Inclusion initiatives; Policies and training; Risk of backfire;	Context dependence; Safeguards in small companies;

5.8.1 Macrotheme 1: Team Resistance Depending on Organizational Context

Level: Company/Organization **Model Items:** Channels; Code of Conduct; Training

Recommendations:

- *Channels:* Provide effective listening and reporting channels and ensure psychological safety.
- *Code of Conduct:* Establish a clear code to support an inclusive culture.
- *Training:* Offer training on unconscious bias and diversity for managers.

Subthemes: Company size impact; Context dependence; Team resistance; Reactive training; Corrective training; Importance of a code of conduct; Safeguards in small companies. **Codes:** Inclusion initiatives; Policies and training; Risk of backfire; Essential listening channels; Valuing codes; Resistance to enforcement.

Quotes:

- P1: “These listening channels, codes of conduct, and training are essential but depend on the company; in small firms they can create an unfavorable environment.”

⁴ <https://figshare.com/s/c7361e4e746c0f313872>

- P1: “In a larger company, you can turn to HR; in smaller companies it’s very context-specific.”
- P1: “A code of conduct is good if the company already has one, but forcing its creation can generate resistance; minimal effort is needed first.”
- P1: “Training should happen when problems arise, otherwise the team will question why the training was held.”
- P3: “Listening channels are important; I had to involve HR once and encountered gender bias.”

5.8.2 Macrotheme 2: Distrust of Formal Organizational Mechanisms

Level: Company/Organization Model Items: Channels; Inclusive Activities

Recommendations:

- *Channels:* Ensure anonymity and transparency.
- *Inclusive Activities:* Develop committees and ongoing events.

Subthemes: Ineffective reporting channels; Insecurity of use; Policy–practice gap; Performative inclusion; Reporting barriers. **Codes:** Non-anonymous channels; Psychological insecurity; Outing; Compliance versus practice; Ineffective channels.

Quotes:

- P5: “Large, rigid channels do not guarantee anonymity; professionals do not feel free to use them.”
- P6: “I used the reporting channel; it was ineffective and privacy was violated.”
- P7: “There is a global code of conduct, but leadership does not follow it.”
- P8: “A transphobia report led to a dismissal; compliance was serious but not universal.”

5.8.3 Macrotheme 3: Work Models as Well-Being and Psychological Safety Strategies

Level: Company/Organization Model Item: Work Model

Recommendation: “Enable flexible work models (remote and hybrid) that promote equitable participation.”

Subthemes: Remote work as psychological protection; On-site visibility; Productivity versus inclusion trade-off; Social connection; Quality of life. **Codes:** Remote protection; Reduced need to mask identity; Segregation; Focus on deliverables.

Quotes:

- P2: “Remote work was a game changer; it greatly reduced anxiety about hiding who I am.”
- P1: “There should be no remote work victimization for LGBTQIAPN+ only.”
- P8: “I only advanced because I was visible on-site; there is pressure to return to the office.”
- P9: “Remote work improved focus and reduced interruptions, but it depends on individual context.”

5.8.4 Macrotheme 4: Leadership Representation as a Catalyst for Cultural Change

Level: Company/Organization **Model Item:** Representation

Recommendation: “Hire LGBTQIAPN+ professionals for leadership positions.”

Subthemes: Inspirational representation; Merit-based leadership; Allied management; Inclusive recruitment. **Codes:** Role-model leadership; Formal development; Referral-based inclusion.

Quotes:

- P1: “My first leader was a lesbian woman; an example of representation.”
- P2: “Seeing LGBTQIAPN+ leaders makes me believe I can reach those roles.”
- P10: “Allied managers make a real difference in daily experience.”
- P7: “Bringing in minority leaders must be matched with genuine commitment.”

5.8.5 Macrotheme 5: Agile Processes and Rituals as Inclusion Enablers

Level: Management **Model Items:** Onboarding; Daily; One-on-One

Recommendations:

- *Onboarding:* Focus on visibility and integration; identity controls.
- *Daily:* Camera-optional or avatar use.

- *One-on-One*: Active listening and structured feedback.

Subthemes: Inclusive onboarding; Identity control; Flexible daily stand-ups; Effective one-on-ones; Adaptable retrospectives. **Codes:** Integration kits; Avatar use; Individual listening.

Quotes:

- P6: “Onboarding included a kit and team introductions; I felt welcomed without disclosing my identity.”
- P11: “Daily stand-ups are well structured; turning off the camera reduces discomfort.”
- P7: “Using an avatar ensures participation without exposure.”
- P10: “One-on-ones work only if the leader listens objectively.”

5.8.6 Macrotheme 6: Team Maturity and Collaborative Practices as Inclusion Foundations

Level: Management Model **Item:** Team Maturity

Recommendation: “Implement structured planning and collaborative practices.”

Subthemes: Team maturity; Collaboration; Pair programming; Mentoring; Safe environment. **Codes:** Senior-junior mentorship; Cognitive diversity; Mutual support.

Quotes:

- P2: “A united, respectful team greatly boosts my engagement.”
- P11: “Collaboration is the basis; no one is left blocked.”
- P8: “Allocating senior time for mentoring accelerates team maturity.”

5.8.7 Macrotheme 7: Structural Barriers to Career Entry and Retention

Level: Company/Organization Model **Item:** Talent Acquisition

Recommendation: “Offer bootcamps and hackathons for minorities; clear event codes of conduct.”

Subthemes: Low diversity; Specialist entry barrier; Male dominance; Program cutbacks. **Codes:** Technical specialization; Homogeneous market; Frustration.

Quotes:

- P1: “Very few trans women in security; only top specialists secure roles.”
- P5: “Big tech consolidation eliminated inclusion programs; minorities suffer most.”
- P9: “Bootcamps opened doors, but few follow-up opportunities exist.”

5.8.8 Macrotheme 8: Identity Management and Disclosure Control

Level: Management Model Item: Identity Disclosure

Recommendation: “Enable control over identity and pronoun disclosure.”

Subthemes: Identity control; Work–social boundary; Administrative processes.

Codes: Disclosure flexibility; Bureaucratic barriers; Psychological safety.

Quotes:

- P6: “My manager knows I’m lesbian; I trust her, but wouldn’t disclose to others.”
- P11: “Updating my pronouns took ages; onboarding felt supportive but system hindered me.”
- P9: “My manager quickly updated my social name; that support mattered.”

5.9 Discussion of Results

Male dominance remains evident in the field and continues to be highlighted by research in Software Engineering (SE). Participants’ reports of distrust in listening and reporting channels converge with evidence already established in the literature (WASSOUF et al., 2025; SANTOS; MAGALHAES; RALPH, 2023; SANTOS; ADISAPUTRI; RALPH, 2023; WASSOUF-JR; FUKUDA; FONTÃO, 2025).

The different work models (in-person, hybrid, and remote) have advantages and limitations that vary depending on professional objectives, especially when it comes to balancing psychological safety and career advancement. The evidence from this research adds nuance and reinforces previous findings (OUTÃO et al., 2023; SANTOS; MAGALHAES; RALPH, 2023). Among the new findings is the desire for hybrid and in-person work as a bridge to growth within the company and “being seen.” This increased visibility, at a time when big tech companies are imposing their policies on the software industry, is crucial to understanding how this population adapts to these changes.

The interviews highlighted the intentional allocation of senior professionals to mentor junior and mid-level professionals as the foundation of a proactive, agile culture oriented toward team maturity. This result is consistent with studies on collaborative and

diverse environments (WASSOUF-JR; FUKUDA; FONTÃO, 2025; WASSOUF et al., 2025).

Identity management and disclosure control were reiterated as dependent on trusting relationships with leaders and teams, which also corroborates the literature (SANTOS; ADISAPUTRI; RALPH, 2023; SANTOS; STUART-VERNER; MAGALHÃES, 2023; SANTOS; MAGALHAES; RALPH, 2023; WASSOUF et al., 2025).

As an original contribution, the data emphasize the strong dependence on the organizational context and team resistance to implementing the model's recommendations, in addition to the uncertainty of how listening channels, codes of conduct, and training work depending on the size of the company. According to reports, the effectiveness of these actions varies with the company's size, the presence or absence of incidents, and the level of team engagement. In contexts without recent events, preventive training tends to be perceived as unjustified, which requires clear communication of purpose, accountability criteria, and monitoring mechanisms to avoid generating resistance to change.

5.9.1 Answers to the Research Questions (RQ1–RQ2)

RQ1. Effectiveness of a flexible and adaptable model: The evidence points to *conditional effectiveness* of the model for improving DX among LGBTQIAPN+ professionals. Interview data indicate positive effects on psychological safety, integration, and collaboration when recommendations are localized to context and accompanied by enabling conditions. Practices perceived as effective include identity-aware onboarding, camera-optional daily meetings, structured one-on-ones with active listening, mentoring and pair programming aimed at team maturity, and leadership representation and allyship. Remote and hybrid arrangements also function as psychological safeguards, although their benefits must be balanced against career-visibility trade-offs. Effectiveness is attenuated where there is low team maturity, distrust in formal channels, or resistance to policy enforcement, and where company size and governance limit anonymity and accountability. Thus, the model improves DX when combined with transparent mechanisms, clear accountability, and context-sensitive implementation; sweeping, one-size-fits-all rollouts were viewed as less effective and sometimes counterproductive.

RQ2. Perceived flexibility, actionability, and credibility/validation. *Flexibility:* Participants consistently emphasized the need to tailor recommendations to organizational size, existing process maturity, and work model. Items involving identity management (e.g., chosen names and pronouns) and reporting channels were seen as especially sensitive to context, requiring local adaptation and safeguards. *Actionability.* Several recommendations were judged usable in day-to-day practice: explicit codes of conduct for internal events, anonymous and effective channels, onboarding with identity checks,

camera-optional dailies , structured one-on-ones, and scheduled senior-to-junior mentoring. These practices were described as concrete, schedulable, and compatible with agile routines. *Credibility/validation*. Credibility was strengthened by convergence with prior literature and by participants' own examples of successful application. However, perceived credibility of *formal* mechanisms (e.g., hotlines, HR-led channels) was undermined in settings where anonymity or follow-up was doubtful. Participants associated higher credibility with transparent governance, clear ownership, and measurable D&I goals tied to routine agile ceremonies.

Synthesis: Taken together, the findings provide a *qualified* answer to RQ1 and RQ2: the model is viewed as flexible and actionable, and it can be effective in improving DX when adapted to local constraints and backed by leadership, accountability, and team-maturity practices. Credibility varies with institutional trust and enforcement. As this study is ongoing and interview saturation has not yet been reached, these answers reflect an interim analysis of partial data; subsequent cycles may refine the extent and conditions under which the model achieves its intended effects.

5.10 Conclusion

An integrated analysis of survey and interview data reveals a interconnected set of challenges faced by LGBTQIAPN+ professionals in software engineering.

This study remains ongoing, as interview saturation has not yet been reached and new codes and subthemes continue to emerge. The evidence collected so far underscores the need for flexible recommendations that account for contextual differences. Notably, participants' motivations are closely tied to time dynamics and professional goals, with many expressing a preference for hybrid or in-person work models when considering career advancement.

Dissatisfaction with inclusion policies, organizational structures, and retention mechanisms emerges as a warning sign. In the face of organizational changes and cost-cutting measures, these professionals are left vulnerable to abrupt shifts in inclusion efforts, threatening their sustained employment and career development.

The heterogeneity of the sample further complicates the design of universal recommendations. Transgender, gender nonconforming, and other gender- and sexuality-diverse professionals bring distinct experiences and needs, making it clear that a one-size-fits-all approach is neither feasible nor effective. Recommendations must therefore be adapted to specific contexts while maintaining a central focus on inclusion and retention.

Perceptions of agile rituals also reveal divergence. Some professionals expressed frustration with less mature teams and leaned heavily on technical engagement with agile

mechanisms. Others, particularly those with challenging prior experiences, emphasized the importance of adaptability and sought safe environments where they could receive feedback, plan their careers, deliver work on time, and engage meaningfully with tasks.

By capturing both perceptions and frictions, this study illuminates the gap between idealized recommendations in the literature and their practical applicability for this hidden population. Important differences also emerge between professionals employed in big tech and large companies versus those in smaller firms, where experiences are shaped by factors such as xenophobia, discrimination and gender bias. Conversely, collaborative environments appear to foster more positive experiences and enable greater synergy over time.

Overall, the findings to date point toward the development of a flexible and adaptable model to enhance the developer experience of LGBTQIAPN+ professionals. The next steps involve expanding the interview sample within this hidden population and refining the model through iterative analysis.

5.11 Takeaways

To organize and present the main insights that emerged from the interviews, this section synthesizes the findings into thematic takeaways. Each takeaway integrates recurrent experiences, perceptions, and structural conditions reported by participants, highlighting both systemic barriers and actionable organizational practices. This synthesis clarifies the implications of the results.

Systemic and Intersectional Barriers: Perceptions range from a meritocratic faith in technical skills (P1) to experiences of LGBTQI-phobia and bullying in "cis-straight white male" environments (P2, P4). Women face stricter hiring and promotion standards (P5) and dismissive attitudes (P6). Insecurity about disclosing one's identity remains widespread (P10).

Distrust of Formal Mechanisms: Reporting channels, codes of conduct, and training programs often fail, anonymity is not guaranteed (P5), reporting can expose victims (P6), and leadership frequently avoids accountability (P7, P8). Prompt and transparent follow-up and independent oversight are essential to rebuilding trust.

Tensions Between Work Models: Remote work offers psychological relief and identity security (P2), but reduces the visibility needed for career advancement (P1, P8). Exclusive remote options for LGBTQIAPN+ employees risk stigma (P10). Flexible hybrid models available to all employees better balance well-being and professional development.

Neurodiversity and Disclosure: Professionals with ADHD or bipolar disorder avoid disclosing their diagnoses due to rigid processes and a lack of accommodations

(P2, P4, P6). Clear productivity guidelines, process flexibility, and individualized support improve performance and retention.

Impostor Syndrome and Team Dynamics: Impostor feelings arise from tokenism, interruptions, and microaggressions (P3, P5). Structured mentoring, pair programming, and frequent positive feedback create psychological safety and mitigate these effects.

Leadership Representation: Visible LGBTQIAPN+ leaders inspire belonging and ambition (P1, P2). Management allyship strongly correlates with positive workplace experiences (P7, P10). Recruitment and promotion should combine merit-based criteria with targeted diversity initiatives.

Inclusive Agile Rituals: Onboarding that respects identity checks, daily meetings with optional video or avatars, and one-on-one sessions with active listening promote inclusion without sacrificing agility (P6, P7, P11).

Structural Exclusion: Low diversity in certain roles and areas, reliance on specialized credentials, and recent cuts to inclusion programs due to changes influenced by Big Tech (P1, P5) highlight the need for sustained investment in bootcamps, hackathons, and clear inclusion policies.

5.12 Lessons for Industry

Create independent and trustworthy reporting. Establish ombuds or third-party listening channels with guaranteed anonymity, case tracking, and anti-retaliation safeguards. Investigate developer perceptions anonymously and publish reports to restore trust where formal mechanisms are distrusted.

Make leadership representation visible and accountable. Set goals for LGBTQIAPN+ representation in leadership and appoint executives to steward inclusion roadmaps. Align incentives with retention and prioritize swift resolution of harassment or discrimination cases by management.

Adopt fair hybrid practices. Offer hybrid flexibility to everyone, not only LGBTQIAPN+ employees or other minoritized groups.

Redesign onboarding and agile rituals for identity safety. Include name/pro-noun checks, optional video or avatar use, and explicit turn-taking norms in daily meetings and reviews. Use one-on-one sessions with active listening to surface frictions early without harming delivery.

Institutionalize neurodiversity accommodations. Provide clear productivity agreements (working-agreement templates, flexible processes) and psychologically safe environments to improve performance and retention: process design matters.

Combat impostor dynamics with structured support. Formalize mentoring and sponsorship, use pair programming for complex tasks, and deliver frequent, specific positive feedback. Monitor interruption patterns to reduce microaggressions.

Ring-fence inclusion investments. Safeguard funding for bootcamps, hackathons, and continuing education through governance that withstands cost-cutting cycles influenced by policy shifts.

Measure what matters safely. Instrument psychological safety and developers' perceptions of fairness and concrete team actions.

5.13 Lessons for Researchers

Center intersectionality and cross-context comparisons. Sample across gender identities, sexual orientations, roles, company sizes, and regions.

Use time-sensitive methods. Combine surveys, semi-structured interviews, and longitudinal studies to capture how motivations and work-model preferences change with career stage and team maturity, and to assess the applicability of existing models in industry.

Develop and validate inclusive DX measures. Extend DX instruments to cover identity safety, team trust, collaboration, belonging, and team culture.

Study neurodiversity in software engineering practice. Examine how specific accommodations affect productivity, defect rates, and well-being; produce design patterns teams can adopt with minimal overhead.

Release practical artifacts. Provide open templates for inclusive onboarding, agile rituals, and workflow designs to accelerate adoption and replication across contexts.

5.14 Threats to validity

Credibility: The topic is sensitive; interview responses can be affected by social desirability, fear of identification, or recall biases. Credibility is limited by the fact that saturation (GUEST; BUNCE; JOHNSON, 2006) has not yet been reached and the analysis is provisional. We mitigated these risks by testing the survey and interview protocols, administering the survey immediately before the walkthrough to reduce ambiguity, ensuring strict anonymity, and conducting follow-up calls to paraphrase and validate interpretations with interviewees. Triangulation between survey responses and semi-structured interviews strengthens internal consistency, but the results should still be read as preliminary.

Transferability: The sample was recruited through social media and seed-based outreach and focuses on specific national and cultural contexts (e.g., Latin-speaking coun-

tries and large, agile organizations). Therefore, the results may not be transferable to other regions, smaller companies, or teams with different levels of maturity. To inform readers' informed judgment, we provided detailed descriptions of team size, company size, roles, and inclusion practices. However, statistical representativeness was not a goal of this mixed-methods design with a qualitative bias, and generalizability is limited.

Reliability: Replication is challenging due to the sensitivity of LGBTQIAPN+ identity in the workplace, evolving organizational policies, and the respondent-driven nature of recruitment. To increase reliability, we revised the instruments after pilot feedback, documented procedural changes and decision rationales in an audit trail, and utilized an iterative coding process with periodic researcher debriefings. Even so, access to similar populations and the timing of data collection may yield different observations in future replications.

Confirmability: Researcher interpretation can influence code assignment, theme construction, and the interpretation of "applicability" during model analysis. We reduced individual bias through code review sessions, internal audits of analytical decisions, explicit traceability of the excerpt to the code and theme, and preservation of anonymized excerpts. We also recorded reflective notes on positionality and retained analytical artifacts to allow for external scrutiny. Despite these steps, complete elimination of interpretive bias is not possible in qualitative analysis.

5.15 Future Work

This study opens up multiple opportunities for further research.

First, we did not thoroughly explore the racial dimensions among LGBTQIAPN+ professionals in multiethnic or global teams. Investigating how markers of race, ethnicity, and nationality interact with LGBTQIAPN+ identity may reveal intersectional patterns of exclusion and resistance strategies that are still underreported in the software engineering literature.

Second, impostor syndrome emerged as a significant gap. Future studies could analyze how this phenomenon relates to the experiences of LGBTQIAPN+ professionals, especially when intersected with racial issues in an industry characterized by white and heterosexual hegemony.

Finally, this work did not capture the nuances of the experiences of LGBTQIAPN+ professionals compared to heterosexual developers (men and women). Comparative research could help highlight which Developer Experience factors are specific to LGBTQIAPN+ groups and which challenges are shared by different developer profiles.

These gaps offer avenues for expanding the conversation on diversity, equity, and

inclusion in software engineering, understanding of how multiple social dimensions shape the developer experience.

6 Conclusion

6.1 Considerations

This master’s thesis investigated, through three complementary fronts, the experience of LGBTQIAPN+ people in agile software teams, that is, Developer eXperience (DX), and proposed a recommendation model to improve it: i) a multivocal mapping that integrates formal and grey literature, ii) an interpretive survey with mixed-methods analysis on perceptions in agile teams, and iii) the consolidation and validation of a flexible, recommendation-based model through walkthroughs of the model in semi-structured interviews. The central objective was to verify whether a set of recommendations, aligned with the literature and the voices of these professionals, is appropriate and effective to improve their DX in agile teams.

The findings converge on three main points. First, organizational context and process maturity strongly shape the experience. Less structured environments, common in smaller companies, tend to present more episodes of prejudice and integration difficulties. Larger organizations, with more mature processes, reduce part of these frictions, without eliminating gender bias or discrimination.

Second, the interviews highlighted practical macro-themes that explain these dynamics: team resistance depending on context; mistrust of formal channels; remote and hybrid work models as strategies for psychological safety; representation in leadership as a catalyst for change; agile rituals as enablers of inclusion; team maturity and collaborative practices, such as mentoring and *pair programming*, as foundations; structural barriers to entry and retention; and identity management, including chosen name and pronouns, as a critical element of autonomy.

Third, the proposed model organizes short, medium, and long-term recommendations and was perceived as context-adaptable, actionable in everyday practice, and coherent with agile values oriented toward individuals and interactions. Suggested actions include inclusive language; anonymous and effective channels; codes of conduct, including for internal events; remote and hybrid work options without stigmatizing specific groups; *onboarding* with identity checks and validation of professionals; *dailies* with optional video; 1:1 conversations with active listening; revisiting recruiting and interviews to mitigate bias; leadership training for psychological safety and constructive feedback; defining diversity and inclusion goals and metrics; and the presence of LGBTQIAPN+ people in decision-making forums.

In the survey and interviews, remote and hybrid work emerged as a protective

factor (psychological safety), with greater control over exposure, focus, and lower anxiety. There are, however, visibility and socialization trade-offs that may affect career progression. Flexibility is recommended for everyone, in order to avoid policy-driven segregation. Team maturity, with structured planning, mentoring, and intentional collaboration, appeared as a cross-cutting lever for engagement, belonging, and performance.

This master's thesis partially confirms the adequacy of a recommendation model grounded in evidence and practice to enhance the DX of LGBTQIAPN+ professionals in agile teams, given that the third front is still in progress. When adopted with organizational intentionality, the guidelines foster increased psychological safety, help reduce microaggressions, strengthen collaborative practices, and enable greater retention and engagement, especially when they combine actions and processes such as adjustments to agile rituals and inclusion-related decisions within organizational governance.

6.2 Contributions

6.2.1 Contributions to the Technology Industry (Practical)

- i) A context-flexible, recommendation-based model structured into short, medium and long-term actions: consistent with agile values and validated through practical guidelines.
- ii) An operational manual for agile rituals and people processes: inclusive language; effective and anonymous channels; codes of conduct (including internal events); identity integration (chosen name/pronouns); *daily sessions* with optional video if appropriate; individual sessions with active listening; mentoring with seniors for entry and mid-level; and *pair programming*.
- iii) Recruitment guidelines: encourage the offering of bootcamps focused on this population in addition to affirmative action positions; explicit capture/validation of identity preferences during onboarding; representation of LGBTQIAPN+ people on committees.
- iv) Leadership training for psychological safety and constructive feedback, with concrete behaviors and teamwork agreements that reduce microaggressions and improve belonging. Evidence and barriers for remote, hybrid, and in-person models as levers for psychological safety: emphasizing flexible policies by default to avoid segregation, as well as mitigations for tradeoffs between visibility and socialization (e.g., mentoring circles, intentional pairing/rotation). Organizational maturity levers: how structured planning, collaborative practices, and process maturity reduce friction points, especially in smaller or less structured contexts. Governance and measurement:

- v) Practical outcomes for teams: improved user experience (DX), greater engagement and retention of LGBTQIAPN+ professionals, and stronger collaboration through routine adjustments to agile ceremonies and people/governance processes.

6.2.2 Contribution to the research field

- i) A multivocal systematization of the Developer Experience for LGBTQIAPN+ professionals in software engineering/agile, integrating formal and gray literature through the dimensions of *Affect*, *Conation*, and *Cognition*.
- ii) Empirical clarification of the mechanisms that link organizational context, team/process maturity, and agile rituals to psychological safety and belonging, supporting operational investments for an inclusive user experience (DX).
- iii) A triangulated design in three stages: (i) multivocal mapping with *snowballing*, quality assessment, and thematic synthesis; (ii) interpretive research with mixed-methods analysis; (iii) semi-structured interviews with a walkthrough model for joint validation.
- iv) Validity procedures in human-centered SE research: pilots, internal audits, and anonymization documented as replicable practices for sensitive populations.
- v) Identification of gaps in agenda-setting: intersectionalities (race, neurodivergence, nationality) and the role of impostorism present in these intersections, motivating targeted hypotheses and future studies.
- vi) Conceptual and methodological bridge on agile team dynamics and psychological safety;
- vii) Evidence positioning remote/hybrid work as a protective factor with documented tradeoffs, in addition to verification of frictions on the topic, related to career growth and opportunities compared to in-person work: offering a differentiated basis for future causal and moderation analyses.

6.3 Threats to Validity

Credibility

We increased credibility through instrument piloting (survey and interviews) with iterative refinements in wording, ordering, and instructions, as well as internal methodological audits that documented decisions. We also ensured strict anonymity and used confirmatory paraphrasing with participants to reduce misinterpretation of self-reports.

Triangulation between the multivocal review, the survey, and the interviews supports the convergence of inferences. Even so, self-reported data are subject to recall bias and self-censorship; varying familiarity with agility/DX/diversity vocabulary may have shaped responses; and cross-sectional evidence does not justify causal claims. Saturation of the final interviews is still ongoing, which may limit thematic completeness in the current landscape.

Transferability

Our non-probability, respondent-driven, social media-based sampling is not statistically representative of LGBTQIAPN+ professionals in technology. Language filters and source availability in the multivocal review further delimited the captured contexts. Therefore, the results should be transferred with caution to settings that differ in organizational size, team maturity, work models, and local culture. To aid transferability, we report contextual descriptors (countries, identities, roles, team/company size, and organizational processes) and frame the recommendations as flexible for adaptation to specific environments.

Reliability

We sought reliability through iterative coding with successive audits and discussions among researchers, a recorded analysis trail, and consistency checks between the research tabulations and the qualitative themes. However, two factors challenge replication: (i) topic sensitivity and hidden population dynamics, which can alter participation and disclosure patterns between replications; and (ii) ongoing saturation, which means that codebook and topic boundaries can still evolve. Quantitatively, subgroup fragmentation and sample size reduce the stability of estimates.

Confirmability

We mitigated researcher bias through protocolization, internal audits, and an additional independent audit of the data. Nevertheless, we chose to have one team conduct the interviews and another team perform model review, which helped reduce confirmation bias. Furthermore, the verifiability of the model by participants is vulnerable to the introduction of bias.

For multivocal review, the inclusion of gray literature increases practical validity but carries risks of selection/classification bias, publication bubbles, platform/language bias, and content ephemerality. We followed established MLR/GLR procedures and quality criteria, documenting inclusion/exclusion, and synthesizing sources to reduce the dom-

inance of a single source; however, personal positions and the availability of materials at the time of collection can still influence interpretations.

6.4 Future Work

As a development of this research, we identify gaps that shape a promising agenda for future investigations. They cover organizational dimensions, the continuous measurement of DX, the effects of different work models on careers and well-being, as well as the operationalization of agile practices and processes in diverse contexts.

Psychosocial phenomena that remain underexplored also emerged, especially impostor syndrome and its interactions with identity, collaboration, and performance evaluation. Below we list research directions that may benefit from comparative studies, longitudinal approaches, and impact evaluations in real-world environments, with the goal of consolidating evidence that is useful to both industry and academy.

- **Race–ethnicity–nationality intersectionalities.** Investigate how racial, ethnic, and nationality markers interact with gender and sexuality in multiethnic and global teams, mapping patterns of exclusion and strategies of resistance that are underreported in the software engineering literature.
- **Impostorism and team dynamics.** Examine the relationship between the impostor phenomenon, LGBTQIAPN+ identity, and collaborative practices, including the influence of interruptions, tokenism, and microaggressions, and the role of structured mentoring, *pair programming*, and safe feedback in reducing such episodes.
- **Comparisons with non-LGBTQIAPN+ developers.** Conduct comparative studies to distinguish DX factors specific to this group from those shared by other profiles, including heterosexual men and women.
- **Long-term effects of work models.** Carry out longitudinal studies on career progression, visibility, engagement, and well-being across remote, hybrid, and on-site regimes, with attention to isolation and stigmatization effects and the importance of offering flexibility to everyone.
- **Team maturity and governance.** Measure how levels of team and process maturity modulate the experience, particularly in small versus large companies, and which governance and leadership interventions most contribute to effective inclusion.
- **Channels, code of conduct, and trust.** Assess the effectiveness of anonymous channels, codes of conduct, and unconscious-bias training, including accountability mechanisms and their relationship with participant trust.

- **Neurodivergence and process accessibility.** Investigate barriers and accommodations for neurodivergent professionals, establishing guidelines for productivity, process flexibility, and individualized supports that improve performance and retention.
- **Evidence-based inclusive agile rituals.** Test the impact of tweaks like *onboarding* with developer-controlled identity sharing permissions, *dailies* with optional video, avatar usage, and 1:1s with active listening on psychological safety, collaboration, and team outcomes.
- **Technical events and communities.** Study policies and practices that make hackathons and technical events more inclusive, including organizing composition, communication, and safety guarantees, and how this feeds back into everyday DX for newcomers and participating developers.
- **Continuous measurement of DX and D&I.** Develop practical metrics and instruments to monitor psychological safety, incidents, and inclusion in teams over time, linking them to leadership decisions and agile rituals.

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